

# Journal of the International Neuropsychological Society

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# Members of the 2004 ASSBI/INS Program Committee

**Annual Meeting of the Australian Society for  
the Study of Brain Impairment (ASSBI) and  
the International Neuropsychological Society (INS)  
July 7–10<sup>th</sup>, 2004  
Brisbane, Australia**

Program Committee Chairperson: Skye McDonald

Vicki Anderson  
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Leanne Togher  
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Atsushi Yamadori

# Continuing Education Program

## Continuing Education Courses ASSBI/INS Joint Meeting Brisbane Australia

Director of Continuing Education: Neil Pliskin

### Wednesday July 7<sup>th</sup>, 2004

Donald Stuss

Sandra Chapman

#### Morning Courses: 9.00am-12.00pm

Frontal Lobes and the Anterior Attentional System

The Revealing Nature of Discourse Macrolevel Abilities in Pediatric Brain Injury: Cognition, Language and Neural Networks

#### Afternoon Courses: 1.00pm-4.00pm

Raja Parasuraman

Adele Diamond

Attention, Genetics and Alzheimer's Disease

The Development of Prefrontal Cortex and Executive Control Functions: Genetic, Biochemical and Environmental Modulation

### Thursday, July 8<sup>th</sup>, 2004

Bryan Kolb

#### Breakfast Workshop: 7.30-9.00am

Repairing the Injured Brain

### Friday, July 9<sup>th</sup>, 2004

Jenni Ogden

#### Breakfast Workshop: 7.30-9.00am

Neuropsychological and Psychosocial Outcome Following Subarachnoid Haemorrhage (SAH) and Risk Factors of Elective Surgery for Unruptured Intracranial Aneurysms

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# Abstracts presented at the 2004 Annual meeting of the Australian Society for the Study of Brain Impairment (ASSBI) and the International Neuropsychological Society (INS)

July 7–10<sup>th</sup>  
Brisbane, Australia

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## WEDNESDAY EVENING, JULY 7<sup>TH</sup>, 2004

### ASSBI Presidential Address/4.30pm-5.30pm

#### SKYE MCDONALD. **Are you crying or laughing? Deficits in emotion recognition following traumatic brain injury**

Deficits in psychosocial functioning are well documented following traumatic brain injury. To a great extent these have been attributed to behavioural and cognitive sequelae of the brain injury. In contrast, the possibility

that such problems reflect disorders of emotion processing have been less systematically examined. This address will focus upon disorders in the capacity to recognize emotions in others. A model for emotion processing will be presented that considers different routes to perceptual categorization of input and the role of emotional responsiveness. The extent to which each of these facets of emotional processing are intact in people with TBI and the extent to which these interact to aid emotion recognition will be discussed.

## THURSDAY MORNING, JULY 8<sup>TH</sup>, 2004

### Poster Session 1/ 9.00am–12.30pm

#### ATTENTION, MEMORY, DEMENTIA, STROKE AND AGEING

#### C. MATTHEWS & S. CROWE. **The Contribution Of Worry, Anxiety And Thought Suppression To Performance On The Components Of Working Memory In A Non-Clinical Sample.**

The aim of this study was to evaluate the contribution of worry to the prediction of the components of working memory in a non-clinical sample. Sixty-one healthy adults (31 men and 30 women) ranging in age from 18 to 63 years were administered three questionnaires and six working memory tasks. The questionnaires were the Worry Domains Questionnaire, the State-Trait Anxiety Inventory, and the White Bear Suppression Inventory. The working memory tasks were the Digit Span task (forward and reversed), the Spatial Span task (forward and reversed), the Visual Patterns Test, and a dual performance task (digit recall plus visual tracking). Separate hierarchical regression analyses were conducted on each of the dependent measures to examine the contribution of the independent variables to the various aspects of working memory. The results indicated that worry was a significant contributor to the prediction of working memory performance. However, contrary to our hypothesis, worry did not contribute to verbal working memory or to the central executive tasks. Worry did make a significant contribution to the performance of spatial span backwards and to the dual task. Further analysis indicated that worry was negatively associated with working memory performance. Thought suppression was significantly and positively correlated with anxiety and

with worry, and was also positively associated with working memory performance on the verbal, spatial, and central executive tasks. In addition, thought suppression was found to be a significant predictor of central executive performance. These issues were discussed in terms of contemporary models of anxiety and working memory functioning.

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#### C. SKILBECK & J. MARTIN. **Working Memory Ability & Card Sorting Test Performance.**

Previous research involving patients with frontal lobe lesions or schizophrenia has indicated a possible relationship between impaired spatial working memory and poor performance on the Wisconsin Card Sorting Test (WCST), although findings have been inconsistent. The present study investigated the role of auditory, visual, and spatial working memory in card-sorting test performance. Forty-seven university students were administered computerised versions of WCST and Madrid Card Sorting Test (MCST), and four working memory tasks; Digit Span Backwards, Letter-Number Sequencing, Visual Patterns Test, and Spatial Span Backwards. Results revealed a significantly higher percentage of total errors were made on MCST than on the WCST. As there are major differences between the two tests; visual/no visual feedback, disclosure/non-disclosure of sorting criteria, ambiguous/unambiguous cards and error definitions, the WCST data was rescored to remove ambiguous cards and to reconcile error definitions. Further analyses of high vs. low scorers on each of the working memory tasks revealed low scorers made a significantly higher percentage of total and non-perseverative errors than high scorers, on both

card-sorting tests. Although there were similar findings across all modalities a significant interaction on LNS suggests a greater role for auditory working memory in MCST performance. However, the omission of visual feedback in the MCST may account for the increased role of auditory working memory and is, therefore, the focus of ongoing research.

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#### **Y. SUCHY & A. E. GOLD Examination Of Hemispheric Contributions To Switching Abilities: A Replication With A Different Paradigm.**

Prior research examining hemispheric contributions to switching has been inconsistent, with some studies suggesting no hemispheric dominance (Demakis, 2003, Dove et al., 2000), others suggesting left-hemisphere dominance (e.g., Rogers et al., 1998), and others yet suggesting right-hemisphere dominance for switching (Volz et al., 1997). These inconsistencies could be explained by the fact that successful switching may rely on both inhibition and initiation, which themselves appear to be differentially subserved by the right and the left hemispheres, respectively (e.g., Stuss et al. 2002). In a recent study (Suchy et al., 2003), we examined the relative involvement of initiation and inhibition in switching, as well as the relative roles of the two hemispheres in these processes. We used a modification of a switching task that allowed examination of switching between (B/W) and within (W/N) hemispheres. We found that switching from right (inhibition) to left (initiation) hemisphere is faster than switching in the opposite direction, and that switching B/W (placing greater demands on initiation) is faster than switching W/N (placing greater demands on inhibition). These results support the notion that initiation and inhibition (and the respective hemispheres) both contribute to switching, and suggest that inhibition may play a more prominent role than initiation. Because this was the first study of its kind, we set out to replicate the results with different stimuli and a substantially different switching task design. We again found faster switching for B/W, as compared to W/N,  $t(40)=3.75$ ,  $p=.001$ , Cohen's  $d=.59$ ; and for right-to-left, as compared to left-to-right,  $t(40)=4.58$ ,  $p<.001$ , Cohen's  $d=.72$ . Although the present results suggest that these effects are stable, further research is needed to test alternative explanations of these findings.

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#### **C. E. MEADE, S. C. BOWDEN, F. J. BARDENHAGEN & M. J. COOK. Memory orrelates Of Rhinal Cortex And Hippocampal Volumes In Patients With Mesial Temporal Sclerosis.**

The function of primate rhinal cortex, comprising the entorhinal (ErC) and perirhinal (PrC) cortices, has been extensively studied. Translating animal models to human memory has been limited by the technological problems associated with characterising neural structures in vivo. Neuropsychological correlates of hippocampal and rhinal cortex volume changes were examined in a sample of 61 temporal lobe epilepsy patients with mesial temporal sclerosis (33 left, 28 right). Patients were administered the Wechsler Adult Intelligence Scale (Revised or Third Edition), Wechsler Memory Scale (Revised or Third Edition) and a spatial maze task. Multiple regression analysis was used to examine neuropsychological data, together with rhinal cortex and hippocampal volumes, collected in our earlier study (unpublished observations, OBrien et al.). The only significant predictor of verbal memory function was the difference score between the volume of left hippocampus and the left PrC. Spatial maze scores were predicted by the bilateral sum of ErC volume. The difference score between the left hippocampus and left PrC volumes was the most powerful predictor of verbal episodic memory. Right hippocampal volume was not a significant predictor of nonverbal episodic memory. Verbal and nonverbal semantic memory were not significantly predicted by any combination of rhinal cortex structures. Results suggest lateralised memory function for the hippocampus and PrC, in contrast to the bilateral role of the ErC. The hippocampus and PrC may act on memory function through an opposing relationship. A differentiation between hippocampal and sub-

hippocampal components in terms of episodic and semantic memory, respectively, was not supported by the current data.

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#### **D. SHUM, J. O'GORMAN, J. ORAM, D. FOGARTY, H. TINSON & K. NEULINGER. Development and Validation of a Computerised Visual Memory and Learning Test.**

Visual memory is defined as the ability to recall or recognise visual patterns that do not lend themselves easily to verbal encoding (Milner, 1971). Impairment in visual memory is a commonly observed symptom in many neurological conditions and it has been found to be a predictor of functional and vocational outcomes in individuals with brain injury. The development of tests of visual memory and learning has lagged behind that of its verbal counterpart. This is because it is difficult to construct visual stimuli that are unfamiliar, complex and difficult to verbalise (Heilbroner, 1992). Eadie and Shum (1995) proposed that Chinese characters meet these criteria (for those who have not learned this language) and showed that the Shum Visual Learning Test (Shum, O'Gorman, & Eadie, 1999), which uses a set of relatively complex Chinese characters with low verbalisation index, is sensitive to lateralised brain damage. Recently, a computerised version of this test was developed to increase its clinical utility. This study aims to describe this latest version of the Shum Visual Learning Test. The study will present data to compare the equivalence of the computerised to the original version of the test and evaluate its reliability. Performance of patients with localised damage to the left and right temporal lobes will also be used to support the validity of this test.

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#### **S. Y. TAY, D. YEO & C. P. L. H. CHEN Cognitive Profile of vCIND Patients and Progression in Dementia.**

**BACKGROUND:** The concept of Mild Cognitive Impairment (MCI) has been widely used in defining the stage between normal aging and dementia that is associated with an increased risk of developing dementia. Although memory impairment with preserved functional abilities has been the main classification criteria, recent research has explored the heterogeneity of this concept and examined the role of non-memory cognitive impairment. Studies that subclassify MCI patients according to their cognitive profile suggest that whilst amnesic-MCI patients are at an increased risk of developing dementia (Busse et al., 2003), this risk is increased in patients with cognitive impairment beyond memory loss (Bozoki et al., 2001). The applicability of these findings to vascular Cognitive Impairment Not Dementia (vCIND) has not been explored extensively. **AIM:** To investigate the incidence of dementia associated with different vCIND subgroups. **METHODS:** Patients with ischaemic stroke were cognitively assessed in the domains of attention, language, verbal memory, visual memory, visuoconstruction and visuo-motor speed within 6 months of their index stroke and 1 year later. Dementia was diagnosed using DSM-IV criteria. Patients who did not meet DSM-IV criteria, but were impaired in one or more cognitive domains, were classified as vCINDmem+ (multiple cognitive impairments including memory), vCINDmem (only memory impairment) and vCINDmem- (impairment in non-memory domains). **RESULTS:** 69 patients diagnosed with vCIND at baseline were included in this study, of which 43.5% were vCINDmem+, 23.2% were vCINDmem and 33.3% were vCINDmem-. At 1-year follow-up, 16.7% of the vCINDmem+ patients compared to 4.3% of the vCINDmem- patients developed dementia. None in the vCINDmem group declined. **CONCLUSION:** Over a 1-year period, the risk of developing dementia was highest in the vCINDmem+ group compared to other vCIND subgroups (OR=7.6; 95% CI 0.8–69.0).

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#### **A. L. FERNANDEZ & L. M. MANOILOFF. Long-Term Cognitive Treatment In Alzheimer Disease: A Single-Case Study.**

The effects of long-term treatment in a demented patient were evaluated in this study. One individual diagnosed with Alzheimer dementia was treated

with neuropsychological rehabilitation techniques as well as drugs for a period of two years and ten months. An A-B-A-B design was performed for the cognitive treatment. Neuropsychological treatment consisted of a combination of direct re-retraining and training in activities of daily living. Cognitive performance was monitored with the Mattis Dementia Rating Scale. Results showed improvement and a slower decline during the treatment phases (A) as compared to the non-treatment phases (B). Conceptualization, and attention were the subscales that benefited the most followed by the memory subscale. Long-term treatment showed effectiveness in AD treatment. Although cognitive drugs may have been beneficial, neuropsychological rehabilitation played the most important role in the success of this treatment, appearing as a necessary condition.

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#### **T. J. KREUCH, Utility Of The Clock Drawing Test In Differentiating Dementia And Traumatic Brain Injury In The Elderly.**

This study examined the utility of the clock-drawing test in differentiating between elderly patients with progressive dementia and those with traumatic brain injury. It was hypothesized that elderly patients with known progressive dementias would perform more poorly than those with acute traumatic brain injury or elderly controls. Subjects were 30 rehabilitation patients, over age 65. The following groups were compared: 1) Dementia Group (elderly patients with diagnosed progressive dementias) 2) Traumatic Brain Injury Group (Criteria: Positive LOC, positive neuroradiological findings, and ER GCS of 12 or lower) 3) Orthopedic Controls. No significant difference between groups was found for age or educational level. The clock-drawing test, using standardized instructions and scoring was administered. Dependent measures included total raw score, number placement score, hand placement score and visuospatial performance. A one-way ANOVA found a significant between group effect for raw scores and all sub-scores ( $p < .01$ ). Post-hoc multiple comparisons analyses yielded significant mean differences between the Dementia Group and the TBI Group on all dependent measures (Progressive Dementia Group significantly lower). The progressive group was also significantly lower than the orthopedic controls ( $p < .01$ ), however, the orthopedic group and the TBI group scores were not significantly different. Results indicate that the clock-drawing test is useful in differentiating between elderly patients with acute traumatic brain injury and those with progressive dementia (e.g. Alzheimer's Disease). The orthopedic group, used as a control group in the study, may not be representative of a normal elderly sample (given the setting), and additional research using a normal aging group may be useful regarding test utility for differentiating cognitive impairment in elderly TBI patients from normal elderly.

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#### **D. W K MAN, S F TAM & C. W Y CHAN Evaluation Of A Virtual Reality-Based Memory Training Programme For Persons Of Early-Stage Dementia Of Alzheimer Type: A Preliminary Study.**

Background: Dementia is a major cause of disability and accounts for a considerable proportion of health care expenditure. Memory is usually the first cognitive function to be affected by the onset of Dementia of the Alzheimer's Type (DAT). Evidence of cognitive rehabilitation of memory in early stage DAT suggests that learning is possible in people with DAT and they are capable of learning and retaining information. The present study thus developed and evaluated a non-immersive virtual reality (VR)-based memory training programme, in which behavioral responses within such environments can be recorded and measured. Method: A control group pre- and post-test quasi-experimental design was applied to 45 DAT subjects who were randomly assigned into three groups respectively: VR group, non-VR group, and a control group. Summative outcome measures included the Chinese Version of Mattis Dementia Rating Scale, Everyday Memory Questionnaire, and rating scales to assess knowledge, skills and self efficacy of subjects in performing community living activities. During a 4-week study period, the three groups underwent a 10-session, two-level

programme in training memory skills. Initial results: ANOVA and MANOVA showed that both the VR and Non-VR programmes were effective in improving memory skills and self efficacy in community living skills; and were significant better than control group. Moreover, subjects would be stratified according to education, gender, site and duration of injury, by means of ANCOVA, to control confounding variables and/or study the possible interaction effects of these factors. Conclusion: VR approaches are initially found to be effective and efficacious in memory training for DAT.

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#### **E. MARCH, Semantic Verbal Fluency in Alzheimer's Disease: Approaches Beyond Traditional Scoring System.**

Semantic and phonemic verbal fluency testing forms an integral part of neuropsychological assessment. This paper aims to discuss possible approaches to semantic verbal fluency testing beyond that provided by the traditional scoring system (i.e., total number of correct words). These approaches are examined through use of semantic verbal fluency data from 26 probable mild Alzheimer's disease patients (MMSE mean = 20.5) and 26 older adults (MMSE mean = 27.7), matched for age (mean = 78.8), education (mean = 8 years) and gender. The paper first discusses the usefulness of recently proposed process-oriented approaches, that is, clustering (i.e., generating words within semantic subcategories) and spontaneous switching (i.e., shifting between semantic subcategories) strategies in Animal and Supermarket categories (Troyer, Moscovitch and Winocur, 1997). It is demonstrated that, in contrast with extant research findings, the variables do not distinguish the two groups particularly well. Second, the paper explores the potential advantage of two other measures, number of clusters (i.e., number of subcategories accessed) and number of repetitions (i.e., repetition of words already generated) as qualitative markers of semantic verbal fluency. Finally, drawing on to Newcombe's (1969) research, the paper argues that, rather than exploring spontaneous switching fluency ability, substantial insights into semantic verbal fluency would be gained through directly testing purposeful switching ability (i.e., alternating between given semantic categories such as Person name/Fruit), with evidence from research data. The discussion focuses on theoretical and clinical implications of these measures, with a view to expanding traditional approaches to semantic verbal fluency assessment.

Troyer, A. K., Moscovitch, M., & Winocur, G. (1997). Clustering and switching as two components of verbal fluency: Evidence from younger and older healthy adults. *Neuropsychology*, 11, 138-146.

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#### **S. TOMASZEWSKI FARIAS & D. MUNGAS, Degree Of Discrepancy Between Self And Other-Reported Everyday Functioning By Cognitive Status.**

Previous studies have shown that patients with dementia tend to overestimate their cognitive and functional abilities as compared to the reports of their caregivers. Recently, there has been interest in the preclinical stage of dementia, referred to as mild cognitive impairment (MCI). Past research has not examined whether this clinical group also tends to underestimate their deficits. In this study we examined whether degree of discrepancy between patient and informant-reported everyday function was associated with cognitive status. The sample consisted of 111 community-dwelling older adults (45 Caucasian, 65 Hispanic, 1 Asian), and was divided into three subgroups dependent on cognitive status: cognitively normal, MCI, and demented. A difference score was calculated by subtracting the patient-reported score on the Daily Function Questionnaire from the informant-reported score. A higher score indicated that the informant was reporting more impairment. The difference scores for Normal and MCI groups clustered around 0, but the average difference for the Demented group was .55, indicating that the Demented group was underestimating their level of functional impairment. Furthermore, the differ-

ence scores for the Demented group significantly differed from both those of the Normal and MCI groups, while the difference scores for the Normal and MCI groups did not significantly differ. These results provide preliminary evidence to suggest that self-reported functional abilities may yield valid and reliable information in older adults falling in the MCI category. Correspondence: *Dr Sarah Tomaszewski Farias, University Of California, Davis 2474 41, Street, SACRAMENTO CA 95817, USA, sarah.farias@ucdmc.ucdavis.edu*

#### **J. M. GLOZMAN. Neuropsychological Diagnosis And Qualification Of Dementia.**

The paper proposes the critical analysis of Russian and American diagnostic criteria for dementia. Neurological and psychiatric aspects of the problem and some reasons for misdiagnosis of dementia are discussed. The main cause for the overdiagnosis of dementia is an imprecise current definition of dementia. The obligate and logical criteria of dementia are proposed. Some approaches and methods to a neuropsychological diagnosis of dementia (available for medical doctors) are analysed. The results of a combined psychometric and qualitative analysis of cognitive and executive disturbances (Luria's battery) in 3 age matched groups of elderly patients with common pathology: vascular encephalopathy, vascular dementia and Alzheimer's disease are presented. A combined approach such as this permitted us: (1) to identify differential symptoms in the executive behaviour of different groups of patients; (2) to determine specific patterns of cognitive disturbances for different kinds of executive disturbances; (3) to demonstrate that human executive behaviour is conditioned by the close integration and interaction of the three functional units of the brain postulated by Luria (the activational unit, the unit for information processing and storage, and the unit for programming, regulation, and monitoring); and (4) to reveal the role of dysfunction in different cortical and subcortical brain regions for the genesis of these cognitive and executive disturbances in each type of dementia. An evolution and progression of cognitive disturbances up to the appearance of vascular dementia is predominantly due to regulatory and operational disorders connected to cortical brain regions. A "corticalization" of the cognitive and executive disturbances takes place. The evolution of Alzheimer's disease is realized via the consecutive "frontalization" and "subcorticalization" of disturbances, that is, by superimposed neurodynamic and regulatory impairments upon operational ones.

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#### **P. E. SPAAN, J. G. RAAIJMAKERS, C. JONKER. Early Assessment Of Dementia: The Contribution Of Different Memory Components.**

The present research investigated whether the differentiation between various memory components (i.e., episodic, semantic, implicit, working memory) contributed to the early assessment of dementia. Whereas clinical neuropsychological assessment primarily employs tests of episodic memory functioning, the present research used a computerised test battery reflecting the different memory components mentioned above. In this way, it was determined which combination of measures (i.e., memory components) was most accurate in predicting dementia, before the diagnosis could officially be made. This memory test battery was administered to a heterogeneous sample (concerning their global cognitive status measured by the MMSE) of initially non-demented elderly subjects (n=147). These subjects were all community dwelling elderly persons, derived from the population based 'Longitudinal Aging Study Amsterdam' (LASA). In order to examine the profile of preclinical dementia, subjects were tested twice: at baseline (T1) all subjects were non-demented according to DSM-IV criteria, while 2 years later (T2) a subgroup had developed dementia. Dementia was best predicted, two years before diagnosis, by the combination of a paired-associate learning test and a priming measure derived from a perceptual identification task. Thus, performance of the preclinically demented subjects was best characterised, relative to cognitively impaired but non-demented subjects, by an inability to benefit at recall from semantic relations and by absent repetition priming effects. In contrast, a purely episodic memory measure (a ten word list-learning test

which demanded free recall of semantically unrelated words) only showed decline relative to controls once dementia was officially diagnosed (at T2). It is concluded that in addition to testing episodic memory functioning, it is particularly important to be aware of semantic and implicit memory deficits in the early assessment of dementia.

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#### **B. H. LEE, J. CHIN, S. J. KANG, E. KIM, K. C. PARK & D. L. NA. Mechanism of Closing-in Phenomenon on Figure Copying Tasks in Alzheimer's disease.**

The 'closing-in' phenomenon is defined as a tendency to copy near or overlap the target figure while performing the copying tasks. It has been reported that the closing-in phenomenon is more closely associated with diffuse rather than focal brain lesion and it can be regarded as one of the specific neuropsychological markers of Alzheimer's disease (AD). However, the mechanisms underlying the closing-in phenomenon have not been fully elucidated. We posit that closing-in may be related to the patients' compensatory strategies for visuospatial dysfunction or visuospatial working memory deficit. Thus it is expected that as the complexity of the target figure is increased or the distance from the target to the copying space is increased, the closing-in phenomenon will increase. We recruited 15 AD patients who showed the closing-in on a screening test and 15 age, sex and education matched normal controls. Each subject performed 12 copying trials (four different stimuli x three different distances) in random order. The proximity (Y-axis) of the subject's drawing (X-axis) toward the target was plotted as a function of distance from the left end to the right end of the drawing and the degree of closing-in was computed by the slope of the regression line. The slope of AD patients' drawings differed as the figure complexity ( $p = 0.003$ ) but the effect of distance from the target to the starting point was not found. There was a linear relationship between the complexity of figures and the magnitude of closing-in ( $p = 0.004$ ), indicating that the severity of closing-in increased in proportion to the complexity of figures. Our results are most consistent with the visuospatial working memory hypothesis. That is, copying near the target figure may be a strategy to compensate for patients' visuospatial dysfunctions or visuospatial working memory deficits.

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#### **A. M. FOX, E. J. MORTON, J. MOYLE & J. M. ROGERS. Inhibition Of Prepotent Responses In Parkinson's Disease.**

Event-related potentials (ERPs) provide a non-invasive technique for examining the nature of processing required during task performance, and are particularly useful when overt behavioural measures cannot be obtained. In addition, they can provide a sensitive indicator of injury in various clinical disorders when behavioural consequences may not be observable in overt behaviour. The present study examined response inhibition processes by recording ERPs whilst participants performed a Go-Nogo task that required responding to certain letters presented on a computer monitor and withholding responses to other letters. Five participants with mild Parkinson's Disease (PD) and nine control participants completed the task. Results from the behavioural analyses indicated that the PD group responded more slowly than controls. Results from the analyses of stimulus-locked ERP components indicated that there was a significant reduction in the amplitude of the Nogo-N2 component in the PD group, suggesting impairment in aspects of response inhibition. Previous studies using high-density electrode mapping techniques have identified sources for this component in the right orbito-frontal cortex and anterior cingulate cortex, suggesting the involvement of these regions in PD relatively early in the course of the disease. Implications of these findings for the management of clients with PD will be discussed.

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**E. KIM, K. PARK, B. H. LEE, W. Y. LEE & D. L. NA. Prevalence of Micrographia on Free Writing Versus Copying task in Idiopathic Parkinson's disease.**

Micrographia is a characteristic sign of idiopathic Parkinson's disease (IPD). Micrographia usually manifests itself in two forms: Consistent Micrographia (CM) and progressive Micrographia (PM). Prior studies that investigated the prevalence of CM reported it to be about 10–15%. However, the definition of micrographia in those studies was ambiguous. This study investigated the prevalence of CM and PM on the basis of letter and figure copying tasks that were performed in both IPD patients and normal controls. Seventy five IPD patients (31 men and 44 women with mean age of  $64.6 \pm 9.4$ ) and 30 sex/age matched controls received tasks consisting of two parts: free writing and copying task. In the free writing task, the subjects were asked to write the names of days of the week in Korean, repeating it three times in their own writing size. In the copying task which consisted of four conditions (letter and Luria figure X of two different sizes), subjects were required to write or draw using a visual guide of two sample letters or figures. CM was defined by the average size of the free writings and the letter or figure copyings of the patients that was 2SD below the mean of the controls. PM was defined by the slope (beta value) of the regression line for patient's free writing or copying tasks that was 2SD below the mean of the controls. In free writing, we found only one out of 75 patients who met the CM definition and only two patients fulfilling the definition of PM. In contrast, copying tasks revealed that in the letter task the prevalence of CM and PM was 31% (23/75) and 12% (9/75) respectively, and in the Luria figure copying tasks it was 24% (18/75) and 16% (12/75). Our study suggests that the prevalence of micrographia is much higher than it had been previously thought, and that the definition of micrographia based on the copying task would be more reasonable than the one based on free writing.

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**S. CAVACO, S. ANDERSON, A. CASTRO-CALDAS & H. DAMASIO. Focal Basal Ganglia Damage And Procedural Memory.**

There is evidence that damage to the basal ganglia impairs acquisition of perceptual-motor skills. The data have come primarily from studies of patients with neurodegenerative diseases (Parkinson's and Huntington's Disease), and have relied on a limited number of laboratory tasks (i.e., Serial Reaction Time Test, Rotor Pursuit, Mirror Tracing). The goal of this study was to further explore the impairments of procedural memory that result from basal ganglia dysfunction, by examining the performances of subjects with focal lesions in this region on a new set of procedural memory tasks. The performances of 8 subjects with unilateral basal ganglia vascular lesions (2 left; 6 right) were compared to 25 normal control subjects on 5 new laboratory-controlled tasks based on real world activities, encompassing a range of perceptual-motor requirements. The tasks were administered in two time periods (Time 1 and Time 2 - 24 hours). The 1st task consisted of pressing a sequence of 5 buttons without visual guidance. The 2nd task consisted of manually tracking constant series of 8 target locations using a joystick. The 3rd task consisted of weaving fabric with an actual loom, by performing a recurrent 5-step routine. The 4th consisted of tracing moving geometric figures with a stylus on a touch screen monitor. The 5th consisted of pouring water from a small watering can into graduated containers, from a point at 20cm distance. The basal ganglia group showed a trend toward reduced acquisition and/or retention on 4 of the 5 tasks (all except the 2nd task), relative to the control group, but the differences between groups were statistically nonsignificant. Each basal ganglia subject showed impaired acquisition and/or retention on at least one of the tasks. The findings provide further evidence for impairment of perceptual-motor skill learning and retention following basal ganglia damage, and suggest that lesion and patient characteristics may influence expression of the impairment.

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**L. GUTIERREZ CABELLO. Neuropsychological Dysfunction And Thalamic Stroke Lesions.**

Thalamic stroke lesions are associated with cognitive and behavioural impairments. Aim: to examine the relationship between thalamic stroke lesions and cognitive dysfunction. PATIENTS AND METHOD: 15 people with stroke thalamic lesions were studied (mean age was 55.8 SD: 16.8 years; 66% were male; and the education level was 7 SD: 3.7) and compared with a control group of 20 healthy subjects (mean age 67 SD: 7.6; male 50%; and education level of 7.6 SD: 2.9). CAT and MRI examinations were performed during the first 48 hours. 31.4% of patients (n=11) had an ischaemic infarction and 11.4% (n=4) had a haemorrhagic infarctions. 46% (n=7) had lesions of the right hemisphere, 40% (n=6) had lesions of the left hemisphere, and 13% (n=2) had bilateral lesions. A battery of neuropsychological assessments were given to measure memory, language, attention and executive functions. The affective scales used were Hamilton Rating Scale Depression (HRS-D) and Beck-Rafaelson Mania Scale (BRMS). RESULTS: Significant statistical differences were found between patients with thalamic stroke lesions and the control group in the different neuropsychological tests: memory learning (RAVLT)  $p = < .000$ ; memory test recall (RAVLT)  $p = < .002$  and phonetic fluency (PhF)  $p = .010$ . No statistically significant differences were observed in the locus of lesions. Comparing patients with ischaemic infarcts with those with haemorrhagic lesions, it was found the patients with haemorrhagic lesions had lower TMT-(A/B) scores ( $p = .061$  and  $p = .063$ ); and semantic fluency, ( $p = .018$ ). Results from the Hamilton Depression Scale (HRS-D) indicated that patients with haemorrhagic stroke lesions had more depressive symptoms than those with ischaemic infarctions,  $p = .022$ . CONCLUSIONS: Patients with thalamic stroke lesions were found to have memory and learning and executive function impairments. Lesion location (left-right) was not observed as resulting in changes in the cognitive functions. Haemorrhagic infarcts resulted in attention deficits, executive function impairments.

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**E. F. TIJS & T. A. MATYAS. Rapid Motor Learning in Hemiplegia During Uninstructed Practice: A Time-series Study With Implications for Clinical Neurorehabilitation.**

Literature on hemiplegia rehabilitation has recently experienced a controversial shift in focus. It has been suggested that specific techniques administered by allied health professionals are not as important as sheer quantity of practice, thus calling into question the value of specialist interventions. This meta-analysis of longitudinal single-case studies investigates the effects of uninstructed practice alone.

Nine participants with hemiplegia attended between 10 and 30 daily training sessions, during which they repetitively practiced three upper limb tasks without any specific intervention. The tasks were copying a circle, a line, and a triangle. Pen trajectories were recorded on a digitising pad, and kinematic data was standardised against an age matched normative sample. Temporal variables (movement speed, duration, and jerkiness) were often initially grossly abnormal, and improved dramatically with practice. Spatial variables (roundness of circles, horizontality of lines, etc) were comparatively well preserved initially. With practice, spatial performance was either maintained, or improved slightly. Results suggest a tendency to prioritize the functional aspects of the task (spatial accuracy) at the expense of temporal performance. The striking improvements in temporal performance without loss of spatial accuracy suggested that substantial gains in coordination occurred with practice. Those with greater initial deficit tended to show faster improvement, suggesting that motor impairment facilitates practice-dependent learning. The tilt of the pen was also measured to indicate normality of arm position. Pen tilt was consistently in the abnormal range, and did not improve with practice. Results suggest that although coordination may improve with task-specific practice, postural abnormalities are likely to persist without specific intervention.

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**D. C. GILLESPIE, A. BOWEN & J. K. FOSTER. The Robustness of the Spot-the-Word Test After Stroke.**

Comparing current with estimated premorbid performance helps identify acquired deficits and assists rehabilitation planning. Tests of reading pronunciation are often inappropriate for stroke patients who may have articulatory problems. Lexical decision tasks offer an alternative approach. The Spot-the-Word test (STWT; Baddeley et al, 1993) requires identification of the real word in 60 word/non-word pairs. Although the test is believed to be resistant to the effects of cerebral damage, neither its validity nor reliability has been demonstrated following stroke. We recruited a consecutive sample of stroke patients ( $n=56$ ) and administered the STWT at four and 16 weeks post-stroke. For each patient, a control subject, matched for age and initial STWT scaled score, was recruited. Controls were also readministered the STWT. Statistical analysis was by limits of agreement (LOA; Bland and Altman, 1986) between four and 16-week STWT scaled scores. LOA were found to be larger for patients (-3.6 to 3.9) than for controls (-2.3 to 2.7). Eight patients (14%) obtained scale score improvements at 16 weeks greater than the upper agreement limit of controls. The 95% confidence interval around the 14% finding was 5 to 23%. The number of patients achieving an improved score is clearly greater than the 2.5% expected by chance. This suggests that, at four weeks post-stroke, the STWT is not resistant to cerebral damage. In contrast, only one patient (2%) deteriorated (i.e. obtained a scaled score decline more extreme than the lower agreement limit). We caution that the STWT may therefore significantly underestimate the actual premorbid level of ability in stroke patients. More work is needed to identify whether there are particular types of patients for whom the test is less robust.

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**S. J. DURRANI, A. P. ATKINSON, R. SPRENGELMEYER, D. I. PERRETT. An Exploration Of Multi-Modal Emotion Perception And Ageing.**

Emotion can be conveyed in many ways, which include facial and vocal expressions of emotion and changes in body movements and postures. Current thinking suggests that specific emotions, regardless of their modality, are processed by partially separable neural mechanisms. Calder and colleagues (2003) reported a progressive decline with age in the perception accuracy of fearful and angry facial expressions. We investigated emotion perception from vocal, static facial, and dynamic gesture displays amongst adults of all ages (range 20–80 years). Results show no differences between older people and their younger counterparts in facial emotion perception. Impairments in perceiving specific emotions in some tasks were revealed that were not replicable across other tasks or modalities. This lack of convergence in our results raises questions concerning the methods used to explore dissociable emotion perception mechanisms and their interpretation. The way these results may influence our understanding of the differential effects of ageing is considered.

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**C. R. GABRIEL Target To Target Interval (TTI) As A Determining Factor In The P300 Component In Elderly Subjects.**

In event-related potential studies, probability effects, inter-stimulus intervals (ISI) and sequence effects are usually manipulated in determining the P300 component. Literature research by Gonsalvez (1999) has determined that these manipulations can also be attributed to the temporal relationship between targets. The experimental design usually utilised is the 2-tone target and non-target oddball paradigm. However, if the target-to-target interval (TTI) is the determining factor of the profile of the P300 component, then sequence effects, ISI and probability effects can be subsumed under this experimental manipulation. A new experiment was designed where two experimental conditions were employed, a two-tone condition

and a one-tone condition. The 2-tone condition followed the standard oddball paradigm with target stimuli being separated by non-target stimuli varying from none (zero non-targets) to 9 non-target stimuli. With the ISI kept constant at 1-second, TTI ranged from 1s to 10s. In the 1-tone condition, only target stimuli were presented and the intervals ranged from 1s to 10s, counter-balancing the 2-tone experimental condition. Elderly subjects, ranging in age from 50 to 75 years with no history of neurological conditions participated in the study. Using the 10-20 system, brain electrical activity was recorded from midline frontal, central and parietal sites. Results indicated that in these subjects, P300 amplitude increased with increasing TTI with the greatest amplitude at Pz. P300 latency decreased with increasing TTI but with a difference between conditions. These findings suggest that the TTI hypothesis is a valid hypothesis. Research is currently on-going examining a clinical sample population.

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**Paper Session 1/9.00am-10.30am**

**ALZHEIMERS DISEASE**

**M. CHERRIER, E. AYLWARD, P. BORGHESANI, M. RASKIND & E. PESKIND. Distinct Patterns of BOLD Activation Using Functional Magnetic Resonance Imaging (fMRI) in Individuals at Genetic Risk for Developing AD Compared to Healthy Controls.**

The apolipoprotein E (APOE)- $\epsilon 4$  allele, is the chief known genetic risk factor for AD. Previous functional magnetic resonance imaging (fMRI) of individuals with the APOE- $\epsilon 4$  allele (APOE-E4 positive) found increases in blood oxygen level dependent (BOLD) activation while performing a memory task compared to individuals without the APOE- $\epsilon 4$  allele (APOE-E4 negative) and these changes were present prior to the presence of memory deficits on psychometric tests. We examined BOLD fMRI response of ten healthy control and two mild cognitive impairment (MCI) subjects while performing verbal and spatial memory tasks. Five participants were APOE-E4 positive and seven were APOE-E4 negative. APOE-E4 positive participants demonstrated decreases in BOLD activation while performing memory tasks compared to APOE-E4 negative subjects. Differences in BOLD activation were not due to performance as there were no differences between the groups with regard to memory task accuracy (in the scanner) or for baseline measures obtained prior to neuroimaging. Results suggest that in contrast to previous findings, the APOE-E4 allele may result in measurable decreases in fMRI BOLD activation rather than increases.

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**A. BOUMA, L. GOOTJES, J. W. VAN STRIEN, P. SCHELTENS. Mechanisms Underlying Ear Asymmetries In The Elderly And Alzheimer's Disease.**

The dichotic listening task (DLT) has been employed in many experimental and clinical studies to assess the functions of the two hemispheres in the brain. In a large study, we have presented the DLT to 144 right-handed, healthy subjects. These subjects were divided into three age decades: 60–69 yr, 70–79 yr, and 80–89 yr. All subjects received the DLT under two different conditions: divided-attention condition (free report) and focused attention condition (ordered report: left ear first; right ear first). The results revealed that in the latter condition attention highly influenced ear asymmetry scores, that is, a large right ear advantage was found in the right-ear focused condition and a smaller left ear advantage was found in the left-ear focused condition. Moreover, as the normal subjects became

older, they had more difficulties to pay attention to the left ear when demanded. Compared to controls (n=40), also Alzheimer patients (n = 25) revealed strong difficulties to report left-ear stimuli in the left-ear focused condition. We observed similar results in other studies. The present findings will be discussed in terms of structural and functional mechanisms underlying the attentional problems of the older subjects and the Alzheimer patients in the left-ear attention condition. Especial attention will be given to the involvement of the corpus callosum atrophy as well as the role of impaired executive functions.

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**M. MIMURA, S. KOMATSU, M. YANO, Y. SUZUKI, H. TABUCHI & H. YOSHIMASU. Optimizing Study Conditions for Patients with Mild Alzheimer Disease.**

Background. Increasing evidence has suggested that patients with early-stage Alzheimers disease (AD) or mild cognitive impairment benefit from intervention with memory training (DeVrees et al., 2001). Clare et al. (2002) demonstrated superiority of errorless learning in cognitive training for patients with AD. We further investigated what type of learning conditions are optimal for early stage AD patients. Method. Twelve patients with very mild or mild AD (Clinical Dementia Rating 0.5–1.0)(mean age=78.0 years old, mean MMSE=22.5) were asked to learn 8 target words under each of four study conditions that differed from one another in the dimensions of error and encoding; (1) Errorless/perceptual: the target was presented with gradually increasing fragment cues using perceptual identification techniques, (2) Errorful/perceptual: the subject was asked to guess the target with an initial letter, (3) Errorless/conceptual: the subject was asked to generate the target with a verbally given definition, (4) Errorful/conceptual: the subject was asked to generate the target corresponding to a given category. Free recall and recognition as well as perceptual identification were tested. Results. The errorless/conceptual condition (definition) led to significantly better free recall (4.2/8) than the other three conditions [errorless/perceptual (perceptual identification) 3.2/8, errorful/perceptual (generation with an initial letter) 2.4/8, errorful/conceptual (generation with a category) 3.0/8]. No differences were observed between each condition in recognition and perceptual identification tests. Conclusions. Overall advantage of errorless learning was replicated in our sample of early-stage AD patients. In addition, when errors were eliminated and controlled, the conceptual encoding condition, which presumably works on residual explicit memory, appeared to optimize learning of early-stage AD.

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**G. CAMPLIN, M. SALING & G. SAVAGE. Recognition Memory Test Performances In Alzheimer's Disease.**

Patients in the preclinical stages of dementia of the Alzheimer type (DAT) perform poorly on traditional cued-recall paired associate learning (PAL) tasks, which assess the ability of the medial temporal lobes (MTLs) to bind, encode and retrieve new relational memories. Research suggests the primary impairment in early DAT is memory encoding, resulting from early MTL pathology. However, patients with memory impairment due to other aetiologies may also perform poorly on cued-recall PAL due to deficits in other cognitive domains. Motivated by the difficulty of identifying memory encoding impairments using cued-recall PAL, we designed a verbal associate-recognition PAL test based on the assumption that recognition paradigms bypass effortful retrieval processes and may be less dependent on additional non-mnemonic cognitive demands. A group of early DAT and normal elderly controls completed the associate-recognition task and its cued-recall analogue, as well as a battery of additional memory and cognitive tasks. We investigated the contribution of non-mnemonic abilities to performance on cued-recall and recognition memory performances with a focus on the domains of processing speed, attention/working memory and semantic memory. Our results suggests that recognition PAL para-

digms should prove to be powerful clinical tools for identifying MTL dysfunction in the early detection of Alzheimer's disease.

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**M. ROGER, S. ROBINSON & G. SAVAGE. Hemispheric Asymmetry In Olfactory Identification In Mild Cognitive Impairment.**

Olfactory dysfunction is a recognised functional impairment associated with the development of Alzheimer's disease (AD). In the last decade, research has begun to explore the possibility of olfactory dysfunction as a marker of the prodromal phase of AD. Research has focused on patients identified as having an increased risk of developing AD such as those with Mild Cognitive Impairment (MCI). Whilst these studies are suggestive of a higher level of olfactory dysfunction in this population compared with matched controls, not all patients with identified olfactory dysfunction have gone on to develop AD. The majority of these studies have used conventional olfactory identification tests, presenting odours aurally with a multiple-choice format. This approach fails to take into account the potential presence of unihinal differences due to underlying asymmetrical neurological changes associated with hemispheric bias to specific pathological processes. Indeed, recent neuroimaging studies suggest hemispheric asymmetry in the pathophysiology of MCI, which affects cortical areas associated with both memory formation and olfactory processing. With olfaction the only human sense which is primarily processed ipsilaterally, it has the potential to be used as a marker of lateralized hemispheric dysfunction in MCI. This paper examines the lateralised effects of olfactory function (detection, spontaneous identification and forced-choice identification) in 18 patients with MCI utilising a modified olfactory function assessment with unihinal presentation. Findings are correlated with cognitive performance on a standardised neuropsychological test battery, and compared with the performance of 26 demographically matched controls. Identification data indicate a left hemisphere bias in impairment, consistent with reports of unilateral onset of AD pathology.

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**A. S. BROOME. Memory Regained: Treatment Effects of Cholinesterase Inhibitors in Individuals Suffering from Very Early Alzheimer's Disease.**

Alzheimer's Disease Assessment Scale (ADAS-cog) data measuring the effectiveness of Cholinesterase Inhibitors (ChEIs) in very mild Alzheimer's disease (ie MMSE 26-30/30) has not been reported to date. Drug trials have reported larger effects from ChEIs in moderate (MMSE 10-20/30) when compared to mild (MMSE 21-26/30) AD. These studies calculate 'effect' as the ADAS-cog score difference between placebo AD groups and ChEI treated groups. Untreated AD has been reported as progressing faster in moderate than in mild AD, and an 'effect' difference score could be enhanced in moderate AD due to accelerated placebo group decline. Consistent with this interpretation, absolute improvement from baseline scores has been reported as greater in mild groups. This paper presents data from 17 successive patients with very mild AD who completed the ADAS-cog to meet Pharmaceutical Benefit Scheme requirements. Repeat scores obtained after three months of ChEI treatment showed an average, significant 6.47 point improvement. Small, significant changes were measured on all memory subtests and some other subtests. The large score change obtained supports the previous prognostic finding that treatment earlier in the disease course produces greater absolute improvement. Consideration will be given to contextual factors that could have influenced scores, and the anatomical progression of AD will be related to different subtest score patterns evident between very mild AD and mild to moderate AD. The clinical and public health implications of increased use of ChEIs in treating very early AD will be explored.

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## Symposium 1/ 9.00am-10.30am

**COMMUNICATION DISORDERS AFTER  
TRAUMATIC BRAIN INJURY**

*Chair:* Leanne Togher  
*Discussant:* Sandi Chapman

The communication problems that may occur after traumatic brain injury (TBI) can be complex, difficult to evaluate and have profound deleterious outcomes for the person and their social network. This symposium addresses all these areas, with novel investigations into the nature of communication deficits, using theoretical perspectives from pragmatics and discourse approaches from sociolinguistics. It also focuses on the communication outcomes of people with TBI. Dr Sandra Chapman, an eminent expert in the area of communication and TBI, will critically appraise the symposium with a discussant address to conclude the session.

**I. S. MARTIN & S. McDONALD. Exploring the Causes of Pragmatic Language Difficulty Following Traumatic Brain Injury.**

This study evaluated the ability of three competing theories to account for the social language comprehension difficulties experienced by people with Traumatic Brain Injury (TBI). The role of Theory of Mind, non-mental inferential reasoning and cognitive flexibility in the ability to comprehend non-literal ironic jokes was assessed. Sixteen individuals who had sustained a TBI and sixteen age and demographic matched controls participated in the study. All participants were assessed on tasks designed to separately measure each of these constructs. The extent to which scores on these tasks were associated with the ability to comprehend ironic jokes was assessed using a correlational analysis. Participants with TBI were observed to be significantly impaired on tasks measuring Theory of Mind, general inferential reasoning and cognitive flexibility, with general inferential reasoning emerging as the most powerful predictor of the ability to comprehend irony. Theory of Mind reasoning in general was not significantly associated with irony comprehension, however the ability to reason about the mental states of characters within the irony task did play a role. It appears that the ability to infer the non-literal meaning from the social context is the most powerful explanation of deficits in the ability to comprehend irony in this population.

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**F. J. HINCHLIFFE, B. E. MURDOCH & H. J. CHENERY. Discourse Ability In Cognitive-Linguistic Subgroups of People With Traumatic Brain Injury.**

Five groups of participants with traumatic brain injury (TBI) were delineated according to their cognitive-linguistic profiles. The narrative discourse produced by each subgroup on a story-retelling task was compared with the discourse produced by a matched control group. Differences in the quality of discourse produced across the five TBI subgroups were also noted. The findings suggest that certain consistent relationships exist between aspects of linguistic and cognitive functioning as measured by standardised clinical tests and ability to produce narrative discourse. The results also identify features of discourse which appear to be highly individual in both brain-impaired and normal populations, and which appear to bear little relationship to linguistic or cognitive competence. The present findings support the need to identify clinical subgroups within larger samples of TBI people, in order to better understand how discourse can be affected by cognitive-linguistic dysfunction.

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**V. H. SMITH, L. TOGHER, C. M. TAYLOR & S. GRANT. The Effect Of Discourse Genre On Communication Opportunity In Individuals With Cognitive-Communication Impairment Following Traumatic Brain Injury.**

Most people who sustain a traumatic brain injury (TBI) have communication problems, the most common being a cognitive-communication disorder (McDonald, Togher & Code, 1999). While recent research has focused on the discourse of people with TBI, few studies have measured the effect of cognitive-communication problems on the everyday communicative functioning of the person with TBI and their social networks. Furthermore, people with TBI have not been studied in interactions with other people with TBI, even though these are some of their primary communication partners during their therapy programs. This study utilised the existing weekly communication group and individual therapy sessions attended by inpatient and community TBI clients at a metropolitan brain injury unit. Results will be presented of the communicative exchanges of four individuals with TBI in a conversation with a therapist, a conversational dyad with their TBI peer, and in group interactions with other TBI participants. The genres included an unstructured chat, the participant requesting information and the participant giving information. Interactions were analysed using exchange structure analysis (Ventola, 1987). Case-by-case analysis was also used to detail the qualitative differences between TBI participants. Results indicated that people with TBI are given different communicative opportunities according to whom they are speaking and the genre in which they are engaged. As therapy aims to maximize communicative opportunities for people with TBI, the implications for clinical decision-making regarding intervention strategies will also be discussed.

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Ventola, E. (1987). *The structure of social interaction: a systemic approach to the semiotics of service encounters*. London, UK: Pinter.

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**J. M. DOUGLAS, C. A. BRACY, P. C. SNOW & D. MCNEILL-BROWN. Communication Outcome Following Severe Traumatic Brain Injury.**

This study investigated communication outcome following severe traumatic brain injury (TBI) from the perspective of injured individuals and their family members. Sixty-one adults with severe TBI (duration of post-traumatic amnesia > 14 days) and a close family member participated in the study. The most frequently reported persistent communication difficulties included going over and over the same ground in conversation, getting sidetracked and losing track in conversation, and word finding difficulties. Comparison of the perceptions of injured individuals with the perceptions of their relatives revealed the existence of distinct subgroups characterised by the degree of congruency between self and family perceptions. The role of awareness of deficit, injury severity and time post-injury in defining membership of these subgroups will be discussed from a treatment perspective.

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**L. TOGHER. Assessing Communication After Traumatic Brain Injury (TBI): Discourse Tasks Are Not All Created Equal.**

The communication of people with TBI is typically assessed by monologic and dialogic tasks including narrative, procedural and interview genres. Outcomes of these assessments direct treatment options and may also be used to define discharge criteria (Hartley, 1992). Determining the tasks that best represent a person's ability to communicate remains unclear. However, communicative opportunity is reliant on the genres offered to the person with TBI, and the communication partners with whom they engage. This paper presents the case of a person with chronic severe TBI who was recorded in 7 discourse tasks, both monologic and dialogic. The TBI subject was matched with a control according to age, sex and educa-

tion. Both subjects produced monologues with a research assistant and dialogues with a friend. Monologues included picture description, a procedure (the Dice Game, McDonald & Pearce, 1995) and giving an opinion; while dialogues included a jointly produced narrative, a problem-solving task, unstructured conversation and an information giving activity with their friend. Transcripts were analysed according to macrostructural elements, and use of micro linguistic resources such as politeness markers and humour. Differences were evident between TBI and control samples in the inclusion and organization of obligatory macrostructural elements. Both the genre and access to a communication partner had a significant influence on both TBI and control subjects' communicative opportunity. Significantly, dialogic tasks provided a better indication of communication skills, and increased communicative opportunity occurred when the person with TBI was in an information giving or equal role. Additionally, tasks where humour and solidarity were evident gave the best picture of communication status. This has implications for assessment and treatment of people with TBI, with the inclusion of friends in the treatment process being a key recommendation.

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### Paper Session 2/9.00am-10.30am

#### NEUROPSYCHOLOGICAL PROBLEMS ASSOCIATED WITH MEDICAL ILLNESS

##### **V. A. RICHARDS, W. R. LEVICK, W. G. REID & K. NAIR. The Role Of Specific Cognitive Impairment And Drug Use In The Development Of Post-Operative Delirium In Older Community Dwelling Adults.**

Point prevalence studies indicate that delirium occurs in up to 51% of surgical and medical inpatients over 50 years of age. Global cognitive impairment and medication use have been identified as risk factors in some studies. No studies have used a range of neuropsychological tests and examined specific cognitive deficits as risk factors pre-operatively, in the population of non-demented older adults. This study examined neuropsychological indices and medication/drug use as predictors of the occurrence of post-surgery confusion/delirium. It was predicted that specific cognitive deficits and medication use may predispose to development of post-operative delirium in older community-dwelling adults. One hundred patients 65 years and over, awaiting elective orthopedic surgery, underwent a neuropsychological evaluation in the 21 days prior to surgery. The development of post-operative confusion was monitored by reference to patient medical records and by nursing staff using a modified version of the Confusion Assessment Method. Results for the 100 participants indicate a 25% rate of post-operative confusion. For this group, differences between the patients with and without delirium were found on the variables of speed of information processing and regular alcohol consumption in the final model. The implications of these findings for management of this patient population will be discussed.

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##### **L. A. CYSIQUE, P. MARUFF & B. J. BREW. Neuropsychological Functions In HIV/AIDS Infection: Are Neurologically Active Antiretroviral Agents Important?**

Despite the Highly Active Antiretroviral Therapy (HAART), studies have demonstrated that HIV-associated neuropsychological impairment remains common. Our results have demonstrated that while prevalence of deficits remains stable across pre-HAART and HAART eras, the nature of cognitive impairment may be changing. One possible explanation for this is that the HAART regimens used contain more or less antiretrovirals that have neurological efficacy (neuro-active drugs). 97 HIV+ individuals with advanced HIV infection were recruited from tertiary referral hospital outpatient clinics and 30 seronegative individuals were recruited as controls. All were examined with a battery of standard neuropsychological

tests assessing seven cognitive domains. The patients were analyzed (t-test, analysis of variance and effect sizes) according to whether their HAART regimen contained three or more neuro-active drugs (neuroHAART group n = 41) or not (HAART group n = 56). Because ritonavir may enhance penetration into the brain of antiretroviral drugs, the patients were further analyzed according to whether they were taking ritonavir: neuroHAART n = 41, HAART mines ritonavir n = 25 and HAART plus ritonavir n = 31. The treatment groups (NeuroHAART and HAART) did not differ on neuropsychological performance. This was despite the fact that patient groups were impaired on several measures compared to controls. Patients receiving a neuroHAART regimen had significantly better performance on verbal memory learning and lower performance on motor-coordination compared to patients on HAART without ritonavir but not compared to patients on HAART with ritonavir. In conclusion, no direct benefit of neuro-active antiretroviral therapy was found. However, this appeared to be due to ritonavir augmenting the neurological activity of HAART drugs that otherwise would not enter the brain. Furthermore our results may provide preliminary evidence for brain mitochondrial toxicity in regimens containing ritonavir.

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##### **E. BOSSEMA, A.N. BRAND, F.L. MOLL, R.G.A. ACKERSTAFF & L.J.P. VAN DOORNEN. Intraoperative Microemboli Do Not Predict Cognitive Decline Following Carotid Endarterectomy.**

Intraoperative microemboli during cardiac surgery are commonly reported and may lead to cognitive deficits. Microemboli are also detected during carotid endarterectomy (CEA). In this surgical procedure severe atherosclerotic plaque is removed from the carotid artery. Cognitive decreases have been reported as well following CEA, possibly due to microembolism. This study examined the relationship between microembolism during and immediately after CEA and postoperative cognitive impairment. CEA patients (n=58) were tested 1 day preoperatively and 3 months postoperatively with a neuropsychological test battery, including tests of attention, memory, executive and motor function, and visuospatial abilities. Number of microemboli was monitored with transcranial Doppler ultrasonography. Forty patients (69%) had signs of intraoperative embolism, varying from 1 to 33 isolated microemboli and/or 1 to 12 embolic showers. Postoperative microemboli (monitored in a subgroup of 27 patients) were present in 22 patients (81%), ranging from 1 to 142 isolated emboli. More than 10 emboli (including embolic showers) were detected in 16 patients (28%) intraoperatively and 6 patients (22%) postoperatively. Cognitive deterioration (at least 1 SD decline from the preoperative score on at least 4 variables) was found in 7 patients (12%). Statistical analysis showed no significant correlations between cognitive change and number of intraoperative and/or postoperative microemboli. Differences in cognitive change between patients with and without embolism were neither found. We conclude that microemboli during and immediately after surgery occur in a large majority of CEA patients, but that degree of embolism is generally small and of no significance with respect to neuropsychological impairment.

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##### **G. J. CHELUNE, K. FEISTHAMEL & L. STONE. Assessing the Prevalence and Relative Risk of Cognitive Dysfunction in Patients with Multiple Sclerosis.**

Estimates of the prevalence of cognitive dysfunction in multiple sclerosis (MS) vary widely within and across cognitive domains depending on the composition of the patient and comparison groups. We extend our previous research examining the prevalence and estimated relative risk of neurocognitive impairment within each of the 6 cognitive domains defined by the joint factor structure of the Wechsler-III tests. In this study we conducted a case controlled investigation of general impairment among 311 patients with clinically definite multiple sclerosis (MS); 219 relapsing remitting MS (RRMS), 68 secondary progressive MS (SPMS) and 24

primary progressive MS (PPMS). The normal comparison group (NC) consisted of 1214 cases in 3 major ethnic categories from the weighted standardization sample that completed both Wechsler-III tests. Scores below the 5th percentile on a given factor using the new demographic norms corrected for age, education, gender, and ethnicity defined an impaired factor. General impairment was defined as 2 or more impaired factor scores. Only 7.8% of NC were impaired compared to 33.8% of the MS sample. However, the prevalence of impaired status varied by clinical course, with 23.3% of RRMS, 70.6% SPMS, and 25.0% SPMS being impaired. The estimated relative risk (odds ratio) for cognitive impairment was 6 times more likely in MS patients than NC, with SPMS having an OR=28.3 compared to 3.6 for the RRMS and 3.9 for the PPMS groups. Among MS patients, the diagnosis of SPMS was 7.9 times more likely than RRMS and 7.2 times more likely than PPMS if a patient demonstrated cognitive impairment. These results suggest that prevalence estimates of cognitive dysfunction in MS should be reported separately by disease course as results can be easily skewed by the composition of sample.

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**C. S. ERNEST, M. LE GRANDE, N. GENARDINI, B. MURPHY, D. G. ANDREWES, M. WORCESTER, R. HIGGINS, A. GOBLE & J. TATOULIS. Cognitive Function in Candidates for Coronary Artery Bypass Surgery.**

While many studies have found cognitive deficits in patients following coronary artery bypass surgery (CABS), very few have evaluated pre-surgical cognitive functioning of patients in detail. Methods: Cognitive performances of candidates consecutively listed for CABS (N=101, mean age 63, 79% males) were assessed and compared with a healthy reference group (N=24, mean age 62, 79% males) and standard normative data. A battery of 13 standard neuropsychological tests was administered before surgery as part of a randomised controlled trial of on-pump versus off-pump CABS. Patients also completed questionnaires assessing pre-surgical anxiety and depression levels. Results: Controlling for effects of sociodemographic variables (age, gender, education and language) and psychological factors (anxiety and depression), CABS patient performances were significantly lower than those of the reference group on the WAIS III Digit Span and RAVLT. When patient performances were compared with age and gender adjusted normative data, significantly lower performances were noted on Trails A & B, Grooved Pegboard, WAIS III DSy, RAVLT and NART-R. Effects of medical comorbidities such as diabetes as well as cardiovascular disease-related factors including hypertension, angina and use of beta blockers were examined. Conclusion: The cognitive performance of candidates for CABS was significantly lower statistically than that of the healthy reference group in the domains of attention, working memory and verbal memory. Additionally, the comparison with normative data showed lower performances in information processing and motor speed. The effects of medical factors on cognitive function and the clinical significance of these findings will be discussed. Correspondence: *Mrs Christine Ernest, Heart Research Centre, Box 2137 Post Office, Royal Melbourne Hospital, PARKVILLE VIC 3050, AUSTRALIA, christine.ernest@mh.org.au*

**L. J. TIPPETT & G. MARTIN. Shime-Waza In Judo: Neuropsychological Effects Of Brief Ischaemic-Hypoxic Episodes.**

Can brief ischaemic-hypoxic episodes cause neuropsychological impairments? We tested high level Judo players, who had been exposed to shime-waza (strangling an opponent's neck by applying pressure to carotid arteries) with brief periods of unconsciousness (20 seconds). The performance of 10 black-belt judo players was compared to two matched control groups (10 black-belt aikido players and 10 normal subjects) on tasks sensitive to hippocampal and basal ganglia dysfunction (regions selectively vulnerable to hypoxic events) and tasks sensitive to diffuse damage accompanying MHI. The judo group performed significantly worse than the aikido group on three measures of delayed memory recall and were significantly

slower on a motor-skill learning task (mirror drawing). The latter was consistent with their generally poorer performance on tasks of pure motor speed. In contrast, there were no significant differences on tasks sensitive to MHI; the judo group performed exceptionally well on PASAT. The judo participant most frequently strangled to unconsciousness was significantly impaired on six of seven measures of learning and recall, but had no impairments on any other neuropsychological tasks and an excellent performance on PASAT. Overall these data imply that even when periods of hypoxia are brief, repeated episodes can induce impairment in delayed memory recall, presumably reflecting hippocampal dysfunction. Protections exist for young judo players, and those of lesser skill, but high-level judo players who engage in shime-waza are at risk of developing significant neuropsychological impairments in new learning.

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**Symposium 2/9.00-10.30am**

**SOME EVIDENCE BASED APPROACHES IN NEUROPSYCHOLOGY**

*Chair: Stephen Bowden*

Evidence based practice are buzzwords with many connotations. In this symposium, the presenters will describe aspects of evidence based practice in developmental neuropsychology, forensic assessment of traumatic brain injury, single-case studies, and adult neuropsychology in general. These presentations all combine the aspiration to derive scientifically defensible conclusions from research of clinical relevance, together with a careful consideration of the practical clinical utility of the research findings. In contrast to some conventional approaches to neuropsychological formulation which place a relatively strong emphasis on intangible dimensions of clinical expertise, strong themes in contemporary evidence based approaches include making the methods explicit and encouraging peer evaluation. In the first presentation in this symposium Tim Hannan and Marita Brack review some problematic aspects of current practice in developmental neuropsychology, and outline potential directions for improving the quality of professional opinions. Next, Stephen Bowden and colleagues address a fundamental assumption in clinical assessment known as measurement invariance, and illustrate the practical impact of retention or rejection of this assumption with analysis of clinical and normative data. John Crawford describes refinements in the popular dissociation methods, with intriguing implications for theoretical development using the single-case approach. Finally, Karen Sullivan discusses the Rarely Missed Index of the WMSIII.

**HANNAN, T. J., & BRACK, M. The Diagnosis And Classification Of Developmental Learning Disorders: Deficiencies In Practice And Neuropsychological Solutions.**

Notwithstanding the importance of psychological assessment to the diagnosis and classification of developmental learning disorders, current practice in this field remains characterized by outdated and deficient theoretical models and a failure to apply principles of evidence-based practice. This paper reports the findings of a review of the reports of psychological assessments conducted on children subsequently seen at a Sydney learning disabilities clinic. Examination of 88 reports authored by 72 psychologists revealed numerous serious errors in common practice in developmental neuropsychological assessment, including the use of outdated, unstandardised and unreliable instruments, the failure to acknowledge the contribution of cultural and psychosocial variables, and limitations in the analysis of individual data. Strategies for improving standards of practice are explored, with discussion of opportunities presented by the concurrent Australian standardization of the WISC-IV, WIAT-II and CELF-4. Correspondence: *Mr Tim Hannan, University Of Western Sydney, School Of Psychology, Locked Bag 1797, PENRITH SOUTH DC NSW 1797, AUSTRALIA, t.hannan@uws.edu.au*

**S. C. BOWDEN, D. LISSNER, K. MCCARTHY, L. WEISS & J. A. HOLDNACK. Reflections on the Assumption of "Measurement Invariance" in Neuropsychological Assessment: Implications from Clinical Studies, and the Comparison of WAIS-III Scores in Australia Versus US.**

Explained briefly, the assumption of measurement invariance requires that a set of test scores reflects the same psychological constructs and the same scales in different groups, for example, community controls versus a clinical group. The assumption of measurement invariance is integral to fair psychological assessment and simple interpretation of construct validity. It has sometimes been assumed that measurement invariance does not apply when assessing cognitive abilities in patients with brain injury. However, rejection of the assumption of measurement invariance produces interesting inferential problems for clinical assessment. Instead, data from clinical studies of core cognitive abilities and mood will be reported to show that measurement invariance may be the rule rather than the exception. Having further established that measurement invariance also applies across normative samples of the WAIS-III in the US and Australia, the advantages of this approach will be illustrated with an analysis of latent mean differences between US and Australia. Although the latent variable means initially differed significantly across the two samples, when the direct effects of demographic variables on latent variables were included in the analysis, no significant differences remained on any of the latent variables. These results support the interpretation that apparent differences in the IQs obtained from Australian and US WAIS-III standardization data were not attributable to real differences in cognitive ability in the respective populations, but instead attributable to a mismatch between the demographic characteristics of the US and Australian samples, as well as between the Australian sample and the Australian population.

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**J. R. CRAWFORD Single-case Studies in Neuropsychology: Statistical Methods for Testing for Deficits and Dissociations.**

Many single case studies in neuropsychology attempt to detect dissociations of function. The conventional criteria for a classical dissociation requires that a patient is 'impaired' on Task *X* and 'within normal limits' or 'not impaired' on Task *Y*. Crawford and colleagues (e.g., Crawford, Garthwaite & Gray, 2003) have argued that this definition is inadequate and that there should be a further requirement that the patient exhibits a significant difference between performance on Tasks *X* and *Y*. They have also developed a series of statistical methods to test for deficits and dissociations; unlike the 'standard' methods (which use *z* or *zD* respectively) the new methods treat the control sample as a sample rather than as a population and are therefore suitable for use with the small control samples commonly employed in single case studies. Monte Carlo simulation was employed to compare the Type I error rates for the conventional criteria for dissociations with Crawford et al's. criteria. Two forms of Type I errors were considered: (a) falsely concluding that a control case exhibited a dissociation, and (b) falsely concluding that a patient with equivalent deficits on Tasks *X* and *Y* exhibited a dissociation. Results showed that in case (a) the Type I error rates were high for the conventional criteria but very low for Crawford et al's criteria (range 2.5% to 0.90%). In case (b) the error rates were very high for the typical criteria (range 19.4% to 49.6%) but acceptable for Crawford et al's. criteria (rates ranged from 2.8% to 7.1%).

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**K. SULLIVAN, R. LANGE & D. S. ANDERSON. An Evaluation of the Rarely Missed Index (RMI) of the Wechsler Memory Scale III in a Personal Injury Litigant Sample.**

The Rarely Missed Index (RMI) is a relatively new method for evaluating cognitive effort. Developed by Killgore and DellaPeitra, this index can be derived from information collected from the Wechsler Memory Scale-III

Logical Memory Delayed Recognition task. While initial research using analogue malingerers has been favorable (Killgore & DellaPeitra, 2000), an independent investigation of the utility of the RMI has not fully supported its use (Lange et al., 2003). The purpose of this study was to further evaluate the clinical utility of the RMI to evaluate cognitive exaggeration in the context of personal injury litigation. Participants were 158 personal injury litigants and 78 non-litigant patients, with mixed clinical diagnoses. Personal injury litigants were further grouped into three sub-samples using standard indices of malingering: those providing inadequate cognitive effort (i.e., Suspected Exaggerators, *n* = 20), those demonstrating borderline effort (i.e., Borderline Exaggerators, *n* = 12), and those providing adequate effort (i.e., Genuine Responders, *n* = 126). Performance across groups was compared using the RMI and yielded false positive error rates (i.e., RMI > 136) ranging from 5.4% in the Genuine Responder to 8.6% in the non-litigant group. Higher rates of positive RMI scores were found for Suspected Exaggerators (25.0%) and Borderline Exaggerators (41.7%). Examination of the clinical utility of the RMI to identify Suspected Exaggerators versus individuals in the Genuine Responder and Mixed Clinical groups revealed low sensitivity (sensitivity = .25), very high specificity (range = .91 to .95), moderate positive predictive power (range = .50 to .71), and moderate to high negative predictive power (range = .68 to .83). These results suggest the RMI may not be a reliable predictor of cognitive exaggeration and its use as a measure to evaluate response bias should be undertaken cautiously.

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**Paper Session 3/11.00am-12.30pm**

**OUTCOME STUDIES FOR ACQUIRED BRAIN INJURY**

**K. A. FRENCHAM, A. M. FOX & M. T. MAYBERY. Meta-Analytic Review Of Neuropsychological Research In Mild Traumatic Brain Injury Since 1995.**

In mild traumatic brain injury (TBI) research, the relationship between the injury and neuropsychological outcome has long been controversial. A meta-analysis conducted by Binder et al. in 1997 was successful in quantifying this relationship, by demonstrating an association between mild TBI and small reductions in cognitive functioning in non-clinical adult samples who were more than 3 months post-injury. As a follow-up, the current study aimed to summarize research addressing the neuropsychological sequelae of mild TBI that (1) was published since that reported in the previous meta-analysis, and (2) included data collected at any stage post-injury; acute and post-acute. Using strict inclusion and exclusion criteria, an extensive search of recent literature revealed 17 studies (including 634 mild TBI and 485 control individuals) containing data that permitted effect size calculation. Resultant effect sizes were weighted by sample size and aggregated. Significant positive effect sizes were found in terms of overall neuropsychological outcome ( $g = 0.32, p < .001$ ) and in specific neuropsychological domains. Time since injury was also addressed as a moderating variable. Comparing present results with those reported by Binder et al., we support their account of a relationship between mild TBI and slightly reduced cognitive functioning. The relationship between degree of reduction of cognitive functioning (both overall, and in specific neuropsychological domains) and time post-injury is also discussed.

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**L. W. BRAGA. Traumatic Brain Injury (TBI) In Childhood And Adolescence: Relation Between Neuropsychology And Neuroimaging, Outcomes and Quality Of Life (QoL).**

Introduction: This study evaluates the outcomes of children and adolescents with severe and moderate TBI an average of 4 years post-accident, addressing neuroimaging findings, neuropsychological evaluation, motor

performance, academics and QoL. Method: A group of 23 children with TBI aged 7-13 were matched with a control group of 23 children. MRI, Medical Charts, WISC, List of 12 Words, Signoret Recognition, Semantic Verbal Fluency Test, Calculation Battery, Physical-functional Scale, Interview with Parents and QoL Questionnaire answered by each child, were used for evaluation. Statistical data analysis: Mann-Whitney and Pearson's Correlation tests. Results: Statistically significant associations were found between: overall IQ and visual and verbal memory tests; lesions to corpus callosum and automobile accidents; dyscalculia and parietal lobe lesions; low verbal memory performance and temporal lobe lesions; occipital lobe lesions and visual memory; posterior fossa lesions and overall IQ, visual memory and verbal memory. No relation was found between total lesion volume and neuropsychological or physical-functional evaluation results. All children returned to school after the accident; 65% needed reinforced academic assistance. Parents primarily reported behavioral problems and attention disorders. Results showed a statistically significant relation between the TBI and the control groups in overall QoL scores, with academic performance being the most important variable. Conclusion: This study revealed several associations between neuroimaging findings and neuropsychological outcomes. Despite a Glasgow average score of 5, most of the children achieved independent gait and returned to regular schooling. Academic performance was the most significant variable in the child's assessment of his/her own quality of life.

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#### **C. M. HERBERT. Outcome Data from 320 Clients with Acquired Brain Injury.**

This paper will present data on the 320 clients with acquired brain injury admitted to Ticehurst House Brain Injury Unit in South East England between June 1989 and July 2001. Pre-injury data, status on admission and on discharge is available for all clients and follow up data are available for 125 clients. The data are based on broad admission criteria (excluding pre-morbid psychiatric history or learning disability) and represents a general clinical population presenting with severe injuries. The data address the effects of rehabilitation on support needs from admission to discharge, and the impact of early versus late stage rehabilitation. Follow up data extending over 5 years is presented, with information concerning ongoing care needs, level of independence, employability and quality of life. In spite of the severity of the original injuries and a range of ongoing needs, the majority of the clients reported a positive quality of life, and the implications of this finding will be discussed.

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#### **A. MCKINLAY, J. C. DALRYMPLE-ALFORD, L. J. HORWOOD & D. M. FERGUSON. Adverse Outcomes Associated With Childhood Mild Head Injury Continue Into Adulthood: A 25 Year Follow-Up Of A Birth Cohort.**

Mild head injury (MHI) is a common childhood event with unknown effects on adult functioning. Only two previous studies have examined this issue and both included some moderate/severe cases. Using data from the Christchurch Health and Development Study of a birth cohort of over 1000 children, born in 1977, we previously demonstrated that most childhood MHIs appear to have no detectable outcome, but more severe (inpatient) MHI results in increased psychosocial deficits during childhood and some psychiatric outcomes in adolescence. Here, we present preliminary findings on outcomes at 25 years of age. After exclusions, children were divided into those with a MHI between ages 0-10 years (n=79) or other-injury control (n=47); the remainder represented a non-injury reference group control (n=409). As before, the MHI group was divided according to severity (inpatient vs outpatient status) and age at injury (prior to or after age 5). Self-report information was collected on a range of outcomes including ADHD, antisocial personality disorder, substance abuse and alcohol abuse, with collateral information provided by a significant other.

Unlike our 14-16 year findings, there was no evidence of increased substance or alcohol abuse. Similar to our previous findings, however, inpatient MHI was associated with increased ADHD symptoms and increased odds ratios for antisocial personality disorder, the adult psychiatric correlate of conduct disorder; these outcomes were particularly evident for those injured prior to age 5. These new findings indicate an adult impact of MHI for some children and the need for early identification and intervention.

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#### **R.L.I. WOOD. 20 Year Follow-Up Of Serious Head Trauma.**

Data will be presented on 71 cases of severe head trauma (PTA > 7days) sustained 20 years previously (X = mean = 20.95 years, sd = 4.88 years) to examine the long term impact on cognitive functions, quality of life issues, psychological adjustment and other psychosocial variables that are known to influence early recovery. Data from two related studies will be presented.

1. A longitudinal study of 22 cases re-examines measures of intelligence and memory after an interval of 20 years to determine:
  - a. If there is evidence of progressive deterioration over this period of time.
  - b. the impact of cognitive status on quality of life and other psychosocial variables.
2. A cross sectional study examines the cognitive abilities of 71 cases on the WAIS III and WMS III, plus a range of other neuropsychological measures to:
  - a. Compare the cognitive abilities of a large clinical sample against age related norms in order to determine neuropsychological profiles and indicators of early cognitive decline.
  - b. Evaluate long term psychosocial adjustment in relation to
    - i. Severity of injury
    - ii. Pre-accident psychosocial variables
    - iii. Coping styles and other 'personality' measures.
    - iv. Level of functional independence
    - v. Quality of life

Preliminary analysis of the data has not shown any sign of progressive cognitive decline or predictable patterns of neuropsychological impairment. Psychosocial adjustment and quality of life measures, using data from both head injury survivors and their nearest relative, appears surprisingly good, considering the severity of injury and early recovery indicators. It is possible that the poor long term prognosis often adopted regarding cognitive and psychosocial outcome will need to be revised.

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### **Symposium 3/11.00am-12.30am**

#### **DEVELOPMENTAL COORDINATION DISORDER: A NEUROPSYCHOLOGICAL PERSPECTIVE.**

*Chair : Deborah Dewey  
Discussant: Caroline O'Brien*

Deficits in motor skill have been labelled in many ways over the centuries (e.g., neurological soft signs, clumsiness, dyspraxia), but the current dominant term is Developmental Coordination Disorder (DCD). According to the DSM-IV, DCD is "... a marked impairment in the development of motor coordination... (which) significantly interferes with academic achievement or activities of daily living...". The prevalence of DCD is estimated to be about 6-10 percent in school age children and there is no identifiable neurological or medical cause. Although DCD may occur in



isolation, many children with this disorder display additional problems, including attention deficits, learning disabilities and speech/language deficits. Children with DCD have also been noted to have deficits in visual perception, kinaesthetic perception and memory, as well as socio-emotional difficulties. The fact that DCD often co-occurs with other developmental disorders poses a challenge to neuropsychologists in terms of identifying, assessing for and determining appropriate interventions for children with this disorder. The papers presented in this symposium will address these issues and attempt to answer the following questions: (1) What is DCD and what are the longterm outcomes for children with this disorder? (2) To what extent does DCD co-occur with developmental disorders of learning and attention, and emotional/behavioral problems? (3) Are visual perceptual difficulties a common feature in children with DCD and do these distinguish children with DCD from children with other developmental disorders of learning and attention? (4) How can children be adequately assessed for DCD? (5) What intervention strategies are useful for children with DCD?

#### **M. CANTELL. What is Developmental Coordination Disorder?**

Developmental Coordination Disorder (DCD; APA, 1994) is used to refer to the difficulty that about 10 percent of children have in learning everyday movement skills in home, school and play environments. The difficulties experienced by children with DCD are not primarily due to general intellectual, primary sensory or motor neurological impairment. This paper will introduce definitions used for DCD, and the reasons why several definitions such as developmental dyspraxia and DAMP are also being used. Next, issues related to prevalence and aetiology will be discussed. Both of these are dependent on the diagnostic tools used, which vary from observational studies carried out by class room teachers to standardized perceptual motor tests carried out by psychologists. Finally, the long-term outcomes of DCD will be discussed from perceptual-motor, cognitive and social perspectives. As an example, I will summarize a study of a cohort of 5 year olds in one town in Finland. One hundred and forty-six children with motor problems and an age comparison group of 40 children were studied at 7, 9, 11, 15 and 17 years of age. In the perceptual motor domain, a large neuropsychological battery including gross motor tasks, Purdue Pegboard and VMI, were used. In the cognitive domain, data on intelligence, academic achievement and occupational plans were collected. In the social domain, questionnaires, interviews and behavioural ratings were administered. The longitudinal data indicated that the detrimental effects on cognitive, occupational and social development, at least in adolescents with severe DCD, can be lost lasting.

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#### **P.H. WILSON. Developmental Coordination Disorder: Toward a Neurocognitive Model.**

Adopting a neurocognitive framework, this presentation considers recent work examining the locus of motor control deficits in children with motor coordination difficulties (or Developmental Coordination Disorder-DCD). We have argued that the ability to internally represent the visuospatial coordinates of prospective actions is impaired in DCD, as evidenced by abnormal performance on converging measures of feedforward control: e.g., covert orienting of attention, motor imagery (or simulated action), and performance on double-step saccade tasks. Here we present recent data taken from stage-one testing in a large longitudinal study examining the relationship between motor skill development and the ability to internally model movement parameters. Motor skill status was assessed using a 2-step process involving teacher referral and motor screening on the Movement Assessment Battery for Children (M-ABC). The sample comprised 220 children aged between 7 and 11 years; there were 80 children who met criteria for DCD and 140 controls. Measures of imagery included a mental rotation paradigm using both hand and object stimuli, and visually-guided pointing task (VGPT) performed under real and imagined conditions. Results validate an earlier study that shows that most children with DCD manifest a specific deficit in motor imagery, while the ability to

mentally manipulate objects remains intact. Mental rotation of hand stimuli did not conform to the conventional trade-off between angle of rotation and response time, while rotation of objects was normal. On the imagined condition of the VGPT, children with DCD, unlike controls, failed to show the characteristic trade-off between response time and target width (or Fitts' Law). These results are consistent with our working hypothesis, as well as recent data showing the efficacy of imagery training in facilitating skill acquisition in these children.

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#### **D. DEWEY, B. J. KAPALN, S. G. CRAWFORD, & B. N. WILSON. Co-occurrence of Developmental Coordination Disorder with other Developmental Disorders.**

Although developmental coordination disorder (DCD) may occur in isolation, many children with this disorder display additional problems, including attention deficits, learning disabilities and speech/language deficits. Children with DCD have also been noted to have deficits in visual perception, kinaesthetic perception and memory, as well as socioemotional difficulties. Research has suggested that DCD is associated with the co-occurrence of a number of disorders of development. We will begin with a discussion of some of the terminology that has been used to describe the co-occurrence of developmental disorders and address some of the problems associated with its use in developmental research. This will be followed by a discussion of extent of overlap of developmental disorders among children who display disorders in motor function. Finally, we will present our own research, which has examined problems in attention, learning and psychosocial adjustment in children with DCD. In this study 51 children with DCD, 51 children identified as "suspect" for DCD and 78 comparison children were compared on standardized measures of attention, learning and psychosocial adjustment. Our findings revealed that children with motor problems, regardless of the degree or severity evidenced problems in attention, learning and psychosocial adjustment. Thus, children with DCD, no matter what the degree or severity, are at significant risk for developmental problems in a number of areas.

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#### **S. G. CRAWFORD, B. J. KAPLAN, D. DEWEY. Visual Perceptual Functioning In Children With Developmental Coordination Disorder, Reading Disabilities, And Attention Deficit Hyperactivity Disorder.**

Wilson and McKenzie (1998) reported that the greatest deficiencies among children with DCD were in visual perceptual processing. No studies have, however, investigated visual perceptual functioning in children with DCD, and other learning problems such as reading disabilities (RD) and/or Attention Deficit Hyperactivity Disorder (ADHD). We will present data from our research program with children (n=199) examining deficits in visual perceptual functioning in relation to DCD, RD, and ADHD. Children were identified as DCD based on their performance on standardized tests of motor functioning. Children also completed the Test of Visual Perceptual Skills (TVPS) and the Rey Osterreith Complex Figure (ROCF; copy and delayed recall). Our findings revealed that, after controlling for IQ, children with DCD and at least one other disorder (i.e., ADHD and/or RD) had impairments on the TVPS perceptual quotient compared to control children, and to those with just DCD or just ADHD. In contrast, on the ROCF, children with DCD and at least one other disorder scored significantly lower than children with ADHD and/or RD. Interestingly, there were no differences between the two DCD groups on this measure which unlike the TVPS has a motor component. These findings suggest that the presence of visual perceptual problems should alert the neuropsychologist to the possibility of motor coordination problems in children with ADHD and/or RD.

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**D. LARKIN, T. BOYLE, M. LICARE, E. ROSE. Identifying and Assessing Developmental Coordination Disorder.**

Parents and professionals often have difficulty with the identification of children with motor learning difficulties, more commonly referred to as developmental coordination disorder (DCD). As a result many children with DCD receive little support in their daily struggle with motor difficulties and the accompanying social problems. Here we will address some of the difficulties associated with the recognition of DCD and discuss different approaches to identification and assessment. We will compare our database (N = 878) on the incidence of DCD with a range of other studies and discuss why occurrence rates might differ across studies, as does the ratio of boys and girls. We will present data from our research program to show the relationships between the McCarron Assessment of Neuromuscular Development (MAND) motor test, a short 4-item movement screening test, Stay in Step ( $r = .82$ ), a parent questionnaire, the DCDQ ( $r = .79$ ), and an assessment of associated movements ( $r = .62$ ). Finally, we will make a case for multi-level assessment for DCD to ensure that children who do have difficulties with motor learning are identified and supported. Correspondence: *Dr Dawne Larkin, University of Western Australia, School Of Human Movement & Exercise Science, 34 - 35 Stirling Highway, CRAWLEY WA 6009, AUSTRALIA, dlarkin@cyllene.uwa.edu.au*

**Paper Session 4/11.00am-12.30pm**

**AGEING**

**L. A. BIELIAUSKAS, L. GREENFIELD, S. LANGENECKER, J. O'NEILL, M. PROCTOR. Cognition and Retirement in Aging Surgeons.**

Preliminary baseline data are presented for one hundred sixty-six surgeons tested with the Cambridge Neuropsychological Test Automated Battery (CANTAB). Measures obtained were Reaction Time (RT), New Learning and Memory (NLM), and Visual Sustained Attention (VSA). The number of participants obtained in age ranges was: 45-49 (N=25); 50-59 (N=54); 60-69 (N=52); 70+ (N=36). Surveys about practice patterns were also given. All cognitive variables showed age-related decline with NLM showing the greatest change. Reaction and movement times were faster than comparison norms at all age ranges with surgeons performing above 70th percentile at all age ranges. NLM was measured in terms of a maximum of five stages of learning. Participants achieved all five stages through age 59, while the average number of stages achieved declined to 4.40 over 70 years of age. For VSA, the surgeons performed between the 50th and 60th percentiles at earlier age ranges, with performance dropping to the approximately the 45th percentile at age 70+. Surveys were obtained from 321 participants in total, including the 75 surgeons who participated in the cognitive testing. Survey results suggest a decline in clinical workload beginning around 45 years of age as well as a decrease in complexity of cases managed; 24% reported a decline in workload overall, and 17% reported a decrease in the complexity of their cases. These preliminary measures show the expected age-related decline for RT, NLM, and VSA in this group of highly educated participants, though RT was significantly better preserved than the age and I.Q. matched normative cohort. Age-related decline in clinical workload was also observed. The specific relationship between cognitive changes and clinical workload will be explored as the study continues, with the goal of eliciting predictive relationships between cognitive change and functional change in patterns of surgical practice.

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**S. KARANTZOULIS, J. B. RICH & J. A. MANGELS. Neuropsychological Correlates of Performance on Subject-Performed Tasks in Healthy Elderly and Individuals with Mild Cognitive Impairment.**

Individuals with mild cognitive impairment (MCI) have impaired memory but intact general cognition and independent functioning. We com-

pared the performance of 26 healthy controls (M age = 76) and 26 individuals with MCI (M age = 75) on subject-performed tasks (SPTs), in which individuals act out a command during encoding, and verbal tasks. Two lists of 20 commands were presented in SPT and verbal conditions; one list was semantically meaningful ("Pet the toy dog"), and one was bizarre ("Pet the compass"). Recall of the object-action pairs was better for enacted than verbalized commands in both groups, but this SPT superiority effect was larger in the control group. Forced-choice recognition of previously presented actions was better for the semantically meaningful relative to bizarre commands in the MCI group (but not the controls). Considering that individuals with MCI are not demented and that they have particular difficulty in forming new associations, memory for the object-action pairs in the experimental tasks should be specifically related to neuropsychological measures of associative learning. Surprisingly, however, performance on Paired-Associates and Digit Symbol was unrelated to recall and recognition of the object-action pairs. Instead, mental status (Telephone Interview for Cognitive Status and Dementia Rating Scale) scores correlated with free recall of the object-action pairs and with recognition of the actions from the bizarre pairs. These results suggest that global cognitive functioning in MCI (but not neuropsychological measures of associative learning) may account for this group's impaired acquisition of novel associations on experimental variables even though mental status is in the normal range in MCI. Longitudinal analysis of individuals with MCI is needed to determine whether global cognitive functioning or specific difficulties in forming new associations is a better predictor of subsequent conversion to Alzheimer's disease.

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**C. FELDMAN, M. T. MAYBERY & A. FOX. A Deficit In Selective Attention On A Visual Working Memory Task In Older People.**

Previous studies have shown that older people fail to benefit from cuing to a specific feature in a visuo-spatial working memory task with stimulus objects varying on more than one feature (e.g. colour and location), compared to younger people. The present study sought to determine if this was due to a failure to selectively attend to a specified feature among multiple objects. Thirty-one undergraduate students (aged 17 to 25) and 31 healthy older people (aged 67 to 87) participated. Each stimulus display consisted of four objects, which varied on colour and location, presented on a computer screen for 500 ms. This was followed by a 900 ms retention interval and a probe display consisting of a single object. Participants indicated if the probe was the same as or different to the stimulus on a specified feature, while ignoring the other feature. There were four probe types which occurred with equal frequency: positive probes were identical to the stimulus, negative probes differed from the stimulus on the attended feature only, inhibited positive probes differed from the stimulus on the ignored feature only, and facilitated negative probe differed from the stimulus on both features. The results produced an interaction such that older people were impaired on the inhibited positive probes (performing at chance level) but had less of a decrement relative to younger people on facilitated negative probes. This pattern of results indicates that older people have difficulty attending to a specified feature across several objects in a working memory task. This may be a significant factor in the everyday visual working memory difficulties older people experience.

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**M. A. LUSZCZ & K. J. ANSTEY. Executive Functioning as a Longitudinal Predictor of Memory Change over 6 Years in a Population-Based Sample of Very Old Adults.**

As the population ages, understanding the neuropsychological underpinnings of changes in cognition is of growing importance. We examine the

unique contribution of executive function as a predictor of age-related changes in memory over a six-year period. Executive function is thought to reflect the integrity of the frontal lobes, which are especially vulnerable to cortical ageing. Thus it provides an index of early signs of cognitive ageing, particularly higher order cognitive functions, e.g., flexible use of retrieval strategies, which are in turn important for optimal remembering. Speed of processing also reflects brain integrity and is considered to be a cognitive primitive crucial to all other cognitive functions. Behavioural data come from a longitudinal population-based sample of participants in the Australian Longitudinal Study of Ageing (ALSA), based in Adelaide. Data from participants on two occasions ( $n = 333$ ; Wave 3 in 1994, Mage = 80, range 66-105; Wave 6 in 2000, Mage = 84) were analysed. Measures of executive function included three variants of fluency measures; incidental immediate and delayed word recall and immediate symbol recall indexed memory; speed was indexed by the digit symbol task. Multiple regression analyses showed that although after entry of gender, education, and health, executive function partially explained age-related change in memory, when processing speed was entered only it, and the respective memory measure at Wave 3, predicted memory change. These longitudinal results contrast with cross-sectional findings we have previously reported. This disparity will be discussed in the context of age-related covariation observed in cross-sectional studies.

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**R. M. SHAW, E. HELMES & D. MITCHELL. Age-Related Change in Visual, Spatial, and Verbal Memory.**

Changes in working memory have been commonly reported in association with increased age. Sixty-two individuals aged between 18 and 57 years completed a listening span version of Daneman and Carpenters (1980) reading span task, a dot memory task, and an irregular polygon with articulatory suppression task in a study designed to examine whether performance on spatial and visual memory tasks would decline as a function of chronological age to a greater or less extent than that observed in verbal memory, and whether verbal, visual, and spatial memory could be measured as separate memory representations. The results indicated that verbal and spatial memory declined as a function of increased age. The relationship between age and visual memory, although negative, was not significant. A test for the equality of correlations for dependent samples (Cohen & Cohen, 1983) showed significant differences among the correlations between age and verbal, visual and spatial memory, with age correlating with verbal memory to a greater extent than with either of the other memory systems. Correlations between verbal, visual and spatial memory task scores were all non-significant and below 0.25, suggesting that each memory task was tapping a distinct type of memory. These results show that each of the different types of memory may be differentially affected by age. Therefore, it is important that they be studied as separate representations.

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**M. MIYAHARA. Spontaneous Use and Instructional Effects of Verbal Labelling Strategy on Sequential Working Memory for Hand Movements in High Functioning Adults in Late Adulthood.**

Objectives: To examine whether: 1) high functioning adults in late adulthood spontaneously form verbal labels to remember non-meaningful sequences of hand movements; 2) an instruction of a verbal labelling strategy could enhance the memory performance; 3) there is a difference in sequential working memory and non-verbal cognitive ability between spon-

taneous verbal label users and non-users. Method: The Kaufman Hand Movement Test (KHMT) and the Raven's Progressive Matrices Test (RPMT) was administered to 31 high functioning individuals in the 60s and 70s. Results and conclusions: Nineteen participants (41%) of the sample formed no labels spontaneously, but they all were able to learn and retain the strategy. Spontaneous verbal label users performed significantly better than the non-users on the KHMT and the RPMT. Sequential working memory decline for non-meaningful hand movements was attributed to a combination of short visuospatial memory span, disuse of verbal labelling technique, and the decreased non-verbal cognitive ability.

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**Symposium 4/11.00am-12.30am**

**TRAIT MARKERS, GENES AND ENVIRONMENTAL INFLUENCES IN SCHIZOPHRENIA.**

*Chair: Philip Benson*

*Discussant: Melissa Green*

The field of genetic epidemiology has evaluated the relative contributions of heritability and environmental risk to the schizophrenic phenotype. Phenotype concordance in twin pairs and their offspring, siblings, and lesser-degree relatives suggests a greater degree of clinical determination due to genetic factors than is actually present in the population. Overestimation of prevalence on the basis of the genotype may be explained by a variety of environmental factors and heterogeneity within the spectrum of schizophrenia disorders. Therefore, we must differentiate between sensitivity to high-risk environments (passive genotype-environment interaction) and [preferential] behavioural selection due to these environs (genotype-environment correlation). Could 'schizophrenic' behaviour actually afford selective advantages for the survival of the species within the current social environment? The symposium will discuss putative trait-markers for schizophrenia (e.g. eye movement patterns during perception, sensitivity to anomalous external events) in relation to diagnosis, neurodevelopment, and the evolution of psychotic behaviour. Collectively, the contributors argue for the use of psychophysiological measures in order to improve our understanding of the aetiology of schizophrenia.

**R. LANGDON, T. CORNER, J. MCLAREN, M. COLTHEART & P. B. WARD Attentional orienting triggered by gaze in schizophrenia**

The ability to automatically detect other people's gaze and to shift attention reflexively in the same direction facilitates the sharing of attention with other people. Such sharing of attention may be critical for the maintenance of normal social cognition. Social cognition is severely impaired in people with schizophrenia. We used spatial cuing paradigms to investigate whether social deficits in schizophrenia reflect a lack (or a delay) of attentional shifts reflexively cued by other people's gaze. In Experiment 1, 30 patients and 24 controls detected targets right or left of a central image of a head turned right, left or straight-ahead. Gaze-cues were non-predictive. Counter to expectations, patients, but not controls, showed a reflexive congruency advantage at 100ms SOA. The congruency advantage was similar in patients and controls at 300-800ms SOA. In Experiment 2, 20 patients and 24 controls detected targets 300-800ms after a central gaze-cue that looked toward the non-target location most

of the time. Controls, but not patients, were able to reverse the reflexive congruency advantage at 800ms SOA. Our results accord with the view that schizophrenia is characterised by abnormal social hyper-arousal/vigilance coupled with impaired controlled processing.

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#### **M. WALDO. Auditory Evoked P50 Response in Schizophrenia.**

The gating of the auditory evoked P50 response in a paired click, conditioning-testing paradigm, has been found to be abnormal in nearly 90% of schizophrenics and half of their first degree relatives, including the parent with additional family history of schizophrenia, designated as the obligate carrier. Recent evidence has linked this deficit to chromosome 15, in an area associated with the alpha-7 nicotinic receptor. However, since half of the first degree family members share this trait marker, we know that other deficits and risk factors must be important to the development of the clinical syndrome. Among other deficits, we have shown that schizophrenics have abnormal findings on MRI, cognitive deficits as compared to their siblings, and evidence of abnormal lipid functioning. These are not found together with the sensory gating abnormality in clinically normal family members. Certain disorders in addition to schizophrenia are also found in first degree family members, but again, only in the absence of the sensory gating abnormality. In this talk we review this data and discuss its implications for the development of the cluster of symptoms we know as schizophrenia.

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#### **P. BENSON. Analysis Of Fixated Regions Of Interest During Visual Scanning.**

A challenge in the study of visual perception is the analysis of seemingly arbitrary looking behaviour during free-viewing of stimulus scenes. Quantification of features/regions of interest (ROIs) has been tackled in various ways including cumulative counts of eye gaze falling within areas of the stimulus array. Although large ROIs such as 'upper part of face' may capture a significant proportion of variance in eye tracking data, this frequentist approach may overestimate the salience of the predefined ROIs because it is insensitive to salient cues within it. We used picture categories (natural scenes, faces, fractals, noise) to examine whether local features of interest could be identified automatically rather than using a priori methods. Higher-order factor analysis revealed catalogues of fixation features unique to each image category that could not have been due to random viewing. ROI factors could also be used to estimate scanpaths to previously unseen stimuli indicating the model has predictive capabilities. Low-dimensional projections of the feature factors suggest that looking behaviour can be summarised in a concise manner either for individuals or whole participant groups. Previous work on schizophrenia has provided evidence of restricted scanpaths and clustered fixations, and our calculations show that it is possible to distinguish the degree of difference between normal and abnormal viewing using only a few parameters. Significantly, it is now possible to objectively assess the content of visual information acquired in schizophrenia and to infer what features of visual experience are consciously avoided. Aberrant scanpaths are thought to reflect many dimensions of thought disorder in schizophrenia including avoidance of socially-salient experiences. New tools may shed light on the evolution and purpose of viewing strategies in schizophrenia when exposed to images of negative, positive and chimeric images of spontaneous, posed or sham facial displays.

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#### **T. RUSSELL. Dynamic Fear Perception in Schizophrenia: an fMRI investigation.**

The amygdala responds in healthy subjects to the presentation of fearful facial stimuli. Abnormalities in this area have been demonstrated in patients with schizophrenia. However, most previous studies have used static stimuli, which may lack ecological validity. To address this issue we devised a new dynamic stimulus set showing fearful expressions either emerging or dissipating. Using this paradigm we aimed to probe amygdala response to dynamic fearful stimuli in schizophrenia. We conducted a high-resolution BOLD functional magnetic resonance imaging (fMRI) study with 10 right-handed male patients with schizophrenia and 10 controls. In order to ensure high spatial resolution and reliable detection of amygdala activation, 50 slices, each 2mm thick were acquired in a 128x128x64 matrix (TR = 6000 ms). A covert gender decision task required subjects to decide if the face was male or female. To make the stimuli, four male and four female identities from the Ekman and Friesen Pictures of Facial Affect (1976) were morphed in 10% increments from neutral to 100% (prototypical expression) of fear. A block design was used whereby the experimental condition consisted of 10 trials (animated sequences), each lasting 6000 ms depicting animated faces changing from 50% to 100% (emerging fear) and allowing time for the gender decision. The control condition consisted of the same animated faces changing from 50% to 0% (dissipating fear). There were 5 of each block. A non-parametric method of image analyses was employed (XBAM v3.0). In controls, right amygdala activation was observed in response to dissipating fearful expressions. Schizophrenic subjects also demonstrated amygdala activity to this condition, however this was in the left amygdala. Amygdala response to this ambiguous condition may engage a right lateralized orienting response in controls and an inappropriately sustained left amygdala response in individuals with schizophrenia.

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#### **M. J. GREEN Context Processing And Social Cognition In Schizophrenia.**

Schizophrenia patients show reduced context processing on non-social cognitive tasks, and poor social cognition on face perception and theory-of-mind tasks. This paper reports two experiments designed to examine social context processing in schizophrenia, when judging the meaning of facial expressions. In the first study, social contextual information was provided in short vignettes that were read to participants immediately before they judged the meaning of a facial expression. Story-face pairs were designed to be discrepant in affective valence so that mental state judgments reflected the dominance of either situational context or visual information in the faces. Control subjects were influenced by story-contextual information such that faces depicting basic emotions were interpreted according to the situation described in vignettes. Schizophrenia patients showed reduced context processing when the situation suggested a complex mental state (e.g., perceived an angry face as 'anger' even when the context cued 'confusion'), but showed normal use of context when vignettes cued a basic emotional state. A second task examined the processing of visually presented contextual information during a mental state attribution task; visual scanpaths provided a measure of attention to contextual information while participants judged the meaning of facial expressions depicted within social scenes. Paired colour photographs depicting target faces presented in isolation (Series 1) or in the context of a social situation (Series 2), were viewed by participants for 10 secs each. Group differences in attention to social contextual information were analysed in terms of the number, location, and duration of fixations upon salient features of the scene (faces, objects). Results of both studies support aberrant social context processing in schizophrenia, and are discussed with regard to previous studies of context processing which have hitherto focused on non-social cognition.

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THURSDAY AFTERNOON, JULY 8<sup>TH</sup>, 2004

## Poster Session 2/1.30pm-5.00pm

METHODOLOGICAL AND CONCEPTUAL  
ISSUES AND TESTS**M. SUGAWARA & K. SUZUKI. EMDR (Eye Movement Desensitisation and Reprocessing) and REM sleep.**

[Background] Eye movement desensitization and reprocessing (EMDR) is a new innovative treatment with a high success rate for psychological disturbances rooted in traumatic memory. However, the neurophysiological mechanisms of EMDR have not yet been elucidated. Why is saccadic eye movement effective for the reprocessing of previously established conditioned reflex? [Aims] The present research analysed (i) the topographical changes of EEG (and ERP) and REM sleep after EMDR treatment, and (ii) the subjective units of emotional distress (SUDs) and VOC. [Methods] Subjects (13 males and 20 females) were assigned to three groups according to varied conditions (control, provocation, and EMDR), and engaged in sets of horizontal saccadic-eye movements lasting approximately 30 seconds per set. Topographical changes of EEG and ERP activities were recorded from 14 placements over frontal, central, parietal, temporal and occipital scalp locations in the international 10-20 system with linked mastoides (A1-A2). Electrodes were also placed on the lateral canthus and above the supercillum of the left eye in order to measure the electrooculographic and electromyographic responses. [Results and Conclusions] The statistical significance of topographical EEG differences and REM densities during the pre-/post EMDR treatment situations, were evaluated using an ANOVA and Mann-Whitney U test. The neurophysiological and psychological data indicate that the density of eye movement during REM sleep increased after provocation and EMDR, and the left frontal activities might indicate a treatment efficacy. It supports the hypothesis that REM sleep is intimately involved with the mechanisms of emotional and memory reprocessing.

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**R. C. CHAN & R. BODE. Analysis of Patient and Proxy Ratings on the Dysexecutive Questionnaire.**

This study had two objectives: 1) to examine differences in the ratings of patients and proxies on a measure of the dysexecutive syndrome; 2) to further explore the insight impairment problem in patients with traumatic brain injury using Rasch Analysis. A total of 179 patients (self- and proxy ratings) were obtained. Eligible proxies were significant others of the patients who lived with the patients for at least the past year. The Dysexecutive Questionnaire (DEX) is a 20-item instrument measuring cognitive, behavioural and emotional factors, rated on a 5-point frequency scale from never to very often. Rasch analysis of the ratings by the patient, a proxy, and the difference in ratings between the two describe the psychometric characteristics of the DEX. Rasch calibration of the separate patient and proxy data showed slightly more internally consistent ratings for proxies (.91) than patients (.89) while the difference between ratings was slightly less reliable (.85). At the item level, the ratings for restlessness misfit the model for both patients and proxies, and five items exhibited differential item functioning: distractibility, temporal sequencing problems, poor decision-making, knowing/doing dissociation, and lack of concern, reflecting differences in the perspectives of patients and proxies. A conversion table from patient to proxy scores shows slight differences in comparable scores along the scale. The present study confirms the findings that proxy estimates are slightly more reliable than patient estimates. The provision of a conversion table from patient to proxy scores further facilitates the interpretation of the discrepancy between the two sets of ratings.

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**T. AI, M. MATSUI, K. KATO, H. YUKI & M. KURACHI. Factor Analysis Of Neuropsychological Function On A Normal Population.**

Objectives: This study is aimed at analyzing factor constructs of neuropsychological function of normal people. Methods: Fifty-five healthy subjects (mean age=24.9 years, ranging from 16 to 40 years) were screened by both the Minnesota Multiphase Personality Inventory (MMPI) and the questionnaire for psychiatric settings to rule out psychiatric, drug, and alcohol problems (SCID), which was then followed by administration of the Digit Span, Picture Completion, Block Design, Vocabulary, Digit Symbol [Wechsler Adult Intelligent Scale-Revised], Logical Memory, Visual Reproduction [Wechsler Memory Scale-Revised], Wisconsin Card Sorting Test (WCST), Trail Making Test (TMT) A & B, prospective memory task, Letter Number Sequencing (LNS), Word fluency test, and Japanese verbal learning test (Matsui et al., 2001). A factor analysis on the 15 variables of neuropsychological tests was performed using least squares solution and varimax rotation. The method of choosing components with an eigen value >1 was used as a guide. Results: Factor analysis indicated five factors: the first comprising TMTA, TMTB, and Prospective Memory named cognitive planning. The second comprising Digit Span, verbal learning test, LNS named short-term memory. The third comprising Vocabulary, Visual Reproduction, and WCST named conceptual image organization. The fourth comprising Block Design and Picture Completion named visual spatial organization and the fifth comprising Logical Memory, Word Fluency test and Digit Symbol named verbal memory organization. Conclusion: Further study is necessary to compare the factor constructs of neuropsychological function between normal people and patients with schizophrenia with reference to brain structure or brain function.

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**M. HENNESSY & G. GEFFEN. Executive Functioning: The Development of Theoretical Bases.**

The validity of domain specific versus process fractionation theories of executive functioning was examined, with the aim of developing a theoretical basis for executive functioning. Two frameworks were selected. The first was a four construct theory based on a domain specific functional adaptation of Goldman-Rakic's experimental primate research. The second used Luria's stage and process theory of complex cognitive behaviour. A group of normal participants (n=73) was recruited from an undergraduate university setting. Eleven neuropsychological tests were chosen according to four domain specific executive constructs on an a priori basis. Principal components analysis produced a four factor structure that accounted for approximately sixty percent of the total variance. However, contrary to the hypothesis, process fractionation theory was a superior explanation for the latent structure within the data. The study provided empirical evidence for a process fractionation structure of executive functions, and experimentally defined four separable executive processes: checking, inhibiting, sharing and integrating. The process fractionation structure supported in this study needs to be validated and extended to include other potentially separable executive processes. This research provides evidence for the need to conduct theoretically derived and empirically validated research to advance an understanding of the structure of executive functioning.

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**S. E. DAWES, G. J. SENIOR, R. T. LANGE & G. CHELUNE. Examination of the Clinical Utility of Cognitive Patterns in a Mixed Diagnostic Sample on the WAIS-III/WMS-III and Other Neuropsychological Tests.**

A fundamental assumption in neuropsychological assessment is that different disorders generate specific patterns of psychological test scores. Using cluster analysis, Lange (2000) challenged this assumption and pre-

sented compelling evidence that a small number of cognitive patterns were commonly found in a number of disorders on the WAIS-R/WMS-R. He derived three common cognitive profiles, which occurred with approximately equal frequency across seven disorders. Utilising the WAIS-III/WMS-III and other tests (including TMT, WCST, BNT, & FAS), a nine-cluster solution of which five-clusters were retained, was derived using Hierarchical and K-Means cluster analysis. These clusters were determined to occur across all twelve diagnostic groups examined. If prototypical patterns exist related to diagnosis then stark asymmetries in the distribution of cluster membership should be evident across the diagnostic groups (e.g. profile for TBI should be distinct from the profile for CVA). The outlier metric, Mahalanobis Distance, was then used to allocate individual cases to one or more of these stable cognitive patterns in order to examine the clinical utility of this classification method.

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#### **T. OLM & G. J. SENIOR. An Adaptive Approach to Psychological Test Battery Selection.**

One of the challenges confronting clinicians engaging in psychological assessment is how to combine information from a wide variety of assessment measures into a coherent system of interpretation. Assessors are often called upon to vary their psychological test batteries to better meet the limitations of their clients and address hypotheses regarding the nature of potential deficits. While the reliability and validity of individual tests should be well established, the psychometric properties of flexible batteries as a whole are not usually known. The difficulties inherent in the substitution of various measures into an individual battery, therefore, include the potential introduction of error due to a lack of knowledge regarding the interrelationships between the substituted measures. Detailed knowledge of the statistical relationships between individual tests would allow the clinician to control for the error associated with combining them into a battery. Such knowledge would also facilitate the combination of individual tests of the same underlying cognitive construct into composite scores with a known and controlled margin of error and so facilitate accurate and efficient analysis of test results. This paper presents a systematic method for determining how to substitute measures within a structural framework based upon assessment of clinically salient cognitive constructs. The model will be presented along with the algorithms for combining different psychological tests and computing the psychometric properties of their resultant composites. The study aims to present a "model" by which the clinician could combine a varying and clinically appropriate battery of individual tests using knowledge of their statistical interrelationships to control for psychometric error. This method is proposed as a way of more effectively and flexibly assessing the cognitive strengths and weaknesses of brain-damaged individuals.

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#### **G. J. SENIOR & L. A. DOUGLAS. Forensic Neuropsychology and the MMPI-2: I. Discriminating Between Neurologic and Psychiatric Conditions.**

The second edition of the Minnesota Multiphasic Personality Inventory (MMPI-2) is the most widely used measure of psychosocial maladjustment in the assessment of personal injury claimants. While initially developed for use in the assessment of psychiatric disorders, more and more, it is being used to examine those with neurological injuries and contribute to discriminating between neurological and psychiatric influences on psychosocial functioning. Utilising more than 3000 cases, this study examines the ability of the MMPI-2 to discriminate between personal injury claimants diagnosed with either neurological or psychiatric conditions. In particular, the role of the Basic and Content scales will be contrasted with those of measures developed for the specific assessment of neurological conditions.

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#### **H. E. GOH & G. J. SENIOR. Forensic Neuropsychology and the MMPI-2: V. Development of a Structural Summary Approach to the Assessment of Personal Injury Claimants.**

A number of approaches have been proposed with regard to analysing and interpreting MMPI-2 protocols in order to assess psychosocial maladjustment. The current study presents a Structural Summary approach to the organisation and interpretation of the MMPI-2 developed specifically in the forensic setting and the assessment of personal injury claimants. The Structural Summary is based on a scale level principle components analysis with oblique rotation of more than 3000 MMPI-2 protocols. While ten components were derived, only eight form the basis of the structural summary. One component was represented by only a single scale while another was based on scale loadings (Mf, FRS2), the clinical significance of which remains undetermined. The utility of the approach will be demonstrated with illustrative case examples.

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#### **H. VILJOEN, G. IVERSON & J. BRINK. WAIS-III Performance in Forensic Psychiatry Inpatients with Schizophrenia Spectrum Disorders.**

From a clinical and commonsense perspective, some might hypothesize that forensic psychiatric patients are likely to be more cognitively impaired than civil psychiatric patients. Forensic psychiatric patients typically have a history of violent behaviour, and they have relatively high rates of co-morbid substance abuse. Moreover, a history of traumatic brain injury also is common in this patient group. The purpose of this study was to compare the WAIS-III performance of a sample of forensic psychiatry inpatients with schizophrenia spectrum disorders to a non-forensic outpatient sample from the literature. It was hypothesized that the forensic psychiatry inpatients would have lower index scores than non-forensic outpatients given their relatively low education and frequent co-morbid substance abuse problems. The primary sample consisted of 30 patients from a 211 bed forensic psychiatric hospital in British Columbia, Canada. Their average age was 32.3 years (SD = 10.1). Their average education was 10.3 years (SD = 2.1). All patients had a diagnosis of one of the schizophrenia spectrum disorders. The patients demonstrated medium to large deviations from the healthy normative mean on the Verbal Comprehension Index (M = 91.5, d = .54, medium effect size), Working Memory Index (M = 89.2; d = .69, medium-large effect size), and the Processing Speed Index (M = 82.3, d = 1.22, large effect size). The sample performed normally on the Perceptual Organization Index (M = 98.3, SD = 16.0). Contrary to expectations, the forensic sample did not differ on any of the WAIS-III index scores from a large sample of outpatients from Maryland with schizophrenia spectrum disorders (all p's > .05; N=120; Dickson, Iannone, & Gold, 2002), despite significantly less education in this forensic sample. This study suggests relative consistency of neurocognitive deficits in heterogeneous patients with schizophrenia spectrum disorders.

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#### **S. E. DAWES, G. J. SENIOR, L. A. DOUGLAS. The Relationship of the Problem Checklist and Competency Rating Scale to the MMPI-2 within a Forensic Setting.**

The Problem Checklist (PCL; Cavallo, Kay, & Ezrachi, 1992) and Competency Rating (CRS; Prigatano et al., 1986) scales were developed for the assessment of traumatic brain injury (TBI). While used primarily in the rehabilitation setting, recent research has suggested that they may be valuable in the assessment of the types of problems experienced by personal injury claimants with or without TBI, as well as the degree to which these difficulties impact upon their daily functioning. In contrast, the Minnesota Multiphasic Personality Inventory-2 (MMPI-2), while the most frequently used psychosocial inventory in the medicolegal setting, is limited by its mode of evaluation. Respondents on that test indicate only whether a

statement is "True" or "False". Consequently, assumptions regarding type and severity of symptoms are based solely on the number of endorsements and not on any direct measure of perceived severity or frequency. The current study examines the relationship between the PCL and CRS which require respondents to indicate the level of perceived difficulty or severity they experience, and their responses on the MMPI-2. Additionally, the degree to which these measures characterise the type and extent of psychosocial difficulties of both TBI and non-TBI litigants will be examined. Correspondence: *Sharron Dawes, University Of Southern Queensland, Psychology Department, 90 Kennington Road, Camp Hill, BRISBANE QLD 4152, AUSTRALIA dawes@usq.edu.au*

**W. WALKER & M. L. DREXLER. Color Trails and Five-Digit Tests: Education Effects in Modern Greek Speakers.**

The Five-Digit Test (FDT) is a new instrument designed to assess areas of speeded or controlled information processing (Sedo, 1999). One subtest is designed to measure an interference effect, comparable to that observed in the Stroop Color-Word Test (Stroop, 1935). However, the Five-Digit Test was designed to reduce reliance on vision and knowledge of numbers and letters. Thus, its utility for cross-cultural assessment has been noted, and it has been administered in English, Spanish, and Chinese (Lang, 2002). The contribution of important demographic variables to neuropsychological test performance is well known (Lezak, 1995), with education being important. The purpose of this study was to examine the influence of education across scores on the Five-Digit Test and to compare the results to an established cross-cultural measure like the Color Trails Test in a Modern Greek-speaking sample. Subjects included 49 individuals recruited utilizing a snowball sampling technique in Greece. The average educational level was 17 years ( $SD=4$ ). The complex relationship between education and performance across the subtests of the Color Trails Test and the Five-Digit Test was explored and a preliminary examination of normative implications was conducted. The development of this brief, easy to administer test may be relevant to those assessing patients in linguistically and culturally diverse areas such as Australia. The test was well received by all subjects. Suggestions for future research are offered, and the clinical utility of the test for cross-cultural assessment is discussed.

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**K. SULLIVAN. Towards The Development Of Alternate Prose Recall Passages.**

Repeat assessments of memory function can contribute to diagnosis and treatment evaluation, yet memory tests may be susceptible to practice effects. To reduce such effects it has been suggested that alternate forms of memory tests should be used where possible. In this study, alternate forms of the logical memory stories were devised. Passages were matched to the original Wechsler Memory Scale-Revised stories in terms of a number of passage attributes such as story length and readability. Three clinical neuropsychologists were asked to independently score taped passage responses to determine inter-rater reliability statistics. Estimates of passage difficulty were based on the responses of thirty-two undergraduate students asked to recall passages administered in a counterbalanced order. Preliminary investigations of the psychometric properties of prose recall stories devised in this study suggest these passages have good inter-rater reliability and are equivalent in terms of difficulty. Importantly, although the development of alternate prose recall passages is not new, the passages devised in this study have been shown to match each other across a broader range of variables than has been attempted previously and as such these passages may prove useful in the repeat assessment of auditory-verbal memory.

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**I. BURGESS, D. AMY & I. GILCHRIST. A Component Analysis of the Zoo Map Test.**

The purpose of this research was to investigate the utility of the separate component scores of the Zoo Map 1 and 2 subtest of the Behavioural

Assessment of Dysexecutive Syndrome battery relative to the usual Profile Score. As part of a neuropsychological assessment the Zoo Map test was administered to a group of clinical patients diagnosed with mental health problems. Their scores were compared with those of a control group. In addition to calculating the usual Profile Score we also analysed scores on Planning Time, Total Time, Action Time (Total Time - Planning Time), Sequence Score and Number of Errors across both Zoo Maps 1 and 2. Statistical analysis revealed that the clinical group had significantly lower Profile Scores than the control group. On Zoo Map 1 the clinical group had significantly shorter Planning Times (indicating online planning) but longer Action Times (indicating poorer sequencing ability) than the control group. On Zoo Map 2 Action Time was significantly longer for the clinical group. We conclude that the component scores provide more information as to how the different groups approach this test relative to the usual Profile Score. Implications for use of this test in clinical situations is discussed.

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**C. S. SIRA, R. GRAVES & C. MATEER. The Twelve Elements Test of Executive Function.**

The Six Elements Test (SET; Shallice and Burgess, 1991) is a measure of planning and organisation. A potential difficulty with the SET is that there is a limited range (0-6) in possible scores. Because of practice effects, a test with limited range may lead to ceiling effects. A possible solution to this dilemma is increasing the number of tasks to increase the potential range of the task. This study reports initial results for our new modification of the SET, the Twelve Elements Test, which has a possible range of 0-12. This test was administered to 45 female and 12 male undergraduates (aged 17-26 years) with no history of brain injury or neurological condition. Results for this high functioning sample showed a good distribution of performance: Tasks Attempted  $M = 9.00$ ,  $SD = 2.74$ , range 3 to 12; Number of subtask Switches  $M = 9.02$ ,  $SD = 3.47$ , range 2 to 15. This sample rarely broke the rule of the task ( $M = 0.26$ ,  $SD = 0.67$ ) and made few requests for the amount of time remaining ( $M = 1.51$ ,  $SD = 1.24$ ). The relatively low mean and large range for tasks attempted suggest that our new test may better allow for reliable change to be calculated despite expected practice effects. Further work will determine the potential utility of this new test for evaluating executive dysfunction in a brain injured sample.

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**S. J. KANG, B. H. LEE, M. J. BAEK & D. L. NA. One-hand versus Two-hand Tactile Bisection in Normal Subjects.**

Background and Objectives: When asked to bisect a line presented through the visual modality, normal subjects tend to bisect slightly to the left of the true midpoint, a phenomenon termed 'pseudoneglect'. Tactile bisection also shows the pseudoneglect which, however, is less consistent among studies than in visual bisection. This inconsistency may be related to such factors as manual motor exploration, memory of the starting and ending position of the stimulus, or 'overshoot phenomenon'. This study investigated whether the pseudoneglect occurs even in a new tactile bisection task that minimizes these factors. Methods: Normal subjects were asked to bisect the distance (three different lengths) that spans between the right and left index finger by moving either of the fingers toward the midpoint. When moving the finger, in one condition the finger was to keep touching the surface of the stimuli (touch condition), and in the other the finger was moved in the air without touching the stimuli (jump condition). Thus, the experiment consisted of 12 conditions (three lengths x two hands x touch versus jump). Each condition had two trials and the total 24 trials were presented in a random order. Results: Subjects were accurate in the jump condition but undershot in the touch condition. Conclusion: In the jump condition of the new version of tactile bisection, pseudoneglect did not occur, which suggests that pseudoneglect is restricted to the visual modality. Results of the touch conditions suggest that the surface resistance of

the stimulus can be another variable that affects the tactile bisection performances of normal subjects.

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**R. A. RAGGL, S. A. WINGENFELD, S. G. CREWETHER. Modified Scoring System: Measurement of the Global and Local Elements of the RCFT in Children with and without ADHD.**

Similar to most complex shapes, the Rey Complex Figure Test (RCFT) consists of global (the whole object in its entirety) and local features (the shapes embedded within the whole figure). As the RCFT has a high level of complexity, numerous scoring systems have been developed. No system independently measures the global components separate from the local elements rather they produce a single accuracy score assessing a combination of global and local features, and/or an organisational strategy score. A modified scoring protocol, termed Rey Complex Figure - Global Organization and Local Accuracy (RCF-GOLA), was designed to measure children's reproduction of the key local and global features. RCF-GOLA was based upon the theoretical premise of Taylor (Spreeen & Strauss, 1998) and the developmental perspective of Waber and Holmes-Bernstein (1996), thus measuring internal and external accuracy and developmental organization. Reproductions of the RCFT (copy condition) by 210 children, including 20 children with ADHD, were scored according to the RCF-GOLA and compared to two other scoring systems. Results revealed high inter-scoring reliability, good concurrent validity with the other scoring systems, sensitivity to gender and developmental trends, and discrimination between children with and without ADHD. In conclusion, the RCF-GOLA scoring protocol accurately assessed higher-order developmental perceptual and executive functioning impairments. The RCF-GOLA can contribute to our understanding of paediatric global and local processing performance, and may be useful in the assessment of childhood executive and perceptual disorders.

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**A. JANSARI, K. KRZYCKA, F. QUINN, C. WATTS, S. PATTERSON, A/ CANTAGALLO, A. MAIETTI, M. MAINI & A. GOSLING. Faking It! The Use Of A Battery Of Tests To Detect Malingered Amnesia.**

The malingering of amnesia is reported to be increasing in society; despite this, methods to detect it successfully still do not exist. Studies attempting to detect malingered amnesia have found that when using single tests, although detection rates of participants instructed to simulate can be significant, misclassification of individuals still occurs. Additionally, knowledge provided to simulators has been shown to have equivocal effects on performance. A series of experiments evaluated the combined ability of three neuropsychological tests to accurately identify whether or not an individual is feigning memory impairment; coaching given to simulators was also manipulated. The performance of three groups (naive simulators, coached simulators and controls) was measured across the tests used by Hanley et al (1999): word fragment completion, coin-in-the-hand and distraction/no-distraction tests. Discriminant function analysis on accuracy scores resulted in 85.4% of individuals being classified accurately. A translation of the paradigm into Italian resulted in 86.7% accurate classification. Finally, an extension of the paradigm using computerized presentation such that reaction times as well as accuracy could be recorded resulted in an 81.9% success rate. The findings suggest that the pattern across tests is useful in discriminating between malingerers and genuine amnesics. The results also suggest that even when individuals are given information regarding the pattern of impairment of amnesia they cannot use this effectively to avoid detection. The practical implications of the findings as well as further directions for research are discussed.

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**S. AL-ADAWI, A. A. DORVLO, M. B. GLENN, D. T. BURKE & E. SELLECK. Utility of Hospital Anxiety and Depression Scale on Cross-Cultural Traumatic Brain Injured Patients.**

The detection of mood disturbance is of great clinical importance in the rehabilitation of patients who have endured traumatic brain injury. Imported assessment measures from western cultures have not been validated in other cultures. This study assesses the Hospital Anxiety and Depression Scale (HADS). Forty-seven male and twenty-one female patients were screened using HADS and interviewed with the semi-structured, Composite International Diagnostic Interview (CIDI), in order to investigate the relationship between false positives and negatives at different cut-off points of the HADS. A receiver operating characteristic curve was used to discriminate the power of the HADS for every possible threshold score. Nine percent of the patients were identified by HADS as probable anxiety cases and nineteen percent as probable depression cases, compared to 50% and 57.4% respectively by the structured interview based on the gold standard. The sensitivity and specificity for the anxiety sub-scale of HADS were 17.6% and 97.1% respectively, while the sensitivity and specificity for the depression sub-scale were 33% and 100%. In using the ROC analysis, the cut-off score of 5 gave the best compromise between sensitivity, 61.8%, and specificity, 61.8%, for anxiety, and the cut-off score of 4 gave the best compromise between sensitivity, 53.8%, and specificity, 75.9%, for depression. The results are discussed with respect to the concept of depression from cross cultural settings and impaired goal-directed behaviour in patients with traumatic brain injuries.

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**C. SKILBECK. Structure of the Visual & Object Space Battery (VOSP).**

Warrington & James' Visual Object & Spatial Perception battery (VOSP; 1990) has been available to clinicians for 12 years, although studies on its structure are rare. The present research provides the first factor analytic study of the VOSP carried out on a patient sample (subarachnoid haemorrhage; SAH). The data obtained from 76 participants suggest a 3-factor structure (Object Recognition, Spatial Coordinates, Relative Position). The study also included correlation of these factors with other tasks (WAIS-R subtests, complex figure). Whilst the Object Recognition and Spatial Coordinates factors showed significant correlations with a number of these tasks, Relative Position only correlated significantly with Mental Arithmetic. This finding possibly reflects a shared visual imagery aspect of the two measures. Only non-significant effects upon the three factors were noted from gender and age.

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**S. E. DAWES, G. J. SENIOR, L. A. DOUGLAS. The Shipley Institute of Living Scale: Australian Normative Data and Clinical Utility.**

The Shipley Institute of Living Scale (SILS) was originally developed by Walter Shipley in 1940 as a test designed to provide a brief assessment of an individual's level of intellectual functioning. The SILS is a self-administered test and consists of two main components: Vocabulary and Abstraction. The Vocabulary component consists of 40 items and the examinee is required to choose the best synonym from among four words. The Abstraction component consists of 20 items that requires the examinee to complete a logical sequence of numbers, letters, or words. Traditionally, these measures are used to compute six summary scores: Vocabulary score; Abstraction score; Total Score; Conceptual Quotient; Abstraction Quotient; and an estimated WAIS-R Full Scale IQ. The current study will present data from more than 400 participants collected as part of normative studies at the University of Southern Queensland, Toowoomba, Australia. This normative data updates not only the norms to include WAIS-III FSIQ, VIQ, GAI, and VCI but substantially reduces the complexity of the scoring analyses to reflect more contemporary approaches to discrepancy



analysis. The utility of this approach will be demonstrated in a sample of clinical cases derived primarily from medicolegal practice.

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**S. M. COTTON, S. G. CREWETHER, P. KIELY, D. P. CREWETHER, V. MILANA, B. THOMSON & R. LAYCOCK. Revised Norms for the Raven's Coloured Matrices for Australian primary school aged children.**

The Raven's Coloured Progressive Matrices (CPM) has commonly been employed as a measure of nonverbal intelligence or the nonverbal component of Spearman's g factor, particularly in the United Kingdom and in Australia. The last Australian norms for the CPM were published over two decades ago and can be considered outdated. The aim of this study was to generate new CPM norms for a sample of 534 Australian children (males  $n = 273$ , females  $n = 258$ , ranging in age from 6 to 12 years) and to contrast these findings to the previous standardization. Significant changes in CPM performance were noted with age, however, no gender differences were evident. Hence, percentile ranks were calculated for the six age levels. There were minimal, if any changes, between the previous Australian norms and the current study, indicating that Australian children's performances on the CPM have remained relatively stable over time.

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**S. BARKER-COLLO. Impact of Cultural Content of Verbal Abilities Testing.**

Assessment of verbal abilities (e.g., naming and verbal memory) is a core component of neuropsychological assessment. As with other neuropsychological tests, naming and memory tasks may be impacted by cultural relevance of test content. This poster presents the findings of two studies examining the impact of American content on performance on New Zealanders. Study 1 examined whether 58 New Zealand students perform differently on the Boston Naming Test (BNT) when compared to available North American norms. Mean performance of the sample was significantly worse than norms ( $F(171) = 55.296, p < .01$ , placing the average New Zealand participant 1.2 SDs below the mean. New Zealanders made 60% more error on the items pretzel and beaver, and 20% more errors on globe, funnel, and tripod than North Americans. Study 2 examined the extent to which the American content of the California Verbal Learning Test (CVLT) impacts verbal memory performance of 90 New Zealand adults aged 17 to 81. Participants completed the CVLT and a version of this test modified to reflect New Zealand content (NZ-VLT). Within-subject comparisons revealed that participants performed significantly better on the NZ-VLT with CVLT performance placing the average New Zealander between 1.0 and 1.5 SDs below the mean for long delay free recall and just below 1.0 SD below the mean for long delay cued recall. Conclusion: It was concluded that in administering these tests of verbal abilities to New Zealanders attention should be given to the potential for cultural biases.

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**J. L. MATHIAS, M. BARRETT-WOODBRIDGE & S. BOWDEN. Accuracy of the Wechsler Test of Adult Reading (WTAR) as an estimate of (premorbid) IQ in a healthy Australian sample.**

Measures of premorbid IQ are commonly used by clinicians to evaluate changes to the cognitive performance of patients with a wide variety of neurological disorders. The recently released WTAR has been co-normed with the third editions of the Wechsler Adult Intelligence and Memory Scales (WAIS-III, WMS-III), and has been shown to provide reliable and valid estimates of premorbid IQ in American and English samples. However, the suitability of the WTAR for use with an Australian population has not been established, nor is there any clear basis for determining whether

to use American or English norms to convert WTAR raw scores to estimates of premorbid intellectual ability. This study examined the accuracy with which both the WTAR and the National Adult Reading Test (NART) estimated WAIS-III IQ performance in a sample of 50 healthy Australian adults. WTAR reading, demographic, and combined reading plus demographic estimates of WAIS-III VIQ were calculated using both US and UK norms, as was a NART reading estimate of WAIS-R VIQ. Preliminary analyses revealed that although the WTAR reading and the combined reading plus demographics estimated VIQ scores were correlated with WAIS III VIQ scores (US and UK norms), there were significant differences between estimated and actual WAIS-III VIQ scores. Demographic estimates of VIQ, based on WTAR normative data, were not significantly correlated with WAIS-III VIQ scores. Finally, NART estimates of WAIS-R VIQ also correlated with WAIS-III performance but yielded smaller differences between estimated and actual VIQ scores. All estimates of IQ underestimated WAIS III performance to varying degrees. These findings are discussed in terms of their implications for selecting a measure (WTAR versus NART) and method (WTAR reading, demographic, or reading plus demographic information) for estimating premorbid IQ in clinical settings and for making choices about which norms to use (WTAR US or UK norms).

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**Paper Session 5/1.30pm-3.00pm**

**SOCIAL COGNITION, EXECUTIVE FUNCTION AND MEMORY IN SCHIZOPHRENIA AND AUTISM**

**A. M. JENSEN, H. J. CHENERY & D. A. COPLAND. Metaphor Processing in Schizophrenia.**

Schizophrenia may be associated with figurative language difficulties resulting in a tendency to interpret idiomatic and metaphoric language in a literal sense. A lexical decision task using a cross-modal priming paradigm was used to compare the processing of metaphors in sentences in a group of people with schizophrenia ( $n = 10$ ) with healthy adults matched for age, sex and educational level. Sentences containing metaphors (e.g. 'John finally realized that **Mary was his rock** after many long years') were auditorily presented to the participants who simultaneously saw a target word either literally (e.g. 'hard'), metaphorically (e.g. 'strength'), or unrelated (e.g. 'dress') to the metaphor in the sentence at two stimulus onset asynchronies (SOAs) of 0 and 300ms. Participants were asked to make a lexical decision on the target word. An equal number of non-word targets were included with reaction time being the variable of interest. Reaction times were analysed using a linear mixed model and a significant effect of target type was found in the group of people with schizophrenia. Specifically the individuals with schizophrenia recognised the literally related target words significantly faster than the metaphorically related and unrelated target words. There was no significant difference in reaction times between the metaphorically related and unrelated target types, however, and no significant effect of SOA was observed. The control participants showed an advantage for the literally and metaphorically related target types at both the long and short SOA conditions. The results are interpreted with reference to previous findings of impaired figurative language processing in schizophrenia.

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**D. K. WONG, M. MAYBERY, D. BISHOP, A. MALEY, J. HALL-MAYER. Executive Function and Theory of Mind: Related in Typical Development, Independent in Autism?**

Recent research has consistently demonstrated that executive function (EF) and theory of mind (ToM) are significantly correlated in typically developing children, however the nature of the relationship is a matter of

current debate. While some evidence suggests a deep conceptual or functional link between the two constructs beyond the level of common task requirements, studies of individuals with ADHD, frontotemporal dementia and brain injury have shown that they may be dissociably impaired. Individuals with autism show deficits in both EF and ToM, however it is unclear whether or not these two deficits are related such that one may be subsumed under the other. In this study, 46 children with autism spectrum disorders (ASDs) and 48 control children were tested on tasks measuring ToM and a range of EFs including inhibition, planning, flexibility, and generativity. Results showed that while there were a number of significant correlations between ToM and EF tasks in the control group, there were very few correlations in the ASD group. Furthermore, a considerable proportion of the ASD group passed ToM tasks while failing EF tasks, and vice versa. These results suggest that while ToM and EF are related in typically developing children, they may be independent deficits in autism, possibly underlying different aspects of autistic symptomatology or characterising different subtypes of ASDs. This leads to the surprising conclusion that the two impairments may be a coincidental co-occurrence in autism possibly due to proximal neuroanatomical bases in the prefrontal cortex.

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#### **R. A. LANGDON, J. MCLAREN & T. CORNER. Social Cognition in Early Psychosis.**

Impairments of social cognition are well documented in chronic patients with schizophrenia and are important targets for treatment. Less is known about the severity of these deficits at early stages of psychotic illness. Three 'theory-of-mind' tasks (a joke appreciation task, a story comprehension task and a false-belief picture-sequencing task) were used to assess the ability to ascribe mental states in 24 first-episode patients recruited from two early psychosis intervention services in New South Wales and in 20 age and sex-matched healthy controls. IQ and verbal memory were also assessed. The patient group showed evidence of selective theory-of-mind impairments on the joke appreciation task and the picture-sequencing task but not on the story comprehension task. Findings demonstrate that impairments of social cognition are present at early stages of psychotic illness, thus supporting the view that social cognition impairments are a primary feature of psychotic illness, rather than a secondary consequence of the chronic asociality that is typically associated with long-term psychiatric illness. Findings also suggest that 'indirect' theory-of-mind tasks which do not explicitly cue explanations of another person's behavior may be more sensitive measures of a spontaneous capacity to infer other people's mental states in order to explain observed behaviour.

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#### **M. J. GREEN, J. H. WALDRON & M. COLTHEART. Mental State Perception In Schizophrenia: The Role Of Social Context.**

People with schizophrenia demonstrate reduced context processing on standard neuropsychological tasks, and poor social cognition (such as impaired mental state inference) when tested on facial expression perception and traditional theory-of-mind tasks. Effective processing of social contextual information may be necessary to discriminate complex mental states from information contained in faces. For example, a facial expression of 'determination' (ie., furrowed brow, pursed lips) could be misinterpreted as a display of anger if social contextual information is not perceived correctly, or not efficiently integrated with current percepts. People with schizophrenia may fail to use social contextual information effectively when attributing mental states to other people on the basis of information contained in facial expressions and the surrounding social context. This study investigated whether poor context processing impairs the ability to identify mental states from facial expressions, using visual scanpaths to provide an index of directed attention to the informative

components of realistic social scenes. 20 healthy and 20 schizophrenia participants viewed a series of picture pairs depicting target facial expressions presented in isolation (Series 1) or in the context of a social situation (Series 2). Stimuli were colour photographs (800 × 600 pixels) with the location of the target face matched across stimulus pairs, presented in a pseudo random order for 10 seconds each. The SR Eye-Link binocular eye tracker monitored gaze position at a sampling rate of 250 Hz, with .01 degree accuracy; visual scanpath parameters included the number, location, and duration of fixations across the time series, and the duration of 'first pass' fixations to salient features of the scene (eg., faces, objects, people). Results are discussed with respect to the role of early visual processing of social contextual information when interpreting the meaning of ambiguous facial expressions.

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#### **R. C. CHAN, E. Y. CHEN, E. F. CHEUNG, R. Y. CHEN & H K CHEUNG. Prediction Of Neurological Signs By Neurocognitive Performance In Schizophrenia.**

This study attempted to examine the contribution of different domains of neurocognitive functions to neurological signs in schizophrenia. A total of 90 (74 men, 16 women) schizophrenic patients were tested for executive function components (initiation, sustained attention, switching/flexibility, attention allocation, and impulsivity / disinhibition) and non-executive function (semantic memory, visual memory and working memory). Neurological abnormalities were assessed by the Cambridge Neurological Inventory. Significant correlations were found in the so-called soft signs (motor coordination, sensory integration and disinhibition) but not hard signs with both executive components and non-executive, after controlling for age, duration of illness and intellectual functioning. Multiple regression analyses indicated that Letter-Number Span and the impulsivity/disinhibition components were the significant contributors to motor coordination signs. Significant contributors to sensory integration signs included the attention allocation component and Visual Pattern longest span; whereas intellectual functioning and visual reproduction were the predictors of disinhibition signs. Neurocognitive functions were closely related to neurological signs, particularly the soft signs. However, working memory may be more predictive of motor coordination, while general intellectual functioning was more predictive of sensory integration and disinhibition.

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#### **M. MATSUI, T. SUMIYOSHI, H. YUUKI, K. KATO & M. KURACHI. Impairment Of Event Schema In Patients With Schizophrenia.**

The purpose of this study was to examine event schema, the conceptualization of past experience based upon script theory, in patients with schizophrenia. There were 17 patients meeting DSM-IV criteria for schizophrenia, and 17 age- and sex-matched normal individuals who consented to participate in the study. All patients were recruited from out-patient clinics of the Department of Neuropsychiatry, Toyama Medical and Pharmaceutical University Hospital. This experiment consisted of three tasks. In the recall task, participants recalled a typical scenario of shopping at a supermarket. In the frequency judgment task, participants determined whether the given events happen frequently, occasionally or rarely in a supermarket. In the sequencing task, the subjects put the randomly presented events in the correct order. The total number of responses in the free-recall task for patients with schizophrenia were less than those for the normal participants ( $P < 0.01$ ). As to the performances on the frequency judgment task, schizophrenic patients, when compared with the normal participants, committed more errors on judging both the events that sometimes happen ( $P < 0.01$ ) and the seldom occurring events ( $P < 0.05$ ). There was no significant difference for errors on identifying the usual items between patients and normal controls. As to the results of the sorting task, there was no significant difference between patients and normal controls in putting the events in correct order. Results of the present study suggest that event

schemas of patients with schizophrenia are different from those of healthy normal people.

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### Clinical Forum 1/1.30pm-3.00pm

#### DRIVING CAPACITY IN OLDER ADULTS: ASSESSMENT CONSIDERATIONS AND ETHICAL FOLLOW-UP.

*Chair:* Nancy Pachana  
*Discussant:* Kaarin Anstey

As the populations of many industrialised countries age, considerations regarding the mobility and road safety of older adults will take on increasing importance. We present papers that address the issue from a clinical perspective, from a rehabilitation perspective, and from a public policy perspective. Data is presented from cross-sectional as well as longitudinal studies, examining disparate factors involved in risk assessment, including cognitive performance, personality factors and mood variables. Both traditional neuropsychological assessment techniques as well as newer methods of assessment including virtual reality will be examined. The process of implementing driving cessation, including legislative concerns here in Australia, will be reviewed. Finally, an innovative program to assist older drivers to accept limited driving privileges or absolute driving cessation will be discussed.

#### **J. LIDDLE, K. MCKENNA & H. BARTLETT. From Driving Cessation To Safe Transportation: Developing Resources To Assist Adjustment And Continued Community Engagement.**

Older people may cease driving for numerous reasons including health concerns, financial reasons, discomfort while driving or cancellation of their licence. Driving cessation represents a major adjustment potentially leading to depression, loss of roles or unsafe use of alternative transport. Our study involving qualitative interviews with 17 key people (retired drivers, family members and health professionals) led to an understanding of the process of driving cessation and stages in this process. Outcomes of driving cessation and strategies and recommendations from key people were also noted. Quantitative measures with 195 older people living in the community about transport usage, future plans and lifestyle factors were also undertaken. Analysed using general linear models, transport status (that is, being a driver or nondriver) was the only variable found to significantly influence the number of valuable roles undertaken by participants ( $p < .005$ ). Specifically, drivers currently participated in a mean of 5.4 valuable roles compared to 4.4 for nondrivers. Transport status also impacted significantly on life satisfaction ( $p < .001$ ), along with number of valuable roles ( $p < .01$ ) and health status ( $p < .05$ ). Drivers' mean life satisfaction score was 20.8 (out of a possible 26), compared to 17.2 for nondrivers. Data were also collected on current transport use, future transport plans, and barriers to use of alternatives to driving. Drivers tended to be unfamiliar with alternative transportation, lacked specific plans regarding future changes to driving, and reported inconvenience as a major barrier to alternative transportation use. Nondrivers reported physical access, safety and social issues as barriers to transport use. Results from the qualitative and quantitative investigations have led to the development of resources to facilitate adjustment to driving cessation while promoting continued safe engagement in the community. The study developed a model of the process, exploring the influences, roles and emotions during driving cessation. Potential positive outcomes from driving cessation and strategies suggested by key people were also analysed, indicating the need for population based as well as individualised resources. The resources developed follow the staged model of driving cessation and utilise practi-

cal and cognitive strategies for retiring drivers, their family members and health professionals which can be utilised prior to driving cessation, while making the decision or following cessation of driving.

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#### **N. A. PACHANA, A. FITZELL & D. C. LIE. Clinical And Assessment Tools To Determine Driving Risk And Progress To Driving Cessation In Older Adults.**

It is often difficult for the clinician to know how to proceed when confronted with a patient known to be both driving and diagnosed with early dementia. Ethically it can be a dilemma: trying to balance the impact of cessation of driving on the older person's life with the risk to personal and public safety related to the known hazards of such progressive cognitive impairment. Furthermore, accurate prediction of accident risk in older adults is difficult. Risk assessments with this population have predominantly utilized cognitive, demographic and health measures to calculate levels of risk. In a small pilot project 50 older drivers (20 male, 30 female) aged 55-92 years who possessed current drivers licenses were given a short battery of common measures such as the Mini-Mental State Exam, as well as measures of personality such as risk-taking. Statistical regression analyses suggested no advantage in accident risk prediction for personality measures; however, measures of current cognitive performance, current mood state and selected demographic variables possessed significant predictive value. Implications of these findings are discussed in terms of combining test data with clinical observations and in terms of recommendations of driving risk to patients and their families. This process implies knowledge of the role and influence of police, physicians, specialized testing, the driving authority, and relevant legislation. The authors suggest a practical stepwise approach beginning with simple discussion, through to potential confrontation, notification of risk and involvement of legal authorities.

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#### **M. FLYNN & G. KINSELLA. The Effect of Executive Functioning on Driving Ability in Older Adults.**

The aim of this research is to clarify if decline in higher order executive abilities (attention, working memory, reasoning, planning, assimilation and integration of information, judgement and flexibility of thinking) affect driving performance in older drivers. In Australia, accident statistics involving older drivers has risen to lie just below that of 18 to 25 year olds. As the aging population is expected to double by 2030, and most will have used a car as their primary mode of transport, investigation into this largely unexplored area appears paramount. Participant drivers, drawn from the driving community and aged between the ages of 50 to 80, undertake a neuropsychological assessment to determine levels of cognitive function in executive abilities; questionnaires on driving history and road law knowledge; and, an on-road driving assessment which requires driving a dual control car on a predetermined route, varying in course complexity. The relationships between these three components of assessment will be presented to provide more detailed support regarding cognitive factors, specifically features of executive function, and their impact on older drivers' on-road performance. Application of the study results to the development of more sensitive screens for detecting "at risk" drivers by health professionals will be discussed.

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#### **K. J. ANSTEY & M. LUSZCZ. Predictors of Changing Patterns of Driving Habits over 5 Years in a Population Based Sample of Very Old Adults.**

Mobility and road safety of older adults is an issue of growing importance as Australia's population ages. There is a lack of longitudinal population-

based data on driving habits in older adults internationally, and a greater lack of data based on Australian samples. In this study we examined driving habits over a 5-year period in the Australian Longitudinal Study of Ageing. An electoral role sample from Adelaide, with mean age of 78 years at wave 1, (range of 65-103) were followed annually over 5 years and asked about their driving habits. Of the original 2087 participants, 1032 (50%) were drivers at Wave 1. This reduced to 42%, then 32% then 24% of the remaining sample at Waves 2, 4 and 5 respectively. Among those who continued to drive, driving frequency decreased at each Wave from 28% of the sample driving daily at Wave 1 to 12% at Wave 5. Being older and female was associated with being a non-driver. After adjusting for age and gender, lower levels of visual memory, verbal memory, vision, and higher levels of depression were predictive of driving cessation at later waves.

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### Paper Session 6/1.30pm-3.00pm

#### EXECUTIVE FUNCTION

##### **R. R. TESTA & P. BENNETT. The Fractionation of Executive Functions in a Normative Population.**

Introduction: Executive functions are higher order cognitive processes that act globally across all cognitive domains, and impact upon all types of behaviour (Anderson, 1998; Temple, 1997). Although the importance of understanding executive functions is undisputed, the progress of research examining this area of cognition has been slow. Significant developments have been impeded by the lack of definition in the field, where consensus on what these abilities are comprised of is yet to be reached. The use of executive function measurements is also under scrutiny. Many clinicians and researchers frequently assess executive functions; however, doubt concerning the validity and reliability of executive function tests as accurate assessment tools remains. This study aimed to (a) investigate the dissociation of executive functions in a normal population; and (b) investigate the various components of executive functions, as measured by specific executive tests. Method: 200 normal participants completed a battery of executive function tasks from the Behavioural Assessment of the Dysexecutive Syndrome including the Modified Six Elements Test, the Key Search Task, the Zoo Map Test and the Dysexecutive Questionnaire, in addition to other tasks including Porteus Mazes, Random Number Generation, Stroop, Hayling Test, Similarities Test (WAIS-III), 20 Questions, Cognitive Estimates Test, Brixton Test, Tower of London - Revised, Trail Making Test, Verbal Fluency, Animal Fluency, Concept Generation Test, and the Wisconsin Card Sorting Test. Results and Discussion: Results confirmed the multifaceted nature of executive function tasks and demonstrated that these specific tasks must be considered measurements of several components of executive functions. In addition, substantial variability in the normal population suggests that all test scores should be interpreted conservatively.

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##### **M. BOONSTRA, S. KOIJ, J. OOSTERLAAN, J. SERGEANT & J. BUITELAAR. Executive Functioning in Adults with ADHD.**

We compared the performance of 49 adults with ADHD and 49 normal controls on a large battery of tests for several domains of executive functioning (EF; fluency, planning, working memory, inhibition, and set shifting) and tests of abilities that are necessary to perform the EF tests, but that are not denoted as EF per se (control tests). ADHD participants performed worse than normal controls in the domains of verbal fluency,

inhibition, set shifting, and verbal working memory. After controlling for IQ, the results for verbal fluency were no longer significant. After covarying for the control functions, only the results in the areas of inhibition and set shifting remained significant. These results indicate that not all areas of EF are deficient in adults with ADHD, but that they do show problems with inhibition and set shifting. Moreover, the results of the control tests imply that the difficulties that adults with ADHD experience are not limited to EF, but may extend over areas like verbal memory. This has important implications for theoretical accounts of the disorder.

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##### **M. A. BAILEY, G. GEFFEN, A. LAW & A. CARROLL. Comparison of Rating Scales and Performance Measures of Attention and Executive Functions in Children with Tourette Syndrome and Attention Deficit / Hyperactivity Disorder.**

The study aimed to investigate the behavioural, emotional and cognitive problems of children with Tourette Syndrome (TS) and compare these to children with Attention Deficit / Hyperactivity Disorder (AD/HD). The participants were 125 students aged 7 to 16-years (M = 10.64, SD=2.30 years), 40 diagnosed with TS (33 male, 7 female), 40 with AD/HD (31 male, 9 female) and 45 control children (35 male, 10 female). Groups were matched on age, IQ and sex distribution. Parents of participants completed the Achenbach Child Behaviour Checklist (CBCL), Conners Parent Rating Scales Revised (CPRS-R), Yale Tic Severity Scales (YALE) and Movement, Obsessions, Vocal Evaluation Scales (MOVES) questionnaires. Each child completed the Trail Making Test, Tower of London, Stroop Colour-Word Test, Wisconsin Card Sort Test, Contingency Naming Test and Sustained Attention to Response Test. Discriminant Function Analysis showed that (a) the controls differed from the clinical groups on the attention indices of the CBCL and Conners Scales (b) the TS group showed more obsessive-compulsive tendencies and anxiety than the AD/HD group, (c) the performance measures showed only small differences between the controls and clinical groups. Regression analyses showed that tic severity, attention, and rated behaviour and emotional problems accounted for only a small percentage of the variances in performance of attention and executive function tasks. These results indicate that whereas performance measures of executive functions are relatively insensitive to any group differences, the rating scales may have greater utility in clarifying diagnosis and characterising childhood developmental disorders.

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##### **E. DE HAAN, G. NYS, G. ROKS, P. DE KORT, J. KAPPELLE & M. VAN ZANDVOORT. The Role Of Executive Functioning In Spontaneous Confabulation.**

Spontaneous confabulation is the unintentional report of erroneous memories and is characterized by its bizarre content and the absolute certainty with which these distortions are uttered in spontaneous conversation. Frequent co-occurring neuropsychological impairments are amnesia and executive dysfunction. However, it remains unclear whether or not executive dysfunction, in combination with amnesia, is a necessary condition for spontaneous confabulation. In an attempt to solve this controversy, we followed the course of executive functioning in a 46-year-old male who had suffered a bithalamic infarction. Neuropsychological assessment demonstrated a severe amnesia and an across-the-board executive disorder. His spontaneous confabulations abated over a six month period. Disappearance of spontaneous confabulation paralleled a specific recovery in mental flexibility, whereas other executive functions and memory remained severely impaired at six months post-stroke. Our case study for the first time emphasises the key role of mental flexibility in spontaneous confabulation.

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**A. WITHALL, L. HARRIS & S. CUMMING. Executive Dysfunction Correlates with Psychosocial Outcome in Major Depressive Disorder.**

**BACKGROUND:** Depressed patients often report poor concentration, decision-making and organisation. These symptoms are frustrating and disheartening, can persist after discharge and cause functional impairment. Executive function is a neuropsychological domain with high ecological validity and related to long-term outcome since it involves skills necessary to adapt to a changing environment. **AIM:** To longitudinally examine the neuropsychological functions affected by depression, with an emphasis on types of executive function. **METHOD:** Psychiatric (HRSD-17, DASS, FrSBe, SOFAS) and neuropsychological assessments (NART, Reaction time, Digit Span, CVLT, COWAT, WCST, Stroop, WISC-III Mazes, Prospective memory, Six Elements Test) were administered at admission and 3-months post-discharge, to patients and age, sex and IQ-matched controls. 40 patients (20-60 years and primary diagnosis MDD) were recruited from the Royal North Shore Hospital and Northside Clinic, Australia. **RESULTS:** Patients showed a significant improvement in symptoms at follow-up, however the mean HRSD-17 score remained at 15.4. At follow-up there were no significant differences between patients and controls on structured tests, however significant differences were evident on those tests that require patients to organise, monitor and review their performance (e.g. Digits-backwards, COWAT-phonemic, WCST-perseverations, prospective memory and SET-tasks). Furthermore, these deficits were correlated with poorer SOFAS score. Patients reported an improvement in their depressive symptomatology and apathy however less gains were reported for executive function. **CONCLUSION:** Patients showed impairments in executive function that persisted beyond their clinical improvement. These impairments were associated with loss of social and occupational function. Executive dysfunction is a sensitive neuropsychological outcome measure that predicts psychosocial recovery and highlights patients that need support post-discharge.

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**K. FULLARTON & M. HENNESSY. Rethinking Nonverbal Fluency: The Use Of Process Measures In The Assessment Of Executive Function And Design Fluency.**

Executive functioning has traditionally been studied and measured using standardised total achievement indexes to determine performance levels of the test taker and the effects of underlying cognitive deficits. Recently there has been a shift in focus and researchers are beginning to examine the underlying cognitive processes essential for effective performance and are using process measures to predict cognitive deficits. The process approach focuses on how individuals complete a task (strategy use, error rate, error classifications) rather than their overall score or performance. Troyer et al (1997) examined the use of process measures in assessing verbal fluency and proposed that two distinct cognitive processes (clustering and switching) influenced effective performance on this task. Following on from the introduction of switching and clustering process scores, this research examines the use of four new measures, adapted from Troyer, in assessing performance on a nonverbal fluency task, the Ruff Figural Fluency Test (RFFT). 66 participants (25 female and 41 males), aged between 17 and 44 ( $M = 21.91$  years,  $SD = 6.40$ ) were assessed on verbal and nonverbal fluency measures, intelligence, attention, memory and other executive function tasks and a correlation analysis was conducted to determine whether there was a significant relationship between the four adapted process scores of the RFFT and these other measures. Results demonstrated a differential pattern of correlations with other neuropsychology tests. Most significantly, the number of unique designs generated within the RFFT correlated with the executive process of checking and also with other visuospatial and speed of information processes. Furthermore, the new score of switching on the RFFT correlated primarily with the executive process of inhibition.

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**Symposium 5/1.30pm-3.00pm**

**RETROGRADE MEMORY IN PATIENTS WITH FOCAL BRAIN LESIONS**

*Chair: Laurie Miller*

This symposium will address the question of how memory for the past is affected by brain lesions involving the temporal or frontal lobes. Group and single case studies will be included. Results from memory tests of famous people, famous world events, new vocabulary words, topographical material (e.g., landmarks, routes, layouts), music and autobiographical information will be reported. In general, it is noted that patients with frontal or temporal lobe lesions have a well-preserved memory for vocabulary words, but that deficits are common in other aspects of retrograde memory. It will be argued that temporal gradients are not typically found following acute lesions in these brain regions, but rather that the recall deficits tend to be pervasive. The contribution of the mesial temporal region to the recall and recognition of various types of memories will be considered.

**S. LAH, S. GRAYSON, T. LEE & L. MILLER. Impact of Epilepsy and Surgical Variables on Memory for the Past after Temporal Lobectomy.**

A few previous studies have revealed impairments in retrograde memory in patients with temporal lobe epilepsy, but many questions about the importance of lesion side, type of material, seizure history and hippocampal status remain unanswered. In this study, patients who had undergone unilateral (15 right and 15 left) temporal lobectomy (TL) for the relief of epilepsy and 15 control subjects completed a range of public and autobiographical memory tests. Deficits in recall and recognition of details related to past famous world events were observed for both left and right TL groups. In addition, the left TL group showed impaired retrieval of famous names and TL patients as a group generated significantly fewer names of people from their own past. Current seizure- and medication-status influenced performance on a few measures, but duration of epilepsy and age of onset had no significant impact. Removal of an intact hippocampus resulted in impaired recall of autobiographically relevant names from the remote past, but no impairment for remote world events or famous people. The findings help to clarify the contribution of the temporal lobes to memory for the past.

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**I. HEPNER & L. MILLER. Comparing Remote Autobiographical, Semantic and Topographical Memories in a Patient with Bilateral Mesial Temporal Infarctions.**

According to the standard model of long-term memory consolidation, the mesial temporal lobes (MTL) have a time-limited role in the maintenance, storage and retrieval of retrograde declarative memories, such that they are not necessary for recalling remote memories. In contrast, proponents of the multiple trace theory posit that the MTL are necessary for remembering detailed autobiographical and topographical material from all time periods. The precise role of the MTL in remote memory has been difficult to elucidate, as the majority of studies present cases with widespread brain damage that often occurred many years prior to testing. We investigated retrograde autobiographical, semantic and topographical memories in a subject (SB) who had recently sustained infarctions confined to the MTL bilaterally and the left mesial occipital lobe. In accordance with the standard model of long-term memory consolidation, SB performed similarly to control subjects for remote time periods on various measures of retrograde autobiographical and semantic memory. Recall of well-established routes was also intact for all epochs. However, deficits were found for

both remote and recent landmark recognition and houseplan drawing. The findings indicate that remote autobiographical and semantic memories along with knowledge of familiar routes are not dependent on the MTL, consistent with the results of Teng & Squire (1999). The findings for landmark recognition and houseplan drawing (tested for the first time here in a patient with bilateral mesial temporal lesions) suggest that the MTL and/or left occipital lobe remain important for accessing these types of topographical memories indefinitely.

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**L. MILLER & S. BATCHELOR. Ability to Remember the Past after Frontal or Temporal Lobe Stroke.**

Over the past two decades, there has been a growing interest in understanding the neural underpinnings of memory for the past. Numerous patients with retrograde amnesia after acute brain damage have been described, but often the causative lesions are bilateral and/or fairly diffuse and it is not clear whether a unilateral lesion is sufficient to cause a retrograde memory impairment. In addition, questions about the impact of lesion side and site on the material specificity and temporal extent of retrograde memory deficits remain unanswered. We set out to investigate these issues by comparing 20 patients who had recently had a unilateral frontal- or temporal-lobe stroke (10 left sided and 10 right sided) to a group of 10 matched, normal control subjects on tests of memory for events and semantic details from the autobiographical and public domains. Results indicated that a unilateral lesion was sufficient to cause significant retrograde memory impairment. Side-of-lesion effects were evident only for autobiographical event memory, with right-sided lesions more likely to cause impairment. Across tasks, the memory deficits were most often pervasive rather than characterised by a traditional temporal gradient. Memory for events (both autobiographical and public) was impaired in patients who had had a stroke involving the mesial temporal region, but not in those whose strokes spared this region. Finding that patients with mesial temporal lesions were unable to remember details related to public events even when offered recognition choices suggested that their memory stores (and not just their retrieval abilities) were compromised.

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**J. K. FOSTER, B. LEVINE, S. KANAGASABAI & M. MOSCOVITCH. Remembrance Of Things (Long And Not So Long) Past: Retrograde Memory Functioning After Hippocampal Injury.**

Until comparatively recently, the consensus view was that memory undergoes a consolidation process, in which long-term episodic (i.e. context-dependent) memories are progressively modified until they are represented in a form that is independent of the hippocampus. More recently, the multiple trace theory has been proposed. According to this theory, the hippocampus contributes to the retrieval of both recent and remote episodic memories. In this paper, we report findings obtained from the evaluation of retrograde memory in amnesic patient SJ, a middle aged man who sustained selective hippocampal injury in his late 40s. We evaluated the autobiographical memory of SJ using a recently developed psychometric instrument: the Autobiographical Interview. The findings obtained are supportive of the multiple trace theory of hippocampal memory functioning: SJ experienced difficulty retrieving retrograde episodic memories across the several different periods of his life that were evaluated. A particularly interesting comparison was that observed between patient SJ and the well known amnesic patient KC, who has sustained more extensive brain injury than SJ. In particular, whereas SJ benefited from cuing of older memories, KC did not. Possible explanations for these and other reported findings will be discussed.

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**A. JANSARI, K. DAVIS, S. FIRMINER, N. KAPUR. When Long-Term Memory Does Not Necessarily Mean "Forever": Evidence of Long-Term Amnesia in a Patient with Temporal Lobe Epilepsy.**

Whereas classical amnesics display an inability to transfer memories to a long-term store, a new subtype of patients (usually exhibiting epilepsy) are being reported who are able to do this but later present with an inability to retain the information in long-term memory (e.g. Kapur, 1996; Mayes et al, 2003); a phenomenon known as long-term amnesia (LTA). A detailed case study of an LTA patient with mild temporal lobe epilepsy is reported on a range of tasks looking at retention of single words, faces, the Rey Complex Figure and novel stories at 6 different time intervals (over a 4 week period), as well as performance on a range of autobiographical and flashbulb memory tasks. The results indicate a selective deficit in remembering autobiographical memory and event-related memory for information that has not been repeatedly recalled. Subsequent testing looked at the patient's memory for music and investigated the subjective quality of his intact recognition responses using the Recognition of Conscious Awareness (RCA) paradigm. The implications of the findings are discussed in relation to existing theories of long-term memory consolidation.

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**Birch Lecture/3.30pm-4.30pm**

**BRYAN KOLB: Brain Plasticity And Behaviour**

Brain plasticity occurs through a series of steps that are stimulated by gene expression, but are influenced significantly by environmental events throughout life. In theory, experience could alter the brain and behavior in two ways: by modifying existing circuitry or by creating novel circuitry. In fact, the brain makes use of both strategies, although the details of the particular strategy varies with the precise developmental age of the subject. Various experiences, both pre- and postnatal, including especially sensory and motor experience, gonadal hormones, psychoactive drugs, sexual behavior, and neurotrophic factors modulate the plastic changes that occur spontaneously in the brain and these changes are correlated with long-lasting changes in behavior. These behavioral changes are known by various names including learning, addiction, and so on. Furthermore, the plastic changes in the brain can be altered by injury, the nature of the injury-related effects varying dramatically with age. This talk will summarize the "rules" that appear to govern experience-dependent changes in both brain and behavior and will consider various explanations for mechanisms underlying these changes. Emphasis will be placed upon the synaptic organization of the cortex, the generation of neurons and glia, and the behavioral sequelae.

**Paper Session 7/4.30pm-5.45pm**

**SELF AWARENESS IN TRAUMATIC BRAIN INJURY**

**T. L. OWNSWORTH, J. FLEMING & J. STRONG. The Relationship Between Compensation Status, Symptom Endorsement, Readiness To Change And Strategy Behaviour For Individuals With Traumatic Brain Injury.**

Individuals seeking compensation following a traumatic brain injury (TBI) are often pre-occupied with their symptoms which can significantly affect their response to rehabilitation. Previous studies have examined the neuropsychological functioning and symptom reporting of individuals seeking compensation. However, the limitations of such studies include the ab-

sence of a matched sample of noncompensation-seeking individuals or lack of control for potential confounding variables related to symptom reporting such as self-awareness, causality attributions and emotional distress. The present study aims to investigate the relationship between compensation status and three outcome measures: symptom endorsement, readiness to change and strategy behaviour. The participants are 60 individuals with TBI recruited from outpatient rehabilitation and vocational rehabilitation services with approximately half seeking compensation. The compensation-seeking and noncompensation-seeking groups are matched on demographic, injury-related (e.g. cause and severity of injury) and neuropsychological variables. Another group of 30 individuals with non-traumatic brain injuries provide a comparison on the key outcome measures. Standardised outcomes measures include the Symptom Expectancy Checklist, the Change Assessment Questionnaire and the Self-Regulations Skills Interview. Multivariate analyses will be used to demonstrate whether individuals' level of symptom reporting, readiness to change and strategy behaviour can be predicted from subsets of demographic, injury-related and psychological variables including compensation status. The implications of the findings will be discussed in terms of the effect of compensation status on clinical presentation and tailoring rehabilitation services to maximise outcome following TBI. A University of Queensland MAIC/ School of Health and Rehabilitation Sciences Research Grant funds this study.

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#### **D. W K MAN & S F TAM. Evaluating Self-concepts of Persons with Traumatic Brain Injury (TBI).**

**Objectives:** The present study compared the self-concepts of 64 Hong Kong Chinese with Traumatic Brain Injury (TBI) with 80 healthy Hong Kong Chinese, so as to gain a better understanding the self-perceptions of persons with TBI, and to plan an effective self-concept enhancement programme accordingly. **Methods:** 64 and 80 Hong Kong Chinese with and without TBI participated in the study respectively. They responded to a self-concept questionnaire that was developed by Tam and Watkins (1995) based on a hierarchical multidimensional self-concept model of Hong Kong Chinese with disabilities. Face-to-face interviews were also arranged for subjects who could not respond to the questionnaire independently. **Results:** Through comparing the two groups' responses, by using univariate analysis of variance, the non-TBI subjects ( $n=80$ ) were found to have statistically significantly higher means than their TBI counterpart ( $n=64$ ) in total self-concept, and other specific self-concepts ( $p<0.01$ ). The TBI group also showed significantly lower self-criticism than the non-TBI group. The relatively low self-concept and openness exhibited by the TBI subjects might be due to experiencing unsatisfactory rehabilitation outcomes and underprivileged social conditions. Significant correlations were found between demographic variables and self-concepts of TBI subjects. **Conclusions:** Persons with TBI generally showed significantly lower self-concepts when compared to their healthy counterparts. The findings are a valuable reference to designing rehabilitation programmes for self-concept and rehabilitation outcome enhancement.

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#### **T. HART, G. TRUE & J. BURKE. Self-Awareness of Cognitive, Emotional and Behavioral Change Following Traumatic Brain Injury: A Qualitative Investigation.**

Impaired self-awareness of deficit (ISA) is common after traumatic brain injury (TBI) and predicts poor outcomes. Quantitative studies of ISA, using discrepancies between self- and other-ratings, suggest that cognitive and behavioral sequelae of TBI are self-reported less accurately than physical problems. Qualitative studies of ISA may help to build theories about these phenomenological patterns. We conducted in-depth interviews with 19 persons with TBI and their significant others (SOs) at 1 year post injury to examine self-perceptions and explanations of change in different do-

main of function, and to explore effects of injury-related changes on activities, relationships and goals. Data were analyzed using an inductive, iterative approach informed by Grounded Theory. Atlas-ti software was used to help code transcripts, identify themes and develop theories. Results: As expected, physical and certain cognitive deficits (e.g., STM) were self-described in a straightforward way and seldom denied. Contrary to expectation, persons with TBI also described many changes in complex cognition, interpersonal competence and behavioural/ emotional control; however, denial and self-contradiction were observed in these domains. Frequently reported behavioural/ affective changes included impulsivity, aggression, and overwhelming frustration, anger, or fear. A few persons described initiation deficits and perseveration. Respondents provided a rich variety of explanatory models for behavioural/ emotional changes including exaggeration of premorbid traits, changes in circumstances, and changes in how other people treated them. SOs refuted some of these, but agreed with others. Both sets of respondents reported difficulty sorting out the causes of behavioural change in the injured person, and both reported a surprising number of favourable changes in behavioural function and life circumstances. Results confirm the value of qualitative inquiry for studying the complexity of ISA.

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### **Clinical Forum 2/4.30pm-5.45pm**

#### **ABI AND CHALLENGING BEHAVIOUR IN COMMUNITY SETTINGS.**

*Chair:* Grahame Simpson

*Discussant:* Robyn Tate

Challenging behaviours are often the single most adverse outcome following acquired brain injury (ABI), resulting in family distress, poor vocational outcomes, reduced involvement in rehabilitation programs, and more restrictive accommodation arrangements.

Most people with ABI who have challenging behaviours live and function in diverse community settings such as nursing homes, family homes, shopping centres, and hotels. But much of the literature describes behaviour management approaches conducted in well-resourced programs or highly-structured environments. These traditional approaches to behaviour management do not always translate easily to settings where there may be inadequate resources and little control over environmental elements that govern behaviour. Assessment and management of challenging behaviours in community settings is complicated by the interaction of several factors including insufficient structure and resources, the behaviours themselves, the life stage of the person with ABI, and the broader geographical setting within which the person lives.

The current symposium will present some innovative approaches in addressing this complex clinical issue. A recently devised scale will be presented that helps to clarify the types of overt challenging behaviours encountered in clients with ABI, and which enables ratings of behavioural severity, frequency, and impact. Next, a model to guide clinical decision-making in the management of sexually inappropriate behaviours among adults will be outlined. Following this, case studies will be employed to pay specific attention to sexually based challenging behaviours among people who sustain ABI during adolescence. Finally, the challenges and approaches to managing persisting and severe behavioural problems in rural and remote areas will be outlined. Skill development of family members and support workers will be addressed, as will appropriate behaviour resources for use in community settings.

#### **G. KELLY, J. TODD & G. K. SIMPSON. The Overt Behaviour Scale (OBS): Measuring Challenging Behaviours Following ABI in Community Settings.**

Challenging behaviours such as aggression, sexually inappropriate activity, and absconding are common sequelae following acquired brain

injury (ABI). There is growing evidence that such behaviours often increase and worsen over time, particularly in community settings where there is little structure and support (such as family homes, supported residential services, and shopping centres). However, there are few measurement scales designed to assess overt challenging behaviour in community settings. This limits accurate and systematic assessment of behaviours, and weakens the position of clinicians attempting behaviour management interventions.

Existing 'behaviour' scales typically have one or more significant drawbacks: inconsistent or overly broad definitions of behaviours, not being ABI specific, a lack of psychometric data, difficulties rating behaviours outside controlled settings, limited focus of assessment (e.g. only rating aggression), and failing to separate items relating to behaviour, mood, and cognition.

The Overt Behaviour Scale (OBS) includes the widely-used Overt Aggression Scale (Yudofsky et al. 1986) to measure verbal aggression and 3 types of physical aggression. The OBS also includes 5 new subscales: inappropriate sexual behaviour, inappropriate social behaviour, repetitive behaviour, wandering/absconding, and adynamia. Together, these behaviours represent the vast majority of referrals to the ABI Behaviour Consultancy – a service that specialises in behaviour management interventions in community settings. The OBS enables multiple behaviours to be rated on 3 key indices: severity, frequency, and impact.

The presentation will include examples of OBS subscales and psychometric data. Clinically relevant information will be presented such as how the OBS is used to elicit significant information, clarify behavioural events, and construct behavioural profiles. These are critical initial steps in developing effective community-based behaviour management plans.

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### **G. K. SIMPSON & G. KELLY. Community Management Of Sexually Aberrant Behaviour After Traumatic Brain Injury.**

Sexually aberrant behaviours (SAB) are a problem among a minority of people with traumatic brain injury (TBI). A survey by Simpson et al. (1999) found that inappropriate touching (both genital and non-genital), followed by exhibitionism and coercive sexual acts were the most commonly observed behaviours. A follow-up study found no difference in premorbid, neuroradiological, or neuropsychological correlates between a group of people with TBI displaying SABs (n=25) and a control group matched on sex, injury severity, age at injury, time post-injury but with no history of such behaviours. The aetiology of such behaviours is still unclear, and further research is required to understand the potential contribution that underlying processes such as disinhibition versus hypersexuality may play. Given the serious consequences that can flow from SABs, their effective management is an important clinical concern. A model that provides guidelines to structure and enhance clinical decision-making in the management of sexual behavioural disturbance in community settings will be presented. The model contains a hierarchy of six different interventions organised in concordance with the principle of the least restrictive intervention and include verbal responses/counselling, behavioural intervention, environmental modification, medication, separation and legal sanctions. Six associated dynamics are described which need to be incorporated into the clinical decision-making process for selecting the appropriate intervention including the level of therapeutic intrusiveness, severity of cognitive impairment, the level of insight and personal motivation, the level of personal agency, the constraints around decision-making and the severity of the behaviours. Case examples will illustrate the working of the model. The model can be used by brain injury community services that have to make decisions about intervention, referral or accessing expertise to assist in addressing SABs after TBI.

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### **O. BEADLE. Sexual Behaviour, ABI, & Adolescence.**

Acquired brain injury (ABI) can have a diverse effect upon sexual functioning across the lifespan with changes resulting from either physical, cognitive, behavioural, emotional and/or social factors. The impact of ABI upon sexuality can be even more complex during adolescence when the development, exploration and understanding of sexual functioning and behaviour are first likely to occur. Adolescence is also a crucial time for moral and social skill development and the effects of an ABI can make these tasks of normal maturation much more difficult. As a result, adolescents with ABI can often present with challenging behaviours that can have an impact on their family and peers as well as themselves. Similar to the adult population, a common clinical presentation is making excessive sexually inappropriate comments and/or inappropriate touching both of which have potential social and legal consequences. Another behaviour often more specific to adolescents concerns sexual safety in which individuals with ABI are more vulnerable to putting themselves at risk than their age related peers. This paper will outline the potential causes and consequences of challenging sexual behaviours in adolescents with ABI and determining the most effective management options in a community based setting. Using case examples to illustrate the process of assessment and intervention, the effect of the adolescent's brain injury, their environment and individual characteristics of the adolescent themselves will be explored. In particular, normal developmental expectations and the age of injury need to be considered. In the absence of close monitoring and reinforcement schedules, managing these behaviours in everyday community settings such as the school playground, public transport or the local shopping centre also poses a significant challenge.

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### **E. MORRISS. Managing Challenging Behaviour in Rural and Remote Settings.**

Behavioural problems arising as the result of acquired brain injury (ABI) are typically long-lasting and are the main factors that prevent social and vocational reintegration following severe injury. Whilst the literature suggests that individuals with challenging behaviours benefit from intensive neurorehabilitation, this is not often available in the Australian health setting, and typically not at all in rural and remote locations.

Individuals with challenging behaviour in rural and remote areas confront major barriers to accessing appropriate behavioural intervention and support. Few have access to psychology or other health services with knowledge or expertise in brain injury or in management of challenging behaviour. This paper will describe a collaborative community behavioural intervention model applied in a rural and remote setting. This model incorporates a number of key elements: a) assessment of the complex factors influencing challenging behaviour, b) selection of non-aversive and positive approaches, c) application of a problem-solving approach with key stakeholders to identify solutions, and d) identifying practical, accessible and sustainable interventions. The role of education and skills development of family members, carers, and support workers will be addressed. This paper will discuss the use of new technologies such as videoconferencing in providing behavioural intervention, as an opportunity to extend services to rural and remote areas, but also presenting new challenges to effective clinical service delivery.

Case studies will be used to illustrate the benefits of collaborative community-based behavioural intervention approach. This model works particularly effectively in rural and remote settings where individuals have access to fewer resources for management of behaviour problems. It also facilitates skill development of family members, carers and generic service providers, and thereby creating more sustainable resources for the future.

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## Symposium 6/4.30pm-5.45pm

## SUBCORTICAL FUNCTIONS IN LANGUAGE AND SEMANTICS.

Chair: Bruce Crossen

Discussant: Branch Coslett

Although the role of subcortical structures in language and semantics has been debated for more than a century, significant progress has been made recently in defining these functions. The four presentations of this symposium bring the role of the thalamus and basal ganglia in language and semantics into sharp relief. John Hart's presentation focuses on a model of semantic memory for objects, with a central tenet of the model being that one mechanism of object recall is via the thalamus modulating synchronized 30 Hz gamma rhythms between brain regions (e.g., ventral temporal) that encode for object components. David Copland will present evidence of how semantic priming is altered by Parkinson's disease compared to vascular subcortical lesions. The implications of these findings with regard to a potential role for the basal ganglia in language will be considered in the context of frontal-subcortical networks and converging evidence from lesion, neuroimaging, and neurotransmitter studies. Bruce Crossen will discuss evidence that a dominant pre-SMA-dorsal caudate-ventral anterior thalamic loop participates in word generation. In addition to discussing the role of this loop in lexical retrieval, he will present evidence that the nondominant basal ganglia suppress nondominant frontal activity during word generation. Recent studies based on examination of the effects of deep brain stimulation to the subthalamic nucleus (STN) also have indicated a possible role for the STN in language. Bruce Murdoch will discuss evidence that the STN contributes to the mediation of language by indirectly regulating thalamo-cortical outputs within cortico-subcortical-cortical language circuits.

**J. HART. Neural Hybrid Model of Semantic Object Recall.**

Semantic object memory has been proposed to be structured by categorical and/or feature-based organization. However, the neural mechanisms by which these components combine to represent an object have not been specified. We have proposed a model of semantic object memory, the Neural Hybrid Model, with a central tenet that one mechanism of object recall is by synchronous neural activation of brain regions that encode components of the object, mediated by the thalamus which modulates synchronized 30 Hz gamma rhythms between these brain regions. Recent investigations using event-related functional MRI has extended this work by estimating the time course of fMRI signal changes in the cortical and subcortical regions. Our results indicated that there are separate loci of signal changes in the thalamus (dorsomedial and pulvinar) that exhibit notable differences in times of onset, peak and return to baseline of signal changes. The signal changes in the pulvinar demonstrate the slowest transients of all the cortical and subcortical regions we examined. Evaluation of cortical regions demonstrated salient differences as well, with the signal changes in Brodmann area 6 (BA6) occurring earlier than those detected in other regions. We conclude that BA6 mediates early designation or refinement of search criteria, and that the pulvinar may be involved in the binding of feature stimuli for an integrated object memory. Taken in conjunction with our electrophysiology results from thalamic and scalp electrode recordings, the pulvinar likely engages as a modulator of the selective gamma rhythm mediating semantic object recall via the proposed mechanism.

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**B. E. MURDOCH & B. WHELAN. Building Upon Working Theories of Subcortical Participation in Language: Integrating Intrinsic Basal Ganglia Circuitry.**

In relation to models of motor control, a neurochemically opposed push-pull system, regulated via *direct* and *indirect* basal ganglia pathways, has

been hypothesised to facilitate the execution of movement by way of manipulating patterns of motor cortex activation and inhibition. To date, working theories of subcortical participation in language have failed to adopt this schema, largely endorsing the direct pathway as the primary substrate underpinning the mediation of linguistic processes. Based on prevailing neuroanatomical, neurophysiological and neurolinguistic evidence, the paper to be presented attempts to extrapolate operative subcortical language theory via integration of the indirect pathway, incorporating the subthalamic nucleus (STN), within response-release semantic feedback, lexical decision and selective engagement frameworks. Hypotheses pertaining to the functional specificity of this nucleus within each model are presented, and directions towards the empirical validation of these postulates offered.

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**D. A. COPLAND, H. J. CHENERY & B. E. MURDOCH. Semantics And Striatal Output: Differential Effects Of Parkinson's Disease And Vascular Subcortical Lesions On Lexical Ambiguity Priming.**

Investigations of the potential role of the basal ganglia in language are complicated by associated pathophysiological mechanisms in typical subcortical populations and may be further advanced by comparisons of different basal ganglia pathologies. We compared the performance of a group of individuals (n=10) with Parkinson's disease (PD) with a group of individuals (n=10) with vascular nonthalamic subcortical lesions (NSL) using a lexical ambiguity priming paradigm. Participants made speeded lexical decisions on the targets of word triplets where the first triplet word was concordant, discordant, or neutral with respect to the second and third words. At 100 ms interstimulus interval (ISI), the PD group produced a pattern of priming consistent with selective lexical access, whereas the NSL group showed nonselective meaning facilitation. At 1250 ms ISI, the PD participants showed selective priming in the concordant condition, while the NSL group failed to demonstrate any significant priming. It is argued that the different priming patterns obtained for the PD and NSL groups may reflect the differential effects of dopaminergic deafferentation versus vascular lesions on striatal output, implying a disturbance of subcortically modulated lexical-semantic operations. These findings are considered in the context of recent lesion and neuroimaging data and current conceptions of dopaminergic neuromodulation.

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**B. CROSSEN. Role of the Dominant and Nondominant Basal Ganglia in Word Generation.**

While classical symptoms of aphasia in acute ischemic basal ganglia lesions are related to circulatory dynamics causing concomitant cortical dysfunction, recent lesion studies still suggest basal ganglia participation in complex language functions. Nonetheless, involvement of surrounding white matter leaves doubt regarding the anatomic origin of observed deficits. This presentation summarizes recent functional MRI findings demonstrating participation of a left pre-SMA-dorsal caudate-ventral anterior thalamic loop in word generation. This loop is involved in generating words for both semantic and rhyming cues, but is not involved in repeating words or generating nonsense syllables. Based on these data, we conclude this dominant basal ganglia loop is involved in processes related to activation/retrieval of pre-existing lexical representations, but we must turn to the work of Copland and others to understand the nature of this involvement. It is hypothesized that the basal ganglia maintain response biases automatically generated in the cortex across brief intervals so that these biases can influence conscious top-down processing of pre-existing cortically mediated representations. Robust activity of the nondominant basal ganglia in the absence of significant nondominant frontal activity during word generation also suggests the right basal ganglia mediate suppression of right frontal activity during word generation, probably to prevent interference with left-hemisphere processes. These data have significant

implications for our understanding of the mechanisms of language lateralization. Converging evidence and theoretical constructs supporting these interpretations of our data will be discussed.

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### Symposium 7/4.30pm–5.45pm

#### DO FOCAL LESIONS EQUATE TO FOCAL COGNITIVE DEFICITS IN CHILDREN? THE INFLUENCE OF DEVELOPMENTAL VARIABLES.

Chair: Linda Gonzalez

Discussant: Hudson G. Taylor

In adult populations it is well established that focal lesions (such as tumors or hippocampal sclerosis) are associated with specific focal deficits. Although it has been hypothesized that such specific brain-behavior relationships also occur in pediatric populations, there is growing evidence to suggest that developmental variables have a significant impact on cognitive function. In this symposium the complex interplay between developmental, illness and cognitive variables will be addressed. Four papers will be presented that explore neuro-cognitive relationships that are well-established in adult populations. Individual papers address the relationship between focal lesions in the frontal lobes and executive function; temporal lobe lesions and memory; posterior fossa tumors and the cerebellar cognitive affective syndrome and a functional imaging study examining language function in a heterogeneous focal lesion sample. Collectively the results suggest that focal lesions in childhood are generally associated with more diffuse cognitive impairment than is seen in adult populations. In terms of underlying mechanisms, it may be that these non-specific deficits partially represent the capacity of the immature brain to reorganize at a functional level. Alternatively it may be that focal deficits are present initially but evolve into more generalized cognitive deficits, via a developmental cascade. Therefore, developmental variables appear to be integral in understanding the differential outcome of focal lesions in children and adults.

#### R. K. JACOBS, V. ANDERSON, S. HARVEY, R. LEVENTER. Functional Localisation Of Executive Processes In Childhood: Impact Of Focal Frontal Lobe Lesions.

Adult studies show that executive skills are primarily mediated by the frontal lobes, in particular, the prefrontal cortex. In children, the protracted development of the prefrontal regions and their rich bi-directional links with all other brain regions suggests that they depend on efficient input from posterior and subcortical (extra-frontal) areas for normal development. Thus, children may be vulnerable to a range of executive impairments following cerebral insult in childhood. This study compared executive skills in 79 children between 7 and 16 years with brain lesions. A control group (n=40) matched for age was also recruited. The clinical group was divided into those with focal frontal (n=38), focal extra-frontal (n=20), lesions, and those with generalised pathology (n=21). Contrary to adult studies, results showed very little differentiation in executive processes between the frontal and extra-frontal pathology groups, with both groups performing more poorly on a range of executive measures compared with controls, but not differing significantly from each other. These results suggest that there may be; (i) less specificity of the frontal lobes for executive processes in childhood, particularly for later developing processes such as mental flexibility and; (ii) greater vulnerability of the frontal lobes and associated executive skills for cerebral insult in childhood, irrespective of the specific site (frontal vs extra-frontal) of pathology. Possible mechanisms for this finding will be discussed.

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#### L. M. GONZALEZ, V. ANDERSON, S. HARVEY & S. WOOD. Spatial Memory In Children With Temporal Lobe Epilepsy And Their Peers.

It is often hypothesised that children with temporal lobe epilepsy (TLE) exhibit material specific memory deficits, comparable to adults. Few studies have investigated this issue and results are mixed, particularly in terms of spatial memory function. However, methodological limitations may have contributed to the lack of a clear association between spatial memory impairment and right TLE. The present study investigates memory function in children with left (n=20) and right (n=20) TLE. Verbal Paired Associates (Wechsler, 1987), was employed as a measure of verbal memory function, as this task has been found to be highly sensitive in adults with left TLE. As there are no measures of spatial memory with comparable sensitivity, a number of tasks were administered, including the Nine Box Maze Test (NBMT) (Abrahams et al., 1997). This test was modified for children, as it has a strong theoretical basis and utilises an allocentric frame of reference. This test was expected to be particularly sensitive to right TLE. Despite expectations, the results indicate that memory function is generally depressed relative to controls, with no significant differences between with left and right groups. There were no significant group differences between those with and without hippocampal involvement. However, the right hippocampal group tended to have more difficulty on the NBMT. Seizure variables did not predict memory function. The results suggest that TLE in childhood is associated with general, non-specific memory deficits that sharply contrast the material specific deficits typically observed in adults.

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#### R. STARGATT & V. ANDERSON. Neuropsychological Consequences of Posterior Fossa Tumours: The First Twelve Months.

Most childhood tumors occur within the Posterior Fossa. The principal brain structure implicated at this site is the cerebellum. Children treated for cerebellar tumors can have a wide range of neurological and psychosocial problems. The Cerebellar Cognitive Affective Syndrome described recently suggests that children with cerebellar tumors without adjuvant treatment suffer from deregulation of cognition and affect. This study examined the neuropsychological and behavioral impact of tumor and adjuvant treatment in children with posterior fossa tumors at diagnosis and following treatment. 21 children with posterior fossa tumors [PF] and 20 children with supratentorial tumors [ST] aged 5 to 16 years were assessed at diagnosis and at 12 months. Results indicated that children in the PF group show early deficits in information processing speed and complex visual memory at baseline compared with normative data and the ST group. The PF group experienced a decline in function on tests of attention and information processing over the study period whereas the ST group did not. Both groups experienced heightened behavioral disturbance at diagnosis compared with the normative data. The PF group showed an increase in behavioral disturbance over the twelve-month period compared with the ST group. Neuropsychological and behavioral outcomes were determined by a range of medical, psychosocial and environmental factors. These results provided support for the concept of deregulation of cognition but not of affect.

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#### D. ANDERSON, S. HARVEY, V. ANDERSON, M. KEAN, G. JACKSON, M. WELLARD, D. ABBOTT & P. FEDERICO. fMRI Language Activation And Focal Cerebral Cortical Lesions.

The relationships between brain structure and function can be studied non-invasively through the use of functional magnetic resonance imaging (fMRI). In both adults and children, fMRI of language using word generation paradigms has shown robust and reliable patterns of activation in inferior and middle frontal gyral regions as well as activation in posterior language regions. In a clinically driven study, our group has used fMRI to

lateralize and localize language function in a heterogeneous group of children with cerebral lesions, including children with lesions in primary language cortex. Findings will be discussed with respect to the nature and timing of lesions, and timing of fMRI. Cases of possible intra-hemispheric reorganization of function, of inter-hemispheric reorganization or transfer of function and of rapid switching of language function in the context of seizures will be included. Concepts of language "transfer" and "cerebral plasticity" are at best speculative in these children with cerebral lesions,

due to unknown patient factors such as premorbid language lateralization, susceptibility to the potential deleterious effects of lesions and of seizures, and ability to recover function following insults. Nonetheless, fMRI presents a window to aspects of plasticity of function and may contribute to the understanding of cognitive deficits or their absence in children with focal cortical lesions.

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## FRIDAY MORNING, JULY 9TH, 2004

### Poster Session 3/9.00am-12.30pm

#### CHILDHOOD DISORDERS, OCD, ADHD AND LEARNING DISABILITIES, DEVELOPMENTAL STUDIES, PSYCHIATRIC CONDITIONS

##### **L. KOOISTRA, S. G. CRAWFORD, D. DEWEY, M. CANTELL & B. J. KAPLAN. Motor Correlates of ADHD: Contribution of Reading Disability and Oppositional Defiant Disorder.**

The study investigated (1) whether motor impairment in Attention Deficit Hyperactivity Disorder (ADHD) increases as a function of co-occurring disorders, (2) whether the co-occurring diagnoses of reading disability (RD) and oppositional defiant disorder (ODD) account for the motor deficits seen in ADHD. A total of 291 children (218 boys, 73 girls) participated. Five groups of children: ADHD-only (n = 29), RD-only (n=63), ADHD and RD (n=47), ADHD and ODD (n=19), ADHD and RD and ODD (n=21) were compared with normally developing comparison children (n=112). Motor skills were assessed with the Bruininks Oseretsky Test of Motor Performance, the Beery Visual Motor Test of Integration, and the Southern California Motor Accuracy Test. Key findings were the following: (1) the motor skills of the ADHD-only group did not differ from the comparison group overall; (2) motor impairment in ADHD increased as a function of co-occurring disorders; and (3) RD status rather than ADHD status predicted motor impairment.

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##### **R. L. MOUNTJOY, S. A. WINGENFELD, A. OHLEN & V. KHOO. Using a Continuous Performance Test to Measure Sustained Attention in Preschoolers at Risk for ADHD.**

Preschool-age children displaying high levels of inattentive and hyperactive behaviour may be at risk for the development of Attention Deficit Hyperactivity Disorder (ADHD). The primary impairment in school age children with ADHD is regarded to be a deficit in the ability to sustain attention, which has predominantly been assessed by Continuous Performance Tests (CPTs). Sustained attention in preschool children at risk for ADHD has comparatively been under-researched, despite the potential for CPTs to assist with the early detection of symptoms of ADHD. The present study aimed to examine the utility of CPTs in preschoolers and to investigate the relationship between parent-reported attention and activity level with sustained attention performance. Sixty-six preschool children were administered a CPT and parents completed ratings of their child of hyperactive and inattentive behaviours. Fifteen percent of the sample were classified as at risk for ADHD. Results indicated that overall performance on the CPT could not predict levels of parent-reported hyperactivity and inattention in preschool children. Problems with sustaining attention were found in children at risk, with higher levels of inattention and hyperactivity for CPT omission errors only. CPT performance did significantly pre-

dict observed inattentive and hyperactive behaviour during the task. The CPT was found to be an appropriate measure of sustained attention for use in preschool children as young as three years of age. Developmental effects were evident with performance on the task improving with age. Omission errors were found to be the best discriminator of performance. Length of the inter-stimulus interval affected overall performance on the CPT.

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##### **A. OHLEN, S. A. WINGENFELD, R. L. MOUNTJOY & V. KHOO. Development of Response Inhibition and Interference Control and Relationship to Inattention and Hyperactivity in Preschoolers.**

The association between inhibition and ADHD is well established for school age children, however, much less is known about this relationship in preschoolers. The current study examined the development of two types of inhibition (response inhibition and interference control), the relationship with each other, and with inattention and hyperactivity, in a non-clinical sample of preschool children. Eighty-eight preschool children (3:1 to 5:7 years) completed a response inhibition task (Puppet Says) and an interference control task (NEPSY Statue). Parent ratings on the PIC-2 Early Childhood Questionnaire were used to assess inattention and hyperactivity. Results showed a significant modest association between the two inhibition tasks but this correlation disappeared when controlling for age and IQ. Reasonable levels of inhibition were found to have developed by the age of three, with older preschoolers demonstrating higher levels of inhibition. No significant gender differences were found. The relationship between the two types of inhibition and inattention/hyperactivity was not significant when controlling for age and IQ. Results are discussed with respect to theories of inhibition deficits.

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##### **S. M. COTTON, N. VOUDOURIS, & K. GREENWOOD. Duchenne Muscular Dystrophy: Evidence for subgroups based on profiles on the Wechsler Intelligence Scales.**

Anomalies in cognitive functioning have commonly been observed in children with Duchenne Muscular Dystrophy (DMD), and include impairments in attention, memory, language, and visuospatial and auditory processing. Not all children with DMD experience these problems, lending support for the argument that subgroups exist within the DMD population. The aim of this study was to employ meta-analytical data to establish whether subgroups within the DMD population can be identified using scores from the Wechsler Intelligence Scales (WIS). The sample was derived from 32 published studies and comprised data on 1146 children with DMD between the ages of 2 and 27 years. K-means cluster analysis defined three groups of children based on the WIS subscales. These groups varied in overall ability (ranging from very low to average functioning) and the extent to which verbal skills were compromised. Further analyses revealed that these groups also differed in age and severity of disease.

These findings are discussed with reference to brain dystrophin and the neurogenetics of DMD.

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**S. WEGENER, P. JOY, A. SHORES & B. WILCKEN. Cognitive Outcome in Children of Mothers with Phenylketonuria.**

We investigated a number of unresolved issues regarding the nature of the cognitive impairment caused by exposure to phenylalanine, a neurotoxin, in the prenatal period. To do so we studied 9 mothers with phenylketonuria (PKU) and their 13 children aged 4 to 17 years. The sample consisted of 9 mothers, and their 13 children aged 4 to 17 years. Both mothers and children were administered selected subtests of the Woodcock-Johnson, 3rd Edition (WJ-III). Blood phenylalanine levels during pregnancy were obtained retrospectively from medical records. As expected, children exposed to average phenylalanine levels of greater than 360 mmol/litre in utero had a significantly poorer intellectual outcome than those children exposed to levels below 360 mmol/litre. Contrary to expectations, maternal IQ but not exposure to Phe during pregnancy significantly predicted offspring cognitive outcome and alone accounted for approximately 68% of the variance in observed scores. Children's scores on the WJ-III indices were not significantly different, and therefore failed to provide evidence for a specific cognitive profile in MPKU. Implications of these findings for the treatment and management of PKU for women planning pregnancy are discussed, along with the strengths and limitations of the current results and directions for future research.

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**E. G. SHAPIRO, G. OZ, K. BJORAKER, L. CHARNAS & R. GRUETTER. Neuropsychological And Neurochemical Profiles In Childhood Adrenoleukodystrophy.**

Cerebral ALD (adrenoleukodystrophy) is an X-linked white matter (WM) disease with usual onset between 7 and 10 years of age with rapid demyelination of posterior pathways (85%) and a few with anterior (15%), and death within several years. About half with the biochemical abnormality develop cerebral disease. No method exists except close monitoring with MRI and neuropsychological (NP) tests to identify the onset of cerebral disease. Hematopoietic cell transplant (HCT) is beneficial if done early enough, but has lacked benefit if the P IQ < 80, necessitating early detection of cerebral change. We present preliminary results of a study of the contribution of high field proton Magnetic Resonance Spectroscopy (MRS) in heralding disease onset, following treatment efficacy, elucidating pathophysiology, and correlating with NP function. 15 boys, 5 to 11 years of age, with ALD, 10 with no cerebral disease were seen every 6 months for NP testing and MRS on a 4 Tesla magnet (watching videotapes instead of sedation during 40 min. of acquisition). 5 boys were seen prior to HCT and yearly thereafter. Single voxel (8-16ml) spectra from occipital and frontal WM were obtained. 14 adults and 3 children were normal controls. Results indicated stable NP patterns in boys with no WM lesions. However, even small areas of demyelination in posterior regions result in decreased visual spatial ability relative to other functions. On MRS, 11 metabolites were measured reliably. Several metabolites were markers of lesions, and others normalized as a result of successful HCT (as contrasted to MRI which showed no change and NP tests which showed mild improvement). Comparing NP testing with lesion patterns before and after HCT, correlation was found between frontal lesions and executive, speed, and memory scores, while improving neurochemical profiles in occipital WM were correlated with visual perceptual scores. In sum, MRS is sensitive to changes in WM and correlates with NP status.

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**T. KONDOU, T. TOSHIMA & Y. HASHIMOTO. Different Infant's Brain Activation For Mother And Stranger In Strange Situation: A Near-Infrared Spectroscopy Study.**

Near-infrared spectroscopy (NIRS) is a non-invasive technique that is able to measure relative changes of oxy ( $C^{oxy}$ ), deoxy ( $C^{deoxy}$ ) and total ( $C^{total}$ ) hemoglobin in response to cortical brain activation. This technique is expected to be one of a number of useful methods to obtain infants' brain activation data which up to now have been few and far between. To investigate whether infants have an ability to distinguish between their mother and a stranger, we measured infants' brain activity in a strange situation by multichannel NIRS. This ability is also important for the mother-infant-bond. Participants were six infants (aged 3-9 months) and their mothers. A female assistant played the role of the stranger. In the relaxed state (no interaction with others) which we used as a baseline, we measured infants' relative hemoglobin changes in the occipital lobe induced by interaction between the infant and their mother or a stranger (i.e., A person talks to and amuses an infant face-to-face). When infants were interacting with others,  $C^{oxy}$  and  $C^{total}$  in their left hemisphere were significantly larger than in their right hemisphere. Interestingly, however, different hemodynamics for the mother and stranger were found in two channels in the right hemisphere. The amounts of relative hemoglobin changes for the stranger were larger than those for their mother. These differences were significant in  $C^{oxy}$ ,  $C^{deoxy}$  and  $C^{total}$  in the channel in parieto-lateral region and in  $C^{oxy}$  in the channel in occipito-lateral region. These results suggest that 1) the situation of interacting with others increased left hemispheric cortical activation, which might reflect left-hemispheric superiority for language processing, 2) according to whether infants interact with their mother or a stranger, the right hemispheric cortical activations were different, which might reflect right-hemispheric superiority for specific object (face) recognition processing. It is considered that NIRS could measure brain activities involved in infants' ability to distinguish their mothers from strangers in a strange situation.

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**E. MATUTE, T. MONTIEL, M. ROSSELLI & A. ARDILA. Arithmetic Tasks Performance In Six To 16-Year Old Latin-American Children.**

While it is known that culture has an effect upon several neurocognitive functions, knowledge is limited concerning the effect of age in the development of arithmetic domains among children from different cultures. Objective: To analyse the effect of age on several arithmetic tasks performance across 5- to 16- year- old Latin-American children, and to set up the correlations between arithmetic tasks and executive functions tasks. Method: We analysed the performance of 248 Colombian and 540 Mexican children (349 boys and 439 girls) on nine arithmetic related tasks, three conceptual tasks and 7 executive functions tasks from the ENI (a Child Neuropsychological test for Hispanic children). Results: An overall MANOVA (Hotelling's T) revealed a significant age effect over the arithmetic measures ( $P < .001$ ). Univariate ANOVAs and post-hoc Tukey analysis demonstrated that more accentuated changes among adjacent age occurred before age 10 years in each one of the arithmetic tasks. A Pearson correlation analysis showed a stronger correlation between arithmetic tasks and conceptual tasks than between the former and executive functions tasks. Conclusions: An age effect was present over all the arithmetic tasks and was more accentuated before age 10 years. Even the simplest arithmetic tasks, such as counting, are related to concept formation and reasoning.

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**V. KHOO, S. A. WINGENFELD, A. OHLEN & R. L. MOUNTJOY. Prediction of Problem Behaviour in Preschoolers from Language and Cognitive Measures.**

Research has suggested that behavioural difficulties seen in preschoolers may reflect undiagnosed underlying neurodevelopmental problems and

delays. This study investigated the relationship between language and behaviour in a community sample of 85 preschool children aged three to five. Specific language and neurocognitive abilities – receptive and expressive language, verbal short term memory and phonological processing speed – were examined as predictors of parent-reported externalising and internalising behaviours observed in the children. Children completed a range of language and neurocognitive measures (NEPSY, Woodcock-Johnson-III). Parent-report on behavioural adjustment was obtained with the PIC-2 Early Childhood Questionnaire. Positive linear relationships were found between cognitive and language abilities. Lower performance on language and cognitive measures were associated with higher levels of internalising and externalising behaviour. Verbal short-term memory was found to predict receptive and expressive language performance. Phonological processing speed predicted expressive language only. Lower performance on the language and cognitive measures was associated with more behavioural adjustment difficulty. Verbal short-term memory and phonological processing were comparable predictors of externalizing behaviour. Internalizing behaviour was more strongly related to phonological processing speed. The strength of language predictors for behaviour ratings remains unclear. Findings suggest that expressive language ability may influence both externalizing and internalizing behaviour more strongly than receptive language ability.

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#### **S. Y. KISELEV. Age-Related Differences In Simple, Discrimination And Choice Reaction Time In Preschool Children.**

The goal of this study was to investigate the rate of change of reaction time (RT) with respect to different RT tasks in preschool children using a computerized battery of nonverbal tasks. The study sample consisted of fifty-four 4-years-olds, fifty-two 5-years-olds, and fifty-nine 6-years-olds. There were notable differences between the three age groups in terms of median RTs. However, the age-related change of reaction time with respect to various RT tasks had different rates. The rate of change of simple RT, colour discrimination RT, and two-choice RT during the period between 4 and 5 years of age, and between 5 and 6 years of age was relatively equal. However, the rate of change of four-choice RT, spatial discrimination RT, and alteration two-choice RT during the period between 4 and 5 years of age was more than during the period between 5 and 6 years of age. The highest rate of change during the period between 4 and 5 years of age was observed for four-choice reaction time. The current study provides further support for the global development trend hypothesis with respect to processing speed. However it may be assumed that there are several reasons for developmental decreases in RT. Together with increasing of central processing speed, decreasing RT appears to be related to maturation of those areas of a brain which are actively involved in each type of RT task. These results may help explain the age-related change in performance of various RT tasks in preschool children.

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#### **T. J. JONES, G. S. HALFORD & K. MCFARLAND. Executive Functions and Relational Complexity in Normally Developing Children.**

The relationship between executive functioning and the ability to process relational information has long been recognised in psychology. Halford and his colleagues have developed a measure of relational (structural) complexity based on the number of independent units of information, which need to be related in a cognitive representation. The first level, known as unary relations requires representation of a single component in relation to attributional or categorical information, for example, big dog. Binary relations involve the representation of two entities and their relationship such as an elephant is larger than a dog. Ternary relations involve the representation of three elements and two binary relations, for example, Tom is taller than David, David is taller than Paul, therefore Tom is taller than Paul. Halford and his colleagues have identified developmental changes

in performances on tasks which vary only in terms of the complexity of relational information to be processed, with most five-year-olds succeeding on tasks requiring ternary level processing. Other researchers have identified similar developmental changes in executive functioning with significant changes occurring in pre-school years. The present paper reports on an investigation of the relationship between performances on executive function and relational complexity tasks in 108 normally developing children between the ages of 3:6 and 8:6. Results of regression analyses indicate performances on ternary-level tasks predict a significant amount of unique variance on executive function tasks over and above that associated with age and verbal intelligence. The implications of these findings in terms of current models of executive functioning and possibilities for future research will be discussed.

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#### **K. DALEN, S. BRUARROY, T. WENTZEL-LARSEN & L. LAEGREID. Nonverbal Learning Disabilities In Children With Hydrocephalus.**

The aim of the present study is to investigate nonverbal learning disabilities (NLD) in children with hydrocephalus (HC). The Neuropsychological Assessment of Children (NEPSY) was administered to 57 children with HC; 39 boys and 18 girls, and to 44 controls, 27 boys and 17 girls. The controls were matched according to age, gender, and geographic variables. Age group 4.0 - 8 years, born between 1989 - 1996. All children were living in western Norway. 40 children had congenital HC and 17 had acquired HC. In order to make the groups as homogenous as possible, children with spina bifida, brain tumor, mental retardation (IQ < 70), or a foreign mother language were excluded. The NEPSY subtests were classified along each of the dimensions "assets" or "deficits", according to Rourke's model of the elements and the dynamics of the NLD syndrome. Based on Korkman's description of the NEPSY subtests, five subtests were classified as measuring functions described by Rourke as "assets", whereas 16 subtests were classified as measuring "deficits". Differences between sumscores for the subtests classified as "assets", versus "deficits" were compared (by a permutation test) between the groups (HC and controls). The results demonstrated a significantly higher difference between "assets" and "deficits" in the HC group as compared with the controls ( $p < 0.001$ ), compatible with a higher frequency of NLD in the HC group. As such, the model of the elements and the dynamics of the NLD syndrome, as described by Rourke, may be useful when analyzing neuropsychological test profiles.

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#### **N. EISENMAJER, N. ROSS & C. PRATT. Specificity and Characteristics of Learning Disabilities.**

The specificity of impairments in specific reading disabilities (SRD) and specific language impairments (SLI) has recently been questioned, with many children recruited for studies of SRD and SLI demonstrating impairments in both reading and oral language development. This has implications for the results of previous SRD and SLI studies in which reading and oral language skills have not been assessed. Thus there is a need to compare the profiles of children with mixed oral language and reading impairments to groups of children with SRD and SLI. The reading, oral language, short-term auditory memory, phonological processing, spelling, and maths abilities of 151 children (aged between 7 and 12 years) drawn from a Learning Disabilities Clinic were assessed. Five groups were identified, and although some children demonstrated a specific reading disability or a specific language impairment, 64% of the children showed evidence of both reading and oral language impairments. Differences were also found between the groups on maths, phonological processing, and spelling measures, with the children displaying both language and reading deficits generally performing at a lower level than the children with specific reading or language deficits. It was concluded that there exist three categories of impairment, children with SLI, children with SRD, and a group of children with both impairments. As a result, more careful screening needs

to be conducted in both clinical and research settings to identify the nature of deficits correctly in children with reading and oral language difficulties. Correspondence: Mrs Nola Ross, Western Health, 1202/469 St Kilda Rd, MELBOURNE VIC 3004, AUSTRALIA, nola.ross@wh.org.au

**D. RANKINS, J. BRADSHAW, S. MOSS & N. GEORGIU-KARISTIANIS. Inhibition Of Return In Obsessive-Compulsive Disorder.**

Obsessive-compulsive disorder (OCD) is characterised by repetitive obsessions and/or compulsions that interfere with daily functioning. Neuropsychological studies have suggested that such perseverative behaviours may be due to underlying attentional deficits. Inhibition of return (IOR) is an adaptive mechanism that is thought to assist visual search by biasing attention after a critical, short interval to novel, previously unattended areas. Therefore, this study aimed to examine whether deficient IOR mechanisms could underlie some of the attentional, and perhaps behavioural, problems, reported in OCD patients. Using a computerised IOR paradigm, participants were required to respond to a target that appeared at either the same or different location to a precue that was presented either 100 ms or 700 ms earlier. Results indicate that patients had a reduced IOR for targets presented in the left visual field, suggesting lateralized anomalies in shifting attention. Results are consistent with lateralization anomalies previously reported in OCD.

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**D. M. FOGARTY. Neuroleptic Malignant Syndrome: A Neuropsychological Case Study.**

The Neuroleptic Malignant Syndrome (NMS) is a distinctive adverse reaction to antipsychotic medications (e.g., phenothiazine, quetiapine) and other agents with dopamine D2-receptor antagonist properties. Characteristic symptoms are severe dyskinesia or akinesia, hyperthermia, blood pressure fluctuations, tachycardia, diaphoresis, dyspnea, dysphagia and urinary incontinence. Although cognitive deficits in the acute stage of the condition are commonly reported to occur and to resolve, the literature is not clear by what metric this conclusion is determined or warranted. Only one brief case study, published in 1986, addresses the neuropsychological sequelae of NMS (Rothke & Bush, 1986). It identified nonfocalised cognitive dysfunction and persisting memory dysfunction as a salient feature. This case study reports the findings from a comprehensive neuropsychological assessment of a 24-year-old male diagnosed with NMS who had a prolonged akinetic and mute state. His clinical presentation was further complicated by hydrocephalus, ECT and other factors. The testing protocol included the WAIS-III, WMS-III, CVLT-II, Conners CPT, D-KEFS, and other standardized neuropsychological and psychological tests. The results indicated relatively preserved cognitive functioning including attention, working memory and executive functioning. Memory dysfunction (verbal > visual) was a prominent feature of his profile and was significantly below his cognitive ability. Psychomotor speed was mildly reduced and he fatigued easily. These findings suggest that NMS results in specific memory and psychomotor deficits in the post-acute stage of recovery. As these problems have implications both for everyday functioning and for guiding rehabilitation interventions, the importance of comprehensive neuropsychological assessment to identify the pattern of intact and disrupted cognitive and memory functions is demonstrated. The long-term residual impairments and their impact still need to be ascertained.

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**B. GJAERUM & G. B. GUDMUNSDOTTIR. Indicators Of Neurobiological Deviances In Children With Early Identified Psychopathology.**

Background: High levels of multi-axial co-morbidity and psychosocial impairment have been found in referred school-aged and younger children. Neurobiological deviances may indicate common causal factors and

increase the risk for chronicity in further development. Neurobiological deviances should therefore influence assessment of severity and prognosis and decisions regarding interventions. Research question: Can neurobiological risk factors be identified from medical history, clinical neurological examination, and supplementary neurological examinations? Sample: 219 children (82% <7 years, 66% boys) referred to educational and psychiatric services had been diagnosed on all axes in ICD-10 (Gjaerum & Bjornerem 2003). 88 children with IQ < 70 were excluded due to their high risk for neurobiological disorders. Method: Available data were analysed in order to identify indicators of neurobiological disturbances. Variables showing abnormality for 30% or more were analysed further. Preliminary results: Muscle strength, progressive developmental disorder, hand preference in the family, pregnancy problems, and toilet training were significantly different ( $p < .006-.05$  on a Chi Square test of independence) when two groups of children with IQ 70-84 and IQ=85 or higher were compared, assuming that the first group more often would show neurobiological abnormality. Play development, psychiatric illness in the child's family, total results on clinical neurological examination, and involuntary movements were close to significance ( $p < .07-.08$ ). Auditory function, CT, MR, pregnancy problems and social functioning were also significantly different between 5 groups with different psychiatric disorders. These results will be compared to conclusions regarding degree of CNS-disturbance based on neuropsychological assessment.

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**M S KIM, J. KWON & S. KANG. Nonverbal Memory Impairments In Patients With Schizophrenia And Obsessive-Compulsive Disorder.**

Nonverbal memory deficits in schizophrenia (SPR) and obsessive-compulsive disorder (OCD) patients were investigated. 13 SPR patients, 8 OCD patients and 13 control subjects participated. Construction accuracy and organizational strategy of Rey-Osterrieth Complex Figure Test (RCFT) were analyzed. Three groups (SPR, OCD and control) showed differences on immediate recall accuracy ( $F_{2,31}=9.307, p<.001$ ), and on organizational score ( $F_{2,31}=3.770, p<.05$ ). SPR and OCD patients showed significantly lower scores on immediate recall and organization than the controls. The mediating effect of organizational strategy on immediate percent recall (immediate recall score/copy score x 100) was analyzed by multiple regression. For OCD and control groups, group had direct effects on mediator and on percent recall, and mediator also had an effect on percent recall. In multiple regression, organizational score still had an effect on percent recall, while group effect on percent recall was reduced and did not reach statistical significance ( $p=.434$ ). Regression analysis with SPR and control groups showed significant effects of group on percent recall and on mediator accompanied by an effect of mediator on percent recall. However, F change in multiple regression with the introduction of mediator was not significant ( $F_{change}=1.737, ns$ ). These results indicate that nonverbal memory impairments in OCD are mediated by organizational deficit, while those in SPR result from the direct effect of group rather than an indirect effect mediated by organizational strategy.

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**G. GANSE, J. CULLBERG, R. CARLSSON & H. NYMAN. Performance of the Neuropsychological Version of Picture Arrangement as a Predictor of Outcome in First-Episode Psychosis.**

In the Parachute project 120 patients with first episode psychosis were examined by the neuro-psychological version of Wechsler's Adult Intelligence Scale (WAIS-R NI) within two months after admission. The results were compared to those of 30 healthy volunteers, matched in age, educational level and gender distribution. The data of the standard WAIS-R were analysed in relation to BPRS and GAF ratings at baseline, at 1 year and 3 years. Those who had performed low at the initial WAIS-R examination had a less favourable outcome regarding positive and negative but not depressive symptoms or GAF at first year. At the three years follow-

up, the initial WAIS-R verbal and performance subscales predicted the level of GAF but not presence of psychotic or depressive symptoms. No other demographic or clinical variables predicted either symptomatic or functional outcome. At the WAIS R NI re-examination, 3 years after admission 68 patients were reassessed and the results show significant improvements in almost all patients. Those patients who had a less favourable outcome at three year had a small or slight improvement in the results of WAIS R. In the NI version of the Picture arrangement subtest, subjects must arrange a set of visual images to perform a correct story sequence, followed by an oral report of the story. Patients with a less favourable outcome made significantly more mistakes in the report of the story, indicating difficulties in aspects of executive functioning. It is suggested that the neuropsychological version of Picture arrangement contributes to the understanding of cognitive functioning in first-episode psychosis as well as prognostic signs Relationships with medication status at examination, differences between diagnostic groups and the effect of the duration of untreated psychosis will be discussed

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### Paper Session 8/9.00am-10.30am

#### REHABILITATION

##### **K. ANSON & J. PONSFORD. Evaluation of a Coping Skills Group Following Traumatic Brain Injury.**

High rates of anxiety, depression and anger management difficulties are commonly reported following traumatic brain injury (TBI). Coping style has been found to influence emotional adjustment following TBI (Curran, Ponsford & Crowe, 2000). In an attempt to facilitate more adaptive coping styles following TBI, a Coping Skills Group (CSG) was developed at Epworth Rehabilitation Centre. The aim of the present study was to examine the impact of the CSG on emotional and psychosocial adjustment. The CSG consists of ten, 1.5-hour sessions run over five weeks and uses cognitive-behavioural techniques to address anxiety, depression, reduced self-esteem and anger management problems. Twenty-one TBI participants have completed the CSG to date. A multiple baseline across subjects design was used, with participants assigned to one of two groups with baselines of either 5 or 10 weeks, followed by 5 weeks' intervention and a 5-week follow-up phase. Outcome measures administered at the beginning and end of each phase, included the Coping Scale for Adults, the Hospital Anxiety and Depression Scale, Sickness Impact Profile, State Trait Anger Expression Inventory and Rosenberg Self-Esteem Scale. The groups did not differ significantly on demographic or injury severity variables. The CSG resulted in positive self-reported gains and had a positive impact on the use of adaptive coping strategies. However, these gains were not maintained over time. There was no significant evidence that the CSG had a positive impact on measures of anxiety, depression, anger control, self-esteem or psychosocial adjustment. The implications of these findings will be discussed.

References Curran, C. A., Ponsford, J. L., & Crowe, S. (2000). Coping strategies and emotional outcome following traumatic brain injury: A comparison with orthopedic patients. *Journal of Head Trauma Rehabilitation*, 15 (6), 1256-1274.

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##### **C. BORNHOFEN & S. McDONALD. Treating Deficits in Emotion Recognition following Traumatic Brain Injury**

A significant proportion of individuals with traumatic brain injury (TBI) demonstrate deficits in the perception of emotion-related information from facial expressions, vocal prosody and other nonverbal sources. Despite this, there has been no investigation to date of whether deficits in emotion perception may be successfully remediated. The present research aimed to address this question with a group of adult TBI clients.

Participants were 10 outpatient volunteers (9 male, 1 female) referred by staff members of a brain injury rehabilitation unit in the Sydney area. All demonstrated chronic severe TBI symptoms, and were aged between 20 to 53 years [mean PTA = 148 days (range: 12 to 330 days); mean time post-injury = 7.5 years (range: 1.5 to 15 years)]. Participants were randomly allocated to treatment and waitlist control groups following assessment on a range of emotion perception and psychosocial measures. Treatment comprised 25 hours (across 8 weeks) of a specifically-designed program incorporating a variety of remediation techniques shown to be effective with the TBI population. Emphasis in the program was placed on mastery of basic emotion discrimination skills although treatment also encompassed use of these skills to aid in the interpretation of social inferences such as sarcasm and lying in order to be kind.

Results indicated that participants improved significantly in their ability to judge basic emotional stimuli when presented in a naturalistic format (i.e., video vignettes). A further finding was significant improvement on one measure of social inferencing [The Awareness of Social Inference Test (TASIT), Part 3]. The implications of these findings are discussed with brief reference to the literature on emotion perception remediation and Theory of Mind.

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##### **D. W K MAN, S F TAM & C. W Y HUI-CHAN. Efficacy Of Expert System In Memory Rehabilitation For Persons with Brain Injury.**

Background: In the past decade, computing technology has developed at a rapid rate and is widely applicable to cognitive rehabilitation. A cutting-edge technology of artificial intelligence in the form of an expert system (a computer programme comprising a knowledge base and decision-tree mechanism) in advising people with memory problems in using strategies is proposed. This new ES can be accessed via the Internet or in a stand-alone computer for persons with brain injury (BI) or their caretakers to get quick feedback or advice in memory practice. ES is suggested as an alternative to other memory prosthesis such as memory notebook or digital organizers. Method: A control group pre- and post-test quasi-experimental study involved 30 BI subjects who were randomly assigned into three age and gender-matched groups respectively: ES group, memory-notebook (MN) group, and a control group. They were screened by Mini-mental Status Examination and Neurobehavioural Cognitive Status Examination or Cognistat respectively. During a 4-week study period, the ES and MN groups were requested to use the respective methods in coping with their memory problems. The frequency of usage, satisfaction and usefulness of the methods were evaluated by a weekly checklist. Outcome measures included the Chinese version of Rivermead Behavioural Memory Test (RBMT) and Every Memory Questionnaire. Preliminary findings: ANOVA and MANOVA showed that both the ES and MN groups improved in their coping with memory problems and self evaluation of memory skills; and both treatment groups performed better than the control group. Conclusion: Initial efficacy and effectiveness of expert system in memory was established and further improvement in usability, functionality would be encouraged.

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##### **R. GREEN, B. MELO & B. CHRISTENSEN. Do Cognitive And Motor Recovery Compete For Limited Neural Resources Following Traumatic Brain Injury?**

We are investigating the intriguing possibility that cognitive and motor recovery compete for neural resources following traumatic brain injury (TBI). There is ample evidence that the conditions that could foster competition do exist: (1) recovery proceeds largely through functional reorganization of the brain, with intact regions taking over functions for damaged ones, (2) there are cells/networks that can support either cognitive or motor functions, and (3) neural resources available for recovery are finite and can be measurably depleted. Thirty TBI patients were administered cognitive and motor batteries at 1, 4 and 12-months post-injury. Recovery

was indexed by regressing performances at 12-months on 4-months, and 4-months on 1-month. Recovery in each cognitive domain (e.g. memory, perception) was then compared to recovery in the motor domain. A negative correlation between cognitive and motor recovery was used as evidence of competition, with greater cognitive recovery signalling lesser motor recovery, and vice versa. We obtained strong evidence of competition. There were also differences in competition between early recovery (1-4 months) and later recovery (4-12 months) from domain to domain. We are currently attempting to replicate these initial findings, which have significant implications for rehabilitation. If competition exists, staggering or prioritizing of cognitive and motor therapies might be necessary. The limited efficacy of existing interventions/programs might be partially explained by competition; such interventions could be re-designed to minimize competition, and increase efficacy. Lastly, further basic research would be needed to better characterize competition so that interventions could be developed and tailored to minimize competition, thereby maximizing recovery.

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#### **M. THOMAS. The Potential Unlimited Programme: An Innovative Approach To Facilitating Adjustment To Acquired Brain Injury.**

In 1998, the Southern Area Brain Injury Service (NSW, Australia) and Outward Bound Australia, created the Potential Unlimited Program (PUP). This study examined the effectiveness of two pilot PUPs in facilitating psychosocial adjustment for adults with acquired brain injury (ABI). The study also sought to determine the contribution of the follow-up group work stage of the PUP and investigated the role of post-injury IQ on participants' outcomes. A mixed qualitative and quantitative longitudinal design was employed with programme participants (n=14) and a demographically matched comparison group (n=8) completing a psychological test battery at five points in time. The test battery included the Quality of Life Inventory (QOLI), European Brain Injury Questionnaire (EBIQ) and scales from the Multidimensional Self Esteem Inventory (MSEI). Participants were also interviewed and a thematic analysis carried out, within the framework of Simpson's model of adjustment to ABI. Results showed significant and sustained improvement in overall quality of life for most participants. Significant improvements were also noted on EBIQ and MSEI scales, including Depression, Isolation, Motivation, Communication, and Personal Power. The qualitative analysis provided insights into how participants engaged in key tasks of adjustment to injury. Those participants who attended all stages of the PUP, including the follow-up group benefited most, and interestingly, no differences in outcome were found between participants of varying post injury IQ. This study concluded the PUP represents a unique and powerful approach for addressing many of the complex issues associated with the process of adjustment to injury and restoring quality of life after ABI. With great scope for future development, other services are trialling the PUP, and there is growing interest in Europe and North America.

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### **Symposium 8/9.00am-10.30am**

#### **UTILITY OF NEUROPSYCHOLOGICAL TESTING IN THE ACUTE ASSESSMENT OF MILD TRAUMATIC BRAIN INJURY (CONCUSSION).**

*Chair: Gina Geffen*

*Discussant: A. Hinton-Bayre*

Mild traumatic brain injury (mTBI) or concussion is a common injury for which there is no generally accepted clinical method of detection nor

grading of severity. This symposium considers the utility of brief psychometric measures of information processing, verbal memory and orientation such as the Rapid Screen of Concussion (RSC), in emergency departments of hospitals and at sporting events. Kwapil et al examined the construct and predictive validity of the RSC in assessment of mild to severe TBI. De Monte et al compare components of the RSC, the Digit Symbol Substitution Test and orientation items from a PTA scale in the acute assessment of TBI in an emergency department. Sheedy et al report on a similar study which also included measurement of balance and of headache with a follow up after one month. Hinton Bayre, as a discussant, will consider the application of the methods and results to sporting head injuries.

#### **V. E. DE MONTE, G. M. GEFFEN & B. M. MASSAVELLI. The Effects of Post-traumatic Amnesia on Information Processing Following a Mild Traumatic Brain Injury.**

Measures of post traumatic amnesia (PTA) are notoriously difficult to apply to mild Traumatic Brain Injury (mTBI), because of the need for repeated administration of a scale. The aim of this study was to investigate whether selected psychometric tests could be used to grade severity of mTBI. Within 24 hours of injury, 90 patients presenting with mTBI to a hospital emergency department completed a word recall test, a spoken version of the Speed of Comprehension test and the Digit Symbol Substitution Test (DSS). These patients were divided into "more severe" (N = 51) and "less severe" (N = 49) groups, based on the presence or absence of PTA at the time of testing. PTA was measured with an eight-item orientation scale. Patients with mTBI in PTA recalled fewer words immediately and after a delay, and completed fewer symbols in 90 seconds on DSS than patients with mTBI not in PTA. Furthermore, for mTBI cases in PTA, the number of orientation questions correctly answered correlated with number of sentences judged (r = .30), DSS score (r = .20) and a total standardised score from all tests (r = .24). These results indicate that for individuals with mTBI in PTA, speed of information processing and verbal memory are impaired in addition to orientation. A single brief administration of selected orientation questions and tests of speed of information processing and verbal memory may be sufficient to classify mTBI cases into two broad categories of severity.

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#### **J. PONSFORD, C. J. WILLMOTT, C. PETER, A. ROTHWELL, A. KELLY. Use Of The Westmead PTA Scale To Monitor Recovery Of Memory After Mild Head Injury.**

Methods of assessment and management of mild head injury (MHI) or concussion remain somewhat controversial. One important issue is the accurate monitoring and determination of duration of post-traumatic amnesia (PTA). The most widely used method of assessing PTA duration in Australia is the Westmead PTA Scale (Shores et al., 1986). As it was designed this scale can only be used at 24-hour intervals, which renders it unsuitable for use in monitoring patients with MHI, who by definition have PTA lasting less than 24 hours. As part of a recent Australian, multi-centre study investigating factors influencing outcome following MHI, a revised version of the Westmead PTA Scale was developed for use at hourly intervals in the Emergency Department. 147 MHI adults and 109 control adults with other injuries, and 67 MHI children (aged 7-15 years) and 66 control children, were seen in the Emergency Department and at one week follow-up. Results revealed that the Westmead Scale hourly scores correlated with initial Glasgow Coma Score duration and self-report of PTA in the adult sample. The majority of Emergency Departments do not attempt to objectively measure PTA duration in this sample, and the Westmead Scale when given at hourly intervals, appears to be a valid measure. In the paediatric sample, the Westmead Scale did not prove to be a particularly reliable measure of recovery from PTA.

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**J. SHEEDY, J. DONNELLY & G. M. GEFFEN. The Validity Of Neuropsychological Testing, Balance Testing And Pain Measurement For The Prediction Of Outcome Following Mild Traumatic Brain Injury.**

Mild traumatic brain injury (mTBI), or concussion, is a commonly acquired injury and a significant proportion of those affected continue to report chronic symptoms. This study investigated whether acute assessment of neuropsychological and balance deficits and of head pain severity in 29 concussed individuals presenting to a hospital Emergency Department (ED) predicted post concussion symptoms at one month post injury. Thirty patients with minor orthopaedic injuries and 30 ED visitors were recruited to the study as control subjects. Concussed and orthopaedically injured groups were followed up by telephone at one month to assess symptom severity. The performance of the concussed group on some neuropsychological tests was worse than that of the orthopaedic group. The concussed group also had decreased balance compared to controls in the ED and reported significantly more post-concussive symptoms at follow-up. Cognitive impairment, pain and balance deficits were all significantly positively correlated with severity of post concussion symptoms. The findings suggest that a combination of several measures assessable in the ED may be useful in predicting which individuals will suffer persistent post concussion problems.

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**K. J. KWAPIL, G. M. GEFFEN & A. HIGGINSON. Recovery From Mild Traumatic Brain Injury: An Examination Of The Construct And Predictive Validities Of The Rapid Screen Of Concussion.**

The Rapid Screen of Concussion (RSC) is a brief neuropsychological test battery, designed to provide a functional criterion to aid clinical diagnosis of mild traumatic brain injury (mTBI) (Comerford, Geffen, May, Medland, and Geffen, 2002). Three studies were conducted to examine the construct and predictive validity of this instrument. In Study 1, Discriminant Function Analysis was performed to determine how well the RSC, administered several months post injury, differentiated between uninjured controls (N=16), mTBI patients (N=22) and moderate to severe TBI patients (N=14). As predicted, moderate to severe TBI patients had lower scores than the mTBI and control groups. The RSC also successfully differentiated between each of the diagnostic groups, yielding an overall correct classification rate of 75%. Study 2 examined the predictive utility of RSC scores within 24 hours of injury in the mTBI sample (N=22). Acute performance scores correlated with post-injury scores ( $r = .53$  -  $r = .80$ ) taken at an average of 6 months post-injury. This indicates that acute RSC scores correspond with the degree of residual incapacitation from mTBI. In the third study, Reliable Change Indices were calculated on the RSC subtests to examine individual patterns of recovery from mTBI. Extent of recovery varied between subtests, but a striking finding was that only 13 of 25 participants (52%) showed a significant improvement on the rapid judgement of sentences subtest within 6 months. The differential recovery of function challenges the notion of full recovery from mTBI within 3 months. These overall results offer support for the construct and predictive validity of the RSC as an aid to clinical management of mTBI. Correspondence: Ms Karleigh Kwopil, University of Queensland, Cognitive Psychophysiology Laboratory, Edith Cavell Building, Medical School, Herston Rd, HERSTON QLD 4006, AUSTRALIA, k.kwopil@psy.uq.edu.au

**A. D. HINTON-BAYRE. The Sports Model Of Concussion And Its Application To The Assessment Of Mild Cognitive Impairment.**

Studies of concussion in sport suggest that non-specific slowing of information processing speed is a hallmark of the mild cognitive impairment (MCI) that occurs after the injury, with impairment of memory a less consistent finding. Several approaches to the assessment of concussion sustained in sport have been adopted. This discussion evaluates the efficacy of these methods. There has been a conventional division between acute (minutes to hours) and post-acute (days to months) assessment of traumatic brain injury. In the sporting context, a combination of acute and post-acute assessment methods has been adopted. It is argued that such an

approach might yield a more sensitive and efficient means of assessing the MCI that occurs after most concussions, whether sustained during sport or otherwise.

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**Symposium 9/9.00am-10.30am**

**CONSEQUENCES OF WHITE MATTER INJURY IN CHILDHOOD.**

*Chair:* Peter Anderson

*Discussant:* Kimberley. A. Espy

White matter pathology is common in childhood conditions as myelination is easily disrupted by trauma, infection, and metabolic imbalances. Despite the obvious significance of white matter in neuropsychological functioning, our understanding of the consequences of white matter pathology is limited. Thus, the primary aim of this symposium, which comprises five papers, is to describe common neurobehavioral impairments associated with white matter injury that occurs in childhood. One paper explores differences in neuropsychological functioning and neuropathology in obstructive and communicating hydrocephalus, both of which are associated with significant white matter abnormalities, but which differ in terms of timing and mechanism. Another paper examines attention and information processing skills in children who experienced acute disseminated encephalomyelitis (ADEM), which is an autoimmune inflammatory disease that predominantly affects the white matter. This paper will also investigate the relationship of information processing with severity of neuropathology and age at illness. Two papers examine executive functioning in children born very preterm or with extremely low birth weights. Executive dysfunction is expected in this population as prematurity is associated with white matter injury and disrupted myelination. The final paper describes the long-term consequences of childhood traumatic brain injury (TBI). Although the neuropathology associated with TBI is broad, injury to the white matter is clearly the most prominent. Quality of life in early adulthood following TBI will be examined, as will the importance of rehabilitation and environmental factors on long-term outcome.

**J. NEALE, R. JACOBS, A. KORNBERG, V. ANDERSON & L. SHIELD. Information Processing In Children With Acute Disseminated Encephalomyelitis (ADEM).**

Acute disseminated encephalomyelitis (ADEM), is an autoimmune inflammatory disease of the central nervous system that commonly affects children and young adults, usually following a virus or vaccination. ADEM predominantly affects the white matter of the brain and spinal cord, although grey matter may also be involved. Given the predilection for white matter pathology in ADEM, we investigated information processing and attentional skills in 20 children between 5 and 15 years, who had experienced ADEM in the past 7 years. Results were compared with an age matched control group (n=20). Overall, the ADEM group performed more poorly than the control group on measures of intellectual ability, speed of processing and attention. The impact of severity of pathology on MRI was investigated as a possible mechanism for the impaired performance of children with ADEM, with severity of pathology coded as mild, moderate or severe. Although the groups were small, results showed very few significant differences between the severity groups and controls on measures of intellectual capacity, information processing, attention or behaviour. However, illness severity did appear to be associated with poorer performance on measures of reading and mathematics. Results suggest that severity of pathology does not fully explain the deficits seen following ADEM in childhood. Other potential influences include age at illness

onset and length of time to recovery. Prospective longitudinal studies using serial MRI imaging are required to tease out these issues.

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**V. A. ANDERSON, H. NEWITT & S. BROWN. Long-Term Functional Outcome In Adulthood Following Childhood TBI.**

White matter injury is the most prominent neuropathology of traumatic brain injury (TBI). While we now have a reasonable understanding of the short-term implications of childhood TBI, the long-term quality of life for these patients is not known. This study aimed to describe the outcome in adulthood following childhood TBI with respect to injury severity, injury age, pre-morbid function, access to rehabilitation, family factors, and presence of disability. The sample included 100 young adults (18-30 years), ascertained from hospital records, who had sustained mild, moderate or severe TBI between the ages of 0-14 years. Consenting participants completed questionnaires and a semi-structured interview focusing on key areas of daily living including - education, employment, residual physical disability, living arrangements, social relationships and psychiatric status. A subset of the sample also underwent intellectual evaluation. Results show that, while severe TBI was most often associated with poorer outcome, this was not uniformly the case, with some severely injured participants functioning very well in all areas. Factors identified as contributing to possible outcome were (i) access to rehabilitation/education regarding TBI consequences; (ii) older age at injury; (iii) intact family function; and (iv) absence of residual physical disability. These findings indicate that white matter injuries, as a result of trauma, are associated with poorer quality of life in adulthood. However, our results also provide evidence that neuropathology is not the sole mediator of long-term outcome, and that environmental and rehabilitative factors are also extremely important. The developmental and clinical implications of these findings will be discussed.

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**N. CORDY, P. ANDERSON, J. MALLER, A. TUCKER & E. NORTHAM. Neuropsychological Profiles In Obstructive And Communicating Hydrocephalus.**

Hydrocephalus, the abnormal accumulation of cerebrospinal fluid (CSF) in the ventricular system, can have profound effects on the developing brain resulting in neurobehavioral problems. Ventriculomegaly often leads to damage to periventricular regions, and as a consequence the principle neuropathology associated with hydrocephalus is white matter injury and thinning of the corpus callosum. The study aimed to explore differences in neuropsychological profiles of obstructive and communicating hydrocephalus. Obstructive hydrocephalus occurs as a result of a blockage in the normal circulation of CSF within the ventricular system. In contrast, communicating hydrocephalus is the result of inadequate resorption or excessive production of CSF. Given the differences in timing and mechanism of neuropathology, we predicted differences in sequelae between these two etiology groups. Our hydrocephalus sample consisted of children aged between 7 to 15 years who had a shunt inserted in the first 12 months of life to control progressive hydrocephalus. The Obstructive and Communicating groups consisted of 43 and 34 children respectively. A sibling control group consisted of 43 children. These groups were similar in terms of sociodemographic characteristics. When compared to the controls, the Obstructive and Communicating groups exhibited similar cognitive deficits including slow processing speed, inattention, and executive dysfunction. Neuroimaging findings indicated that the two hydrocephalic groups also exhibited similar rates of white matter loss and corpus callosum dysgenesis. In conclusion, despite differences in etiology, obstructive and communicating groups could not be differentiated on neuropsychological or neuropathological parameters. However, both displayed cognitive deficits consistent with periventricular white matter damage.

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**P. J. ANDERSON, L. DOYLE AND THE VICTORIAN INFANT COLLABORATIVE STUDY GROUP. Executive Functioning In Extremely Low Birth Weight Or Very Preterm Children.**

Neurobehavioral impairments in children born preterm are thought to be related to brain anomalies, with periventricular leukomalacia (PVL) being the most common form of brain injury. PVL (diffuse or focal white matter lesions) is thought to be associated with ischemia, although the exact pathogenesis is not clear. Prematurity also heightens the risk for intra-ventricular haemorrhage (IVH), with serious grades associated with ventriculomegaly, white matter loss, and white matter lesions. Given that prematurity is associated with white matter injury and disrupted myelination, high rates of executive dysfunction (EDF) are expected in this population. However, the analysis of executive processes in this population has been largely neglected. This study aimed to determine the frequency, nature and severity of executive dysfunction in extremely low birth weight (ELBW) or very preterm children. Our ELBW/very preterm cohort comprised of 298 consecutive survivors born during 1991-92 in the state of Victoria with gestational ages <28 completed weeks or birth weights <1000g. The control group was a normal birth weight (NBW) cohort, which comprised of 262 randomly selected children matched on sociodemographic variables. Cognitive (e.g., Tower of London, Rey Complex Figure) and behavioural (BRIEF) measures of executive functioning were administered. The analyses revealed that the ELBW/very preterm cohort exhibited significant EDF in both cognitive and behavioural domains, however severe impairments were present in only a small minority of children. These findings will be discussed in terms of risk factors such as gestational age, birth weight, and white matter injury.

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**H. G. TAYLOR. Long-Term Effects of <750 g Birth Weight on Executive Functions.**

To examine the effects of extremely low birth weight on executive functions, portions of the Cambridge Neuropsychological Test Automated Battery (CANTAB) were administered to 48 children with <750 g birth weight, 47 with 750-1499 g birth weight, and 52 term-born controls. The groups were assessed at mean age 17 years and were comparable in terms of sex, race, and SES. Results revealed poorer performances for the <750 g group compared with controls on tests of concept shifting (Intra-Dimensional/Extra-Dimensional Shift), working memory (Spatial Span, Spatial Working Memory), spatial planning (Stockings of Cambridge), and rapid information processing (Rapid Visual Information Processing). Differences on some of these measures remained after adjusting for IQ, suggesting selective effects of <750 g birth weight on executive function. Lower scores on the CANTAB were predicted not only by the degree of low birth weight, but also by neonatal complications and weight for gestational age, suggesting that prediction of poor outcomes can be improved by considering factors in addition to the degree of low birth weight. Poorer performances on the CANTAB, in turn, predicted more behavior problems and lower academic achievement. The results suggest that tests of executive function are sensitive to the long-term sequelae of extremely low birth weight and are related to behavior and learning. The effects of <750 g birth weight on executive functions, together with preliminary evidence for associations between the CANTAB and subcortical brain volumes using morphometric MRI, imply underlying damage to fronto-striatal brain circuits. We are currently completing analysis of brain volumes for our total sample to examine the neuropathological consequences of extremely low birth weight, increase precision in identifying high-risk children, and enhance knowledge of the brain basis of deficits in executive functions and other neuropsychological outcomes.

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**Symposium 10/9.00am-10.30am****THE BORDERLINE IN COGNITIVE AGING:  
NORMALITY AND EARLY PATHOLOGY.***Chair:* Ed Helmes*Discussant:* Mary Luszcz

This symposium highlights aspects of cognitive aging research that focus upon the functions that appear to decline in normal ageing and also are sensitive to deterioration from pathological processes. Within this framework, two presentations deal with changes in memory functions. Hohaus and colleagues report on controlled trials of interventions to improve memory functions in healthy older adults. The other papers deal with aspects of normal ageing that are independent of overt pathological change or with the transition from normative change into the early stages of a pathological process. Anstey and her colleagues contrast various social and biological measures associated with healthy ageing with intra-individual variability or consistency as predictors of speed of cognitive processing. Bush and Helmes use script analysis, an index of intact executive functioning, to explore the performance of healthy older adults to test the hypothesis of declines in prefrontal cortical functioning with age. In contrast, Foster and his colleagues report on a functional magnetic resonance imaging study of the role of iron concentrations in the brain in differentiating cases with Mild Cognitive Impairment from normal ageing processes. The five papers provide an overview of issues in the grey area between the declines seen in older people without evidence of overt pathology to cases in which some evidence of an abnormal process is present, but the exact nature of the pathology remains unclear with the current state of knowledge.

**L. HOHAUS & V. BRUCE. Making A Difference: Optimising Everyday Memory For Healthy Seniors.**

Recent longitudinal studies indicate a significant proportion of those who appear to be experiencing memory impairments in the normal range may subsequently go on to be diagnosed with Alzheimers disease or other forms of dementia. Hence interventions targeting everyday memory performance in seniors may serve two important functions: First for those experiencing normal age-related impairments it may be possible to improve everyday memory performance and hence the quality of their lives markedly. Second, for those who are experiencing the first signs of Alzheimers Disease memory interventions delivered at the very early (pre-diagnostic) stages of this disease may provide the opportunity to learn compensatory strategies before the ability to learn is markedly compromised through the disease. The major purpose of this paper is to briefly outline the major features of the Optimising Memory for Healthy Seniors Program and to provide initial data on the programs efficacy. The program comprises 5 x 3 hour sessions. Data will be presented from a matched controlled study in which 40 elderly participants took part in either the Memory program or an active control condition. Subjective and objective measures of memory performance were obtained. The results show that the Optimising memory program improved objective and subjective memory performance over and above the improvements obtained by the active control group. These findings indicate that even a very brief everyday memory intervention can make a significant difference in the everyday lives of elders. Furthermore this program could facilitate diagnosis and treatment for those at risk for Alzheimers Disease.

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**E. HELMES & J. D. BUSH. Script Analysis and Verbal Working Memory in Early and Late Adulthood.**

Recent neurobiological and neuropsychological findings suggest that executive cognitive functions mediated by the prefrontal cortex are among the first to decline with increasing age during the adult years. The current research aimed to assess the effect of normal cognitive aging on the executive processes involved in planning a course of action, using script analysis tasks proven to be sensitive to prefrontal lobe damage. One hundred participants (ages 17 to 88) performed gender stereotypical and gender-neutral script analysis tasks requiring correct temporal sequencing of component script actions. The findings supported the prediction that script analysis is a sensitive measure of age-related changes in executive planning functions. The hypothesis that performance would be enhanced on same gender stereotypical scripts, implicating a gradient in strength of script knowledge representation from routine to novel action sequences received partial support. The proposed role of working memory in executive planning deficits associated with prefrontal cortex function and normal cognitive aging was also investigated. As predicted, results of the reading span test, a widely used measure of verbal working memory, revealed highly significant differences in working memory spans between older (ages 55 to 88) and younger adults (ages 17 to 40). In addition, a slight but significant inverse relationship was found between verbal working memory capacity and script sequencing ability, partially supporting the hypothesised role of working memory in executive planning functions mediated by the prefrontal cortex.

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**J. J. MALLER, K. J. ANSTEY, A. JORM, H. CHRISTENSEN, W. WEN & P. SACHDEV. Intracranial Volume And Cognition In 60 To 64 Year Old Individuals.**

There have been mixed reports in the literature on the relationship of intracranial volume, or head size, with cognitive performance. While some studies report significant positive correlations, there are many who do not find such relationships. Enhancing the interest in their potential association to one another is the cognitive reserve hypothesis which suggests that having a larger brain may protect against developing symptomatology commonly associated with neurodegenerative diseases such as dementia. For example, several studies report that the risk for AD may be associated with a small premorbid brain size (Graves et al., 1996; Graves et al., 2001; Mori et al., 1997; Schofield et al. 1997), while others (e.g. Edland et al., 2002; Jenkins et al., 2000) have not found such a relationship. In our sample of 452 community subjects aged 60-64 years old (237 males and 214 females), we found a significant positive correlation between ICV and MMSE, Spot-The-Word (number correct) and education, but only for males; no significant relationships were found between ICV and any of the other cognitive variables assessed. The distribution of ICV-MMSE and ICV-STW data points, as displayed on scatterplots, does not support a general significant relationship between ICV and cognition but rather one which is influenced by gender and education.

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**K. J. ANSTEY, K. DEAR, H. CHRISTENSEN & A. F. JORM. The Importance of Variability Versus Speed for Explaining Cognitive Aging.**

Age-differences in speed and intra-individual variability (consistency) of responses to reaction time (RT) tasks were examined in three age-cohorts aged 20-24, 40-44 and 60-64. Demographic, health, biological, lifestyle and psychological variables were evaluated as predictors of RT performance using hierarchical multiple regression. Age-differences in speed were greater than age-differences in consistency. After gender and education, biological markers such as FEV1, grip strength, vision and systolic blood pressure were the most important predictors of RT performance. Some neurological conditions were associated with poorer performance on RT measures of speed and consistency. Both speed and consistency of performance on RT tasks were associated with higher verbal ability, memory and coding speed, but these effects were not larger for older age groups. Overall, our results suggested that speed of response is more important than consistency for explaining cognitive aging.

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**M. BURKHARDT, J. K. FOSTER, P. DRUMMOND, R. CLARINETTE, P. CHUBB, D. BRUCE, R. MARTINS & B. YEAP. Androgen Deficiency & Cognitive Functioning in Older Men.**

The role of sex-steroids in establishing and maintenance of cognitive functions is widely recognised. Findings indicate that testosterone affects learning and memory independently or via its conversion to oestradiol. Epidemiological studies have indicated a curvilinear relationship between levels of plasma testosterone and cognitive function in men, such that both high and low levels of testosterone are associated with poorer cognitive functioning. More specifically, men with Alzheimer's disease (i.e. AD, which is the most common cause of dementia in the elderly) are more likely to have low serum testosterone. However, studies addressing the question of whether testosterone deficiency precedes or follows AD are still lacking. This issue needs to be clarified to establish whether testosterone replacement therapy may help to delay or prevent the onset or progression of AD. This study examined whether age-related androgen deficiency could be a contributing factor to the risk of AD in men by i) assessing the prevalence of androgen deficiency in elderly men referred for memory assessment, ii) comparing androgen status in men with mild cognitive impairment or Alzheimer's disease to levels found in healthy elderly men and iii) examining the association between cognitive status and a) serum testosterone and b) plasma levels of AD-related peptide Abeta-40.

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**Paper Session 9/11.00am-12.30pm.**

**NEUROPSYCHOLOGICAL DEFICITS IN SPECIFIC CHILDHOOD DISORDERS**

**S. HYMAN, E. A. SHORES, D. S. GILL, A. STEINBERG. & K. N. NORTH. Children with Neurofibromatosis Type 1: Neuropsychological and Neuroradiological Aspects.**

Background: Neurofibromatosis Type 1 (NF1) is a single gene disorder associated with a high frequency of cognitive deficits and a complex cognitive phenotype. Children with NF1 generally present with only a slight lowering of IQ compared to the normal population, yet specific cognitive deficits are quite widespread. These cognitive deficits have been associated with focal areas of high signal intensity on T2-weighted MRI images (T2-hyperintensities), however the relationship remains controversial. The aim of this study was to carefully delineate the cognitive profile of children with NF1 and to examine the relationship between cognitive dysfunction and T2-hyperintensities. Methods: A cohort of 81 children with NF1 and 49 unaffected sibling controls (aged 8-16 years) underwent extensive neuropsychological assessments, and 76 of the children with NF1 had MRI examinations. Results and Conclusions: Children with NF1 have a cognitive profile characterized by deficits in visuospatial skills, executive functioning, and attention. There is a significant comorbidity between NF1 and ADHD (38%) and specific learning disabilities (22%). MRI T2-hyperintensities in the thalamus were predictive of a lowering of general intellectual functioning and some specific cognitive deficits. These findings have important implications for the pathogenesis and remediation of cognitive dysfunction in children with NF1.

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**P. STAVINOHA & F. BURROWS. Academic Speed in Childhood Brain Tumor Survivors Treated with Cranial Radiation.**

Advances in treatment for central nervous system cancer, including radiation and chemotherapy, have dramatically improved survival rates in children with brain tumors. However, these treatments have been associated with decreases in a number of neuropsychological capacities. While the survival rate of children with childhood cancer has increased, more of these children are facing challenges in both the school and home environment. A commonly reported late effect of radiation treatment is slowed

information processing speed. However, there is a paucity of literature specifically evaluating the effects of slowed information processing speed on the educational performance of survivors of childhood brain tumors treated with radiation. Given the typical classroom assignments and homework demands of school, information processing speed can have a profound influence on a child's educational success. For the present study, 15 school-age subjects who had undergone surgery and radiation for a brain tumor were evaluated using the Woodcock-Johnson Psychoeducational Battery-Third Edition: Tests of Achievement. This measure provides a delineation of basic academic skill attainment without any time constraints, as well as an academic fluency cluster that measures speed of academic skill performance. Results indicate that children who have undergone radiation treatment for a brain tumor tend to exhibit significantly slower speed of performance of academic skills in relation to basic skill development as compared to the WJ-III standardization sample. Results are discussed in terms of previous findings of neuropsychological deficits and concomitant educational difficulties in this population. Accommodations and modifications for addressing these needs are offered, and suggestions for future research are provided.

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**D. DEWEY, S. G. CRAWFORD & F. P. BERNIER. Neuropsychological Outcomes of Children Who had Choroid Plexus Cysts Detected Antenatally.**

The choroid plexus is easily identified within the fetal cranium due to its echogenicity and choroid plexus cysts (CPC) are associated with an increased risk of aneuploidy (i.e., chromosomal abnormalities), particularly trisomy 18 and trisomy 13; however, the exact magnitude of this increase remains disputed. When no chromosome abnormality is detected, CPCs are considered to be benign variants of choroid development although there is no substantive evidence in the literature to confirm that CPCs are not associated with developmental delays. The purpose of this retrospective double cohort study was to evaluate development in children who had CPCs detected prenatally and to determine whether their presence during the second trimester was associated with delays in cognitive, motor, language or adaptive behavior. Our study cohort (N=38) had a mean age of 2.85 (SD = 0.84) years and the control cohort (N=63) had a mean age of 4.92 (SD = 1.56) years. Although the age difference between our cohorts was significant, there were no differences in socioeconomic status, sex, birth weight or gestational age. Cognitive data showed no significant difference in Full Scale IQ using the WISC III or WPPSI-R (CPC = 113.11, control = 115.85). Scores on standardized measures of language, motor and adaptive functioning also did not show any significant group differences. Overall, we concluded that the presence of isolated CPC's on mid-trimester ultrasound is not associated with any significant neurocognitive delays in early childhood. Thus, in the absence of fetal aneuploidy, CPC's appear to be benign anatomical variants.

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**A. J. SHAH, K. EPPORT & M. ORTIZ. Neurocognitive Function of Pediatric Acute Leukemia Patients: Pre and Post Hematopoietic Stem Cell Transplantation.**

BACKGROUND: Hematopoietic stem cell transplantation (HSCT) offers a curative potential for patients with acute lymphoblastic leukemia (ALL) or acute myeloblastic leukemia (AML). With an increasing number of HSCT survivors, the importance of quality of life is being recognized. Although research has documented the neurocognitive deficits associated with chemotherapy and cranial irradiation, little is known about the neurocognitive functioning of HSCT recipients. METHODS: We evaluated 36 HSCT recipients, who had previously received therapy for ALL or AML, 1 month pre-HSCT, 1-2 years post HSCT and 3-5 years post HSCT. Approximately 35% of the patients had a normal sibling who were evaluated

and used as a control subject. The subjects received a battery of neurocognitive tests including: WISC III, PPVT-R, Beery Development Test and WRAT or Bateria Woodcock Psico-Educative en Espanol and Test de Vocabulario En Imagenes Peabody. RESULTS: There was no significant difference in patients tested 1 month pre HSCT compared to 1-2 years post HSCT except in the area of Visual Motor Integration (pre-HSCT 91.26 vs post-HSCT 85.8,  $p=0.002$ ). However, when comparing matched normal siblings to the HSCT recipients prior to HSCT, there were significant decreases in overall cognitive function (siblings 97.43 vs. pre-HSCT 90.52,  $p<0.05$ ) and receptive vocabulary (siblings 91.64 vs. pre-HSCT 80.19,  $p=0.01$ ). When these siblings were tested with HSCT recipients 3-5 years post HSCT, there were decreases in overall cognitive function, receptive vocabulary and long term memory (siblings = 114 vs. 3-5 years post HSCT 72.8,  $p=0.03$ ). CONCLUSIONS: These results indicate that patients coming to HSCT often have existing neurocognitive deficits due to their previous therapy for ALL and AML. Therefore baseline neurocognitive evaluations should be performed on all patients prior to receiving an HSCT. Patients must also be continuously monitored to determine that deficits that may occur late post HSCT.

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**E. G. SHAPIRO, K. BJORAKER, K. DELANEY & C. PETERS. Risk Factors Contributing To Neurolinguistic Development Following Hematopoietic Cell Transplant In Hurler Syndrome.**

Neuropsychological characterization of untreated and treated phenotypes of neurogenetic diseases is an important contribution to the assessment of new treatments such as hematopoietic stem cell transplant or HCT, enzyme replacement, and substrate reduction. These treatments have been shown to prolong life, halt neurocognitive decline, and reverse somatic manifestations of inborn errors of metabolism. Neuropsychological outcomes are crucial in assessing long term effects on the CNS, quality-of-life, and risk benefit ratios. HCT has been shown to halt the decline in rate of cognitive growth in Hurler syndrome (Mucopolysaccharidosis I), a rare autosomal recessive disorder diagnosed in the first two years of life. Without treatment, cognitive development slows by age 2 with decline in IQ, skills are lost after age 3, and the mean age of death is 5 years. Language is differentially affected. This study examined the contributing effects of various risk factors to post-HCT language development in 39 children with Hurler syndrome examined at baseline, one year and three years post-HCT. Eleven risk factors were studied and results indicated that six factors; baseline low cognitive ability, severe hearing loss, three MRI abnormalities (increased ratio of ventricular size to brain, increased T2 signal, presence of atrophy), and lack of early speech and language therapy were associated with decreased rate of receptive and expressive language development measured on age-appropriate language tests. The number of risk factors correlated ( $r = .58$ ) with the slope of receptive language development and with expressive slope ( $r = .47$ ). The conclusion that a number of baseline risk factors were associated with rate of language development after HCT is an important additional contribution to risk/benefit analyses for this treatment.

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**T. J. JONES, G. S. HALFORD, K. MCFARLAND & J. MCGILL. Executive Function and Relational Processing Deficits in Children with PKU.**

The relationship between executive functioning and the ability to process relational information has long been recognised in psychology. Halford and his colleagues have developed a measure of relational complexity based on the number of independent units of information which need to be related in a cognitive representation. The first level, unary relations requires representation of a single component in relation to categorical information. Binary relations involve representation of two entities and their relationship, while ternary relations involve the representation of three

elements and two binary relations, for example, Tom is taller than David, David is taller than Paul, therefore Tom is taller than Paul. The present paper reports on an investigation of group differences in performance on executive function and relational complexity tasks between children with PKU and controls. Previous research has identified specific deficits in executive functioning in young children with early- and continuously-treated PKU, and performance on ternary level relational complexity tasks has been found to predict a significant amount of unique variance on executive function tasks. The present study included 18 children with PKU and 18 age- and PPVT-matched controls between 3:6 and 8:6 years. Results indicated significant between-group differences in performance on complex executive functioning tasks and ternary-level relational processing tasks. Correlational analyses also indicated significant relationships between historical Phe plasma levels in children with PKU and performance on ternary level relational complexity tasks. Plasma Phe levels below  $120\mu\text{mol/l}$  and over  $360\mu\text{mol/l}$  were negatively correlated, while levels between 120 and  $360\mu\text{mol/l}$  were positively correlated, with performances on ternary level tasks.

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**Paper Session 10/11.00am-12.30pm**

**LANGUAGE**

**N. A. MAHLER THOMPSON, H. J. CHENERY & B. E. MURDOCH. Semantic Priming In School-Aged Children With And Without Traumatic Brain Injury: The Role Of Context.**

Priming effects have been shown to be sensitive to contextual parameters, with children's processing of sentences evidencing different characteristics to that of adults. The current research aimed to contrast the role of facilitation and inhibition in priming relying on different levels of contextual support, namely, single word versus sentential contexts. To investigate the progression of semantic processing in school-aged children, a literacy-free auditory word repetition paradigm was used. Twenty normally developing children aged between six and 14 were assessed on several auditory word repetition experiments. These experiments were constructed so as to tap into automatic and controlled processing of word pairs and sentences, whilst allowing the investigation of priming into facilitatory and inhibitory components. The patterns of priming obtained reflected processing differences for contextual levels, processing modes and prime levels (either related, unexpected, unrelated/anomalous or neutral). Whereas children were lenient in accepting unexpected but sensible targets in the sentence tasks, the corresponding prime levels in the word experiments revealed high levels of inhibition. In contrast, anomalous endings to sentences invoked large suppression, whereas unrelated word pairs did not. Furthermore, the current data provided evidence of a significant developmental component for information processing generally and semantic processing specifically for both word pairs and sentences. Potential use of this approach in investigating contextual processing difficulties in children with Traumatic Brain Injury will be illustrated with reference to a single case of a child with a mild Traumatic Brain Injury.

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**A. J. ANGWIN, H. J. CHENERY, D. A. COPLAND, B. E. MURDOCH, E. A. CARDELL, J. C. INGRAM & P. A. SILBURN. Comprehension of Syntactically Complex Sentences in Parkinson's Disease.**

Research has illustrated that object relative (OR) sentences (e.g., *The girl that the boy pushed bought the food*) can be more difficult to process for Parkinson's Disease (PD) patients than subject relative (SR) sentences (e.g., *The girl that pushed the boy bought the food*). The role of working memory in sentence comprehension was assessed in a group of 12 participants with PD (Age = 63.50,  $SD 4.70$ ; Education = 12.08,  $SD 3.03$ ) and 12 healthy control participants matched to the PD group for sex, age and

education (Age = 61.58, *SD* 5.16; Education = 13.33, *SD* 2.81), using a word-by-word self paced reading task. The task consisted of both SR and OR sentences, with comprehension probes for each sentence. Reading times were recorded for both the non-critical and critical processing regions (critical regions defined as the time taken to read the last word of the embedded clause and the following verb). Accuracy to comprehension probes formed a second dependent variable. Results indicated that whilst the control group demonstrated significantly slower reading times at the critical processing regions of the OR sentences compared to the SR sentences, the PD group did not demonstrate this difference between sentence types. In addition, whilst both groups responded to the OR comprehension probes less accurately than the SR comprehension probes during the reading task, only the PD Group demonstrated significantly poorer comprehension of OR sentences during an auditory comprehension task. Alternative accounts for the sentence comprehension difficulties evident in PD patients will be discussed, including difficulties experienced by patients with PD in the reactivation of moved syntactic elements.

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**H. CHENERY, D. A. COPLAND, B. E. MURDOCH, P. SILBURN & W. L. ARNOTT. Coordinate And Attribute Semantic Priming In People With Parkinson's Disease.**

Degeneration of the substantia nigra and alterations to the neurotransmitter dopamine are hallmark characteristics of Parkinson's Disease (PD), the effects of which have been linked to semantic processing anomalies in people with PD. The aim of the present study was to investigate the temporal course of semantic priming in PD as a function of semantic distance, using both closely related (coordinate) and more distantly related (attribute) word pairs. Nineteen participants with idiopathic PD (10 male; 9 female) with a mean age of 65.58 years (*SD* .71) and a mean educational level of 12.74 years (*SD* 4.24) and 18 matched controls (10 male; 8 female) were recruited. Participants were asked to make a lexical decision on visually presented targets. The stimuli consisted of a total of 120 prime-target word pairs, 48 of which were pronounceable nonwords. Of the word pairs containing real word targets, 12 prime-target pairs held a coordinate relationship (e.g., cat dog), 12 held an attribute relationship (e.g., tiger stripe), 24 prime-target pairs were unrelated (e.g., canoe bandit) and 24 targets were primed by a neutral prime word (e.g., blank bar). In order to investigate the time course of semantic activation, three stimulus-onset-asynchronies (SOAs) were used (i.e., 250 ms, 500 ms, and 1000 ms). Linear mixed model analyses of reaction time (RT) data revealed a significant two-way interaction between Group and Prime Condition only at the 250 ms SOA where control participants evidenced a significant RT advantage for both coordinate and attribute primes compared with the unrelated condition. Participants with PD, however, showed significant priming only for the coordinate condition. These results extend the findings of previous research by highlighting absent patterns of remote priming for participants with PD that are specific to early stages of activation. Correspondence: Dr Helen Chenery, The University Of Queensland, St. Lucia, BRISBANE QLD 4072, AUSTRALIA, h.chenery@uq.edu.au

**G. S. HARRINGTON, S. FARIAS & A. TAOUFIK. Reliability Of Functional MRI Laterality Scores For Language: Task Dependency.**

The lateralization of language function is an integral aspect of a presurgical work-up for the resection of an epileptic zone or other CNS lesions. Functional MRI has been proposed as a possible replacement for the Wada test and recent literature has shown a good concordance rate between language lateralization as assessed by both procedures. However, in order for fMRI to become a valid clinical tool, good test-retest reliability of laterality indices (LI) must be established. We studied the test-retest reliability of 6 different language tasks in 8 normal right-handers. Language tasks examined included: confrontation naming, verb generation, both visual and auditory sentence discrimination, semantic decision making, and story listening. LIs ((active left - active right)/total activation) were calculated by taking the average LI over a range of cut-off thresholds for

regions of interest in Broca's area and Wernicke's area. Tasks that produced the best retest laterality scores were verb generation in Broca's region (ave change in LI = .073, *SD* = .065) and visual sentence discrimination in Wernicke's region (ave change in LI = .146, *SD* = .175). There are other variables such as fMRI signal to noise that contribute to retest scores and it is difficult to make a judgment regarding the best tasks with such a small sample base. The current data suggest that verb generation is the most reliable task for inferior frontal activation while receptive tasks such as sentence and story discrimination are more reliable for temporal activation.

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**B. M. WHELAN, B. E. MURDOCH, D. G. THEODOROS, P. A. SILBURN & B. HALL. Investigating Long-Term Effects Of Subthalamic Nucleus (STN) Deep Brain Stimulation (DBS) On Language: Study Of 2 Cases.**

Background: Regarding language, the effects of Subthalamic Nucleus Deep Brain Stimulation (STNDBS) are yet to be thoroughly delineated. Verbal fluency tasks represent an almost exclusively applied index of linguistic proficiency relative to neuropsychological research within this population. Of note, decrements in performance on these tasks constitute the most consistently reported adverse effect associated with STNDBS, suggesting cognitive-linguistic compromise as a consequence of functional STN inhibition. Despite this observation, extensive investigations of the impact of STNDBS on language functions are currently lacking. Aims: The more precise elucidation of the role of the STN in the mediation of language processes, by way of assessments which probe language comprehension and production mechanisms at single word and sentential levels, served as the focus of this research. Longitudinal analysis afforded consideration of the way in which cognitive-linguistic circuits respond to STNDBS over time. Methods: Two cases with Parkinson's disease served as experimental subjects. Linguistic profiles involving measures of general and high-level language function were compiled for each subject, up to 1 month prior to electrode implantation and after 3 and 12 months of continuous bilateral dorsolateral STNDBS. Performance profiles were then compared to a group of 16 non-neurologically impaired controls. Results: Bilateral STNDBS primarily effected clinically reliable fluctuations in performance across subjects on tasks demanding cognitive-linguistic flexibility in the formulation and comprehension of complex language. Of note, both subjects demonstrated a cumulative increase in the proportion of reliable post-operative improvements achieved over time. Conclusions: The findings of this research lend support to models of STN participation in language, and suggest that bilateral STNDBS may serve to enhance the proficiency of basal ganglia-thalamocortical linguistic circuits over time. Correspondence: Dr Brooke-Mai Whelan, University Of Queensland, School Of Health And Rehabilitation Sciences, Division Of Speech Pathology, BRISBANE QLD 4072, AUSTRALIA, bmw@uq.edu.au

**E. D. BIGLER, E. S. NEELEY, S. OZONOFF, H. COON, W. MCMAHON & J. E. LAINHART. Superior Temporal Gyrus and Autism.**

Deficits in language are a core feature of autism. The current study examined the relationship between language performance on the Clinical Evaluation of Language Fundamentals-3 (CELF-3) and the superior temporal gyrus (STG) in subjects with autism and controls (ages 7 to 19 years), where there was no absolute size difference in the overall volume of the STG (the CELF-3 can be separated into a total language score, receptive scores, and expressive scores). Since the left STG plays a prominent role in language lateralization, it was expected that the more robust findings, relating language function to volumetric differences, would occur on the left and be most prominent in STG grey matter volume. This, in fact, was observed with control, but not autism, subjects. These findings suggest that there is a disconnection in autism between size of the STG and function, particularly in grey matter. When plotting growth curves of the STG for white, grey, and total volume, no significant differences between autism and control subjects were observed. This implies that the size-

function disconnection in autism occurs early in brain development (i.e., before age 7, the age of our youngest subjects). We also performed a voxel-by-voxel morphometric analysis which demonstrated some regional differences in grey matter between autism and control subjects at the level of the STG. These observations have implications for a critical period of language development in autism that suggest language-brain development differences in autism compared to typical development in controls.

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### Paper Session 11/11.00am-12.30pm

#### DEMENTIAS OF DIFFERING ETIOLOGIES

##### **O. PIGUET, W. S. BROOKS, H. P. BENNETT & G. A. BROE. Early Clinical Presentations in an Australian Family with FTDP-17.**

Frontotemporal dementia (FTD) is the second most common dementia before the age of 65 years after Alzheimer's disease. Whilst most cases of FTD are sporadic, families exist where the disease is inherited in an autosomal dominant fashion. Some of these families show mutations in the tau gene on chromosome 17, sometimes associated with additional parkinsonian features. These families have been labeled FTD with parkinsonism linked to chromosome 17 (FTDP-17). The clinical presentation in FTD is characterised by profound changes in personality, social behaviour and cognition. Disruptions of executive functions and working memory are commonly reported but the cognitive deficits are not limited to this cognitive domain and not uncommonly also include memory and language. In familial dementia, there is suggestion that asymptomatic, but at-risk individuals may show very early cognitive signs compared to siblings not carrying the mutation. Here, we present the findings of neuropsychological assessment of two asymptomatic at-risk individuals from an Australian FTDP-17 family with an identified tau mutation and neuropathological confirmation. We compare their cognitive presentations to the clinical features of affected members. These early clinical profiles are also compared to the existing literature on FTD.

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##### **J. M. BRADSHAW, M. M. SALING, M. HOPWOOD, V. ANDERSON & A. BRODTMANN. Improving Clinical Detection of Fluctuating Cognition in Dementia with Lewy Bodies (DLB): A Comparison of Qualitative Characteristics of Fluctuation in DLB and Alzheimer's Disease (AD).**

Background: DLB is a neurodegenerative condition characterized by fluctuating cognition with pronounced variations in attention and alertness, visual hallucinations, and parkinsonism. The fluctuations that characterize DLB appear to be a more frequent and specific diagnostic feature than either visual hallucinations or parkinsonism. In current usage, fluctuating cognition remains a broadly defined phenomenon that is not readily detected in the clinical setting. Methods: Caregivers of twenty (20) patients with early probable DLB matched with twenty (20) patients with early probable AD were interviewed using two recently developed rating scales, the Clinician Assessment of Fluctuation and One Day Fluctuation Assessment Scale. In addition to obtaining standard fluctuation severity scores, caregiver descriptions of fluctuating cognition were recorded verbatim to investigate qualitative characteristics of fluctuation. Results: Descriptions of fluctuating cognition in DLB had a spontaneous, periodic, transient quality, which appeared to reflect an interruption in the ongoing flow of awareness or attention and impacted on functional abilities. By contrast, descriptions of fluctuation in AD frequently highlighted episodes of memory failure, typically occurring in response to the cognitive demands of the immediate environment. These qualitative differences were not always captured in standard severity scores. Conclusion: The fluctuations that

occur in DLB have particular qualitative characteristics that are distinguishable from fluctuations occurring in AD. Interpretation and application of the fluctuation criterion continues to limit the diagnostic sensitivity of the consensus criteria for DLB. Findings suggest that explicit documentation and a wider appreciation of these qualitative distinctions could improve the reliability with which less experienced clinicians identify this core diagnostic feature in the clinical setting.

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##### **J. F. ANDERSON, V. K. SRIKANTH, M. M. SALING & G. A. DONNAN. Investigation Of The Single-Stroke Dementia Hypothesis.**

The notion that a single stroke can set in train a dementing syndrome has become influential in the vascular dementia literature during the past 10 years. Previous studies that have addressed the single stroke dementia hypothesis have contained certain methodological and interpretative limitations. The aim of this study was to address these issues and investigate whether suffering a single stroke results in a greater likelihood of developing dementia than occurs in the stroke-free population. Community-based samples of 99 first-ever single stroke patients and 99 stroke-free control participants were recruited from the North East Melbourne Stroke Incidence Study (NEMESIS); participants were matched for age, gender and socio-economic status. A comprehensive battery of neuropsychological measures was administered to all participants at 3 and 12 months after stroke. There was no evidence that a single stroke set in train a dementing syndrome within the first year after stroke. The long-term cognitive outcome of different stroke types will also be discussed.

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##### **P. S. KENT, J. BRYAN, M. CLARK & M. A. LUSZCZ. Preclinical Signs Of Dementia In A Community Sample: A Longitudinal Analysis.**

We investigated whether people with naming or construction impairments differed in other cognitive abilities and whether they would develop other cognitive impairments over time. Participants from a population-based sample of community dwelling older adults (aged 76 to 97) were selected on these abilities to identify individuals with possible preclinical signs of impairment. Naming was assessed using 15-item versions of the Boston Naming Test (BNT15) and construction using the pentagon copy task of the Mini-Mental State Examination (MMSE). Three groups, equivalent in age, gender and years of education were identified. The impaired naming group (n = 10) and impaired construction group (n = 16) comprised people with scores > 2 SD below the mean for their age group on these respective tasks, but intact scores on the alternative task. The control group (n = 18) had intact scores on both tasks. Current and previous performance, up to 10 years earlier, on memory, executive functioning, speed, verbal abilities and global cognitive functioning were examined. In addition, a further 47 community dwelling older people (aged 61 to 91) were also assessed. All four groups were assessed with a wide range of neuropsychological measures including naming, construction, memory, executive functioning, speed and verbal abilities. Longitudinal analyses between the three groups indicated that the impaired naming group could be identified ten years earlier on the basis of their BNT15 performance. Cross-sectional analyses between the four groups indicated that the naming and construction groups differed from both control groups on memory and other cognitive abilities, thereby meeting criteria for a diagnosis of dementia.

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##### **L. TOGHER, K. DIJKSTRA, G. BAYS, A. BLANCHARD & M. BOURGEOIS. Changing Roles: Empowering People With Dementia To Communicate Effectively.**

There has been an increasing focus on strategies communication partners may use to facilitate the communication process with the person with

dementia. Empowering people by placing them in powerful information giving roles has been shown to be an effective way to facilitate communication (Togher, 2000). The current study arose from a need to foster more appropriate communication by communication disorders students who were interacting with people with dementia in an adult day care centre. Participants were 6 people with dementia (age=83 years, range 77-88 years (SD=3.97); MMSE=9.5, range 3-14 (SD=4.09) who spoke to communication disorders students in two conditions; 1. conversation, where students asked the person with dementia for information (e.g., tell me about your marriage), and 2. advice-giving, where students asked for advice (e.g., what advice can you give me about getting married?). It was hypothesized that the second condition would foster the retrieval of information that was encoded before impairment occurred, and could tap into a respected elder role. Transcripts were analysed using analysis of politeness markers (Halliday, 1994) and other discourse measures (e.g., use of imperatives, empty speech and tangential comments). Politeness markers were used with a greater frequency in the advice condition, indicating that the person with dementia was more likely to express their opinion (e.g., I think, I believe,) and to be in a position of power in the interaction. Additionally, discourse in the advice condition was more coherent, with fewer episodes of empty speech or tangential comments. The advice-giving role may have fostered access to long-term memory stores, and positioned the person with dementia in a powerful senior role, giving them a more positive disposition to the questions. Advice-giving may be a strategy, which can be taught to carers and those who work with people with dementia to facilitate their communication.

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### Symposium 11/11.00am-12.30am

#### ASSESSMENT AND TREATMENT OF PROSPECTIVE MEMORY PROBLEMS.

*Chair:* David Shum

*Discussant:* Barbara Wilson

Prospective memory is a construct that has gained considerable attention in the ageing and neuropsychological literature in recent years. This type of memory is defined as the ability to remember to carry out an intention in the future and is considered to be important for everyday and independent functioning in older individuals and individuals with brain injury. In this symposium, a group of researchers will present their latest findings on the assessment and treatment of prospective memory impairment. Wilson, Emslie, and Foley will describe the development of a new test of prospective memory and present data collected in the UK. Titov and Knight adopted a novel approach that uses virtual reality to assess prospective memory in individuals with brain injury. In their study, Cahill, Shum, and Hohaus used a more ecological approach (viz., asking participants to carry out prospective memory intentions in a simulated kitchen and lounge) to test how prefrontal lobe variables such as interruption and planning will affect prospective memory performance of younger and older individuals. Treatment for prospective memory problems in people with TBI will be reported by Raskin and Buckheit and will include ERP and post-treatment follow-up data. Kinsella, Wallace, Ong, Storey and Hester will present research on spaced retrieval and elaborated encoding in prospective remembering and mild Alzheimer's disease. Fleming, Shum, Strong, and Lightbody will describe the results of a treatment study that included self-awareness and compensatory training for prospective memory impairment in individuals with TBI.

#### **B. A. WILSON, H. C. EMSLIE & J. A. FOLEY. A New Test Of Prospective Memory: The CAMPROMPT.**

Prospective memory is the ability to remember to do things at a particular time or within a given interval of time or when a certain event occurs.

In other words prospective memory is remembering to do things rather than remembering things that have already happened. The most common memory complaints are to do with failures of prospective memory, yet this aspect of memory functioning is rarely addressed formally. The RBMT and the extended RBMT both contain some prospective memory tasks but it was felt there was a need for a more sensitive, ecologically valid test of prospective memory. We describe here the Cambridge Prospective Memory Test (CAMPROMPT). Following a pilot study (Groot et al 2002) we modified the pilot version of the CAMPROMPT and now have a test that comprises three time based and three event based tasks. We collected norms from 134 non brain injured people and a group of people with brain injury. There are significant differences between age groups and between groups of different ability levels. These differences are reflected in the scoring procedure. We found significant correlations between prospective and retrospective memory functioning. There is good reliability. Validity was assessed by a prospective memory questionnaire. Again there were significant correlations between scores on the test and self reported everyday memory memory failures. We conclude that the CAMPROMPT is a valid, reliable and clinically sensitive test of prospective memory.

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#### **N. TITOV & R. G. KNIGHT. Brain Injury and the Virtual Street.**

Computers are increasingly being used to develop psychometric tests that complement the traditional tests available to neuropsychologists. We report here the use of computer-based technology to create a simulation of a shopping precinct, called the "Virtual Street". While using the Virtual Street participants can "walk" up and down a simulated street, and enter and exit the shops along that street. The clinician can control a wide range of stimuli within the environment, including levels of visual and auditory distractors. The application of the procedure to the assessment of persons with traumatic brain injuries is described. Patients were asked to move around the Virtual Street and to complete a series of tasks that placed demands on prospective remembering and multi-tasking ability. The development of these measures and the recent results obtained with participants with brain injury are reported. These results suggest that computer-based simulations of everyday memory tasks can be developed into useful clinical tools that may increase the ecological validity of neuropsychological assessments and provide a basis for rehabilitation.

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#### **S. RASKIN & C. BUCKHEIT. Cognitive Remediation of Prospective Memory in Individuals with Traumatic Brain Injury.**

One of the most promising areas of cognitive rehabilitation is the treatment of prospective memory in individuals with traumatic brain injury. Several studies have suggested that rote repetition helps to increase the span of time for which subjects can remember to perform a task (e.g., Raskin & Sohlberg, 1996; Raskin & Buckheit, in press). Improvements have been demonstrated on laboratory tasks and on measures of generalization in everyday life. Preliminary data using EEG also suggest that some of these changes may be due to a reorganization of brain regions employed in tasks that require memory for intentions. The current study includes 25 subjects with traumatic brain injury. These subjects received treatment for six months in a multiple-baseline A-B crossover design in which each subject served as his/her own control. Treatment maximized rewards and graded learning trials to ensure errorless learning. Treatment targeted both prospective remembering and time judgments. These subjects were re-tested one year following the end of the treatment protocol. Subjects demonstrated only slight declines in prospective memory perfor-



mance. Their performance on the Assessment of Intentional Memory (AIM) remained significantly improved from baseline. Performance on standard neuropsychological tests of attention, time estimation, executive functions, and learning were unchanged from the testing performed at the termination of treatment. Performance on tests of prospective memory in daily life were not significantly different from performance at the termination of treatment and remained significantly improved from baseline performance. These data suggest that gains made in prospective memory performance are long-lasting and provide a significant effect in the daily lives of those treated.

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**G. J. KINSELLA, J. WALLACE, B. ONG, E. STOREY & R. HESTER. Response To Modified Spaced-Retrieval Intervention For Prospective Remembering In Early-Stage Alzheimer's Disease.**

Early-stage Alzheimer's disease (AD) is characterised by significant episodic memory impairment and dysfunctional executive attention skills. Surprisingly, memory performance in early stage AD has rarely been evaluated within a prospective remembering (ProR) framework. In a preliminary study we demonstrated that participants with early-stage AD, as compared to healthy older adults, were significantly impaired in a simple experimental paradigm of ProR (a text reading task). A subsequent intervention study compared ProR performance of 16 participants with early-stage AD (MMSE >19) and 16 healthy older adults under two experimental conditions. Participants were trained to remember and perform a ProR task by using a spaced-retrieval technique alone or spaced-retrieval combined with elaborated encoding of task. The AD group showed significant improvement in ProR following training in the combined condition as compared to spaced-retrieval alone. The results are discussed in relation to interventions for early-stage AD and the value of using combined implicit

memory and residual explicit memory skills to ameliorate everyday memory difficulties of ProR.

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**J. M. FLEMING, D. SHUM, J. STRONG & S. LIGHTBODY. Rehabilitation Of Prospective Memory Deficits: A Compensatory Training Programme For Adults With Traumatic Brain Injury.**

This paper describes a prospective memory rehabilitation programme based on a combination of self-awareness training and compensatory training involving 8 individual 1-2 hour weekly sessions. Case study evaluation of the programme has been conducted on a series of participants with traumatic brain injury (TBI) using pre- and post-intervention assessments and telephone follow-up. Assessments were formal prospective memory assessment, self-report and measures of diary use. Intervention aimed to identify potential barriers, establish self-awareness of memory deficits, introduce a customised compensatory tool, a cueing system, and organisational strategies. A significant other was involved in training to assist generalisation. To date three participants have completed the programme. All improved on formal prospective memory assessment and demonstrated successful diary use after the programme. Self-report of prospective memory failure fluctuated and may reflect increased self-awareness. The preliminary findings suggest that a compensatory approach may be a useful in improving prospective memory performance following TBI.

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## FRIDAY AFTERNOON, JULY 9<sup>TH</sup>, 2004

### Poster Session 4/1.30pm-5.00pm

#### CLINICAL ISSUES, TRAUMATIC BRAIN INJURY AND REHABILITATION

**S. C. RIVERA-GUTIERREZ, M. H. BUENROSTRO-JAUREGUI, N. A. CHAVEZ-PERAZA, R. ZAVALA-SOUZA & C. E. VALENCIA-ALFONSO. Laughter: Neurobiology of an Evolutionary Tool for Social Adaptation.**

The prevalence of laughter in different cultures, its early presentation in human ontogeny and its stereotypical character are clues that suggest this is a selective process through evolution and is not an eventuality. There are different hypotheses trying to explain what are the evolutionary advantages these processes have, such as increased socialization, courtship skills, training to combat through playing, signalization of non-dangerous incongruence clues, and health benefits, among others. Unfortunately, very little is known about the neurobiological mechanisms and evolutionary function of laughter. This review intends to summarize experimental findings concerning the neurobiology of laughter, and its relationship to several evolutionary hypotheses. It is concluded that although there is not a laughter centre in the central nervous system, an important circuit involving the limbic system (hypothalamus and basal ganglia), prefrontal cortex and supplementary motor area seems to exist. Interestingly, these neural structures which are related to laughter are also associated with emotional and social behaviors, and are especially important for the emission and detection of social reinforcement. This reinforcement is very significant in altricial species that develop communities. In humans, both voluntary laughter (cortical control) and involuntary laughter (limbic control) constitute important strategies for social adaptation. Besides, laughing in sev-

eral daily situations might be explained by the concept of social reinforcement. Therefore, experimental evidence strongly supports the social adaptation hypothesis of laughter. Taken together, the data suggests that this behavior involves biological and social aspects, and its study could be very useful, not only to increase the knowledge of our species, but also to establish technologies that favour it. Finally, further investigations are suggested to study this almost unexplored topic related to some of our best experiences.

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**S. AL-ADAWI, A. A. DORVLO, M. DEVITO, M. STEIN & D. T. BURKE. Coping With Brain-Injury: Belief of Spirit Infestation and Ensorcement.**

The coping mechanisms of Western families when a member sustains traumatic brain injury (TBI) have been well documented in the medical literature; however, there is a paucity of studies that examine other, non-Western cultures where services for a neuropsychological impairment are rudimentary or do not exist. This paper aims to address this deficiency. In traditional Omani society, sudden personality change with accompanying neurocognitive impairment following a TBI is often attributed to a spirit infestation or ensorcement. Traditional healing methods, such as exorcism, are often sought in addition to available allopathic medical intervention. This paper reflects on how these beliefs and practices help the family cope with the debilitating neuropsychological impairments and personality change that affected a family member due to a traumatic brain injury. It suggests that distress and stress are experienced in a social and cultural

context even in the presence of obvious neuropsychological dysfunction precipitated by brain injury.

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**R. L. TATE, S. McDONALD, L. TOGHER, M. PERDICES & A. MOSELEY. Rating The Methodological Quality Of Single-Case Experimental Designs: The PsycBITE™ Scale.**

A database, containing published reports of therapies targeting the psychological consequences of acquired brain impairment, is available on PsycBITE™ (Psychological database of Brain Impairment Treatment Efficacy; www.psycbite.com). PsycBITE™ is modelled on the Physiotherapy Evidence Database (PEDro) and was developed to aid clinicians to evaluate and implement evidence-based interventions. Reports with empirical data, including systematic reviews, randomised controlled trials (RCTs), nonRCTs, patient series, and single-case experimental designs, are included on PsycBITE™. A survey of the first 400 reports revealed that the largest proportion (34.5%) were single-case designs. Like PEDro, a distinctive feature of PsycBITE™ is the rating of methodological quality. PsycBITE™ uses the 11-item PEDro scale to rate the quality of group studies (RCTs, nonRCTs, and patient series). The PEDro scale is not appropriate for single-case designs, however, and the PsycBITE™ scale was therefore developed for this purpose while following the PEDro criteria as closely as possible. Preliminary versions of the scale were piloted on single-case reports meeting PsycBITE™ selection criteria by six raters making independent ratings and discussing areas of dissension. As a result a working scale of 11 items was developed. This, like the PEDro scale, has one item for external validity, and 10 focusing on internal validity and statistical analysis. Items include description of patient characteristics, study design, therapy procedures to allow replication, baseline measures, stability of baseline, independence of therapist/assessor, post-treatment/follow-up data, procedures to deal with practice effects, presentation of numerical data and statistical analysis. The application of the PsycBITE™ scale will thus allow evaluation of the methodological quality of single-case experimental designs, which will be ranked on PsycBITE™ in order of their methodological strength, enabling end-users to quickly identify trials with greatest internal validity.

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**M. CRAWFORD & R. KNIGHT. Speed of Information Processing in Persons with Postconcussion Syndrome.**

The aim of the present study was to determine whether access to information is slowed (retrieval-slowness hypothesis) or associations between items in memory are lost (structure-loss hypothesis) following head injury. Twenty persons with postconcussion syndrome and 20 controls matched for age, gender, and occupation participated in this study. Participants were given the Controlled Oral Word Association Test (COWAT; Benton & Hamsher, 1983) and a semantic fluency task where they were asked to name as many fruits and vegetables as possible in 60 seconds. Total scores were calculated and response latencies were measured using a MacLab Chart Sound system. Mean latency, following procedures used by Rohrer, Wixted, Salmon and Butters (1995), was calculated as a test of both the structure loss and retrieval slowing hypotheses. The results failed to find any significant difference in mean latency between the patients and controls. However, the patients produced significantly fewer words and had significantly longer pauses between words than the controls. The patients were also significantly slower at producing their first word on the semantic task and on one trial of the COWAT. Inconsistent with structure loss, the patients produced more words on the fruits and vegetables task than the task requiring them to produce words that were not semantically related. The above findings suggest that retrieval slowing is responsible for the patients' impaired performance on word fluency tasks. Furthermore, response latencies may

be a more sensitive measure of the effects of concussion on letter and semantic fluency than the number of words generated.

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**G. WILLIAMS, K. GREENWOOD & V. ROBERTSON. Measuring High-Level Mobility Following Traumatic Brain Injury: A Review Of Recent Literature.**

The aim of this review was to identify traumatic brain injury studies that reported mobility outcomes and examine which measurement tools they used. The search strategy identified 678 studies. Excluding articles that focused on children, cognitive, behavioural or psychosocial outcomes, 137 studies were collected for full text review. The most frequently used measures for assessing mobility outcomes following brain injury was the Functional Independence Measure (FIM). Findings include the following: activity limitation scales focussing on mobility are seldom used and those that are have a ceiling effect and typically do not measure mobility beyond walking and stair use: inpatient measures such as the FIM are used as outpatient or long-term follow-up measures, applications for which they were not designed; and, 'participation' scales are unable to identify if a restriction in participation relates to a mobility limitation. Many studies developed and used their own, non-validated, outcome measures making comparisons and evaluations difficult and some studies did not use any outcome measures at all. A high-level mobility scale is needed to fill the gap between the current 'activity' scales that measure mobility to a level of walking and stair use and the 'participation' scales that measure leisure and sporting activities. Such a high-level mobility scale is essential to identify and describe the deficits and changes that are currently not measurable following TBI, and may help guide treatment and goal setting for therapists.

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**N. V. MARSH. Neuropsychological Functioning Following Severe TBI: A 5 Year Follow-Up.**

The neuropsychological functioning of a group of 71 adults was assessed at approximately 5 years (mean = 65 months) following severe traumatic brain injury. The average age of the group was 31 years, and 52 (73%) were male. Overall outcome as rated on the Glasgow Outcome Scale, was 13 (18%) with severe disability, 22 (31%) with moderate disability, and 36 (51%) had made a good recovery. Cognitive functioning was assessed by measures of intelligence, attention, verbal and visual memory, and language. Psychosocial functioning was assessed by self-report measures of anxiety and depression, and subjects rated the severity of their current problems on a 22-item measure covering cognitive, emotional, behavioural, and social functioning. The prevalence of difficulties across these domains of neuropsychological functioning, and the interrelationships between them, will be examined.

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**W. Y L SOONG, A. S F TAM, D. W K MAN & C. W Y HUI-CHAN. Evaluating an Interactive On-line Cognitive Skill Training Strategy for Persons with TBI.**

Objectives: An analogy problem solving approach was hypothesized to enable persons with Traumatic Brain Injury (TBI) to learn better problem solving skills. Three modes of service delivery were compared including face-to-face, computer-assisted and on-line. Their treatment effectiveness, functionality and usability were evaluated and compared using problems encountered in daily living. Methods: Sixty Hong Kong Chinese people with TBI were evenly randomly assigned to three 20-session intervention programs. The programs delivered similar training content via different interaction modes, i.e., face-to-face, computer-assisted, and on-line. Training content included basic and functional problem solving tasks and reflective group sessions. Outcome measures included the Category

Test (Halstead Reitan Test Battery); a computerized quiz and a problem solving self-efficacy scale. The programs were also qualitatively evaluated. Results: Subjects from all 3 groups generally demonstrated higher self-efficacy and basic problem solving skills. However, subjects showed differential improvements in different problem solving skills and self-efficacy. Similar to the other 2 conventional programs, the on-line program also produced significant improvement. This innovative program mode was well-received by the subjects though some subjects expressed more real-life simulated practice would improve their functional problem solving skills. Conclusions: Persons with TBI can improve their daily problem solving through systematic and successful environmental encounters. The on-line program is an effective option for those receiving treatment within their living environment. However, the program effects on generalization and maintenance remain to be determined. The work described in this paper was fully supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. PolyU 5291/01M).

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**A. JANSARI, S. COLE & R. MCCARTHY. Selective Short-Term Memory Impairment Following Closed Head Injury: Possible Role Of The Central Executive.**

Selective impairments in short-term memory tend to be more rare than reports of long-term memory problems. Single case studies, however, have shown that patients can have selective impairments in just verbal short-term memory; for example Shallice & Warrington (1970) reported the case of KF who had a digit span of 2 which has been interpreted as a deficit in the Phonological Store of Baddeley & Hitch's (1974) Working Memory model. We report the case of a patient with a selective short-term memory problem following closed head injury but who, unlike KF, has an intact digit span and is unimpaired on other simple measures of working memory function. Following his reports of particular problems when trying to articulate complex sentences when stressed and difficulty following conversations when more than one person is speaking, a detailed case study is presented whereby potential problems at the resource level of the Central Executive's attentional system are investigated. The bearings that the findings have on further understanding of short-term memorial processes are discussed.

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**U. SATISH & S. STREUFERT. Composite Assessment Of TBI Patients: SMS Simulations.**

Simulation data were obtained from patients with a history of closed head injury in the mild to moderate range. Despite apparent adequate functioning on standard tests, many patients demonstrated considerable deficits in real world relevant tasks. The SMS simulation provides the opportunity to specifically delineate these deficits and study the impact of various treatment options. Patients who had experienced prior brain trauma were, on the average, less active, responded inadequately to information from the environment, showed little initiative, were dependent on external contextual cues (seeking more information to use as a basis for action, yet did not utilise that information effectively), responded poorly to an emergency, and showed little breadth. They showed marginal planning ability and displayed limited use of strategy, except in highly externally cued (contextual) situations. In general, their behaviors reflected a restricted orientation toward situational demands with a primary focus on one (or very few) task components. As a result, their scores on "contextual" performance measures and on information search activity tended to be relatively high. In contrast, their understanding of purposes or goals as well as their effectiveness in handling more complex real-world task demands was absent or limited.

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**S. DIKMEN, J. DOCTOR, J. CASTRO, R. FRASER, J. MACHAMER & N. TEMKIN. Risk of Unemployment Following Traumatic Brain Injury.**

*Objective:* Examine the risk of unemployment 1 year after traumatic brain injury (TBI) relative to that expected in the general population *Design:* Inception cohort longitudinal study of TBI cases. General population risk from the US Current Population Survey *Setting:* Level I trauma center *Patients:* 420 consecutive hospital admissions of adults with traumatic brain injury who were working at the time of injury. *Main Outcome:* Work status at 1 year *Results:* 42% of TBI cases were unemployed vs. 9% expected, risk ratio (RR)=4.5. The RR for unemployment was higher in males, those with higher education, more severe injuries, and more impaired early neuropsychological or functional status. The difference in unemployment rates gave similar results for gender, severity of injury and early neuropsychological and functional status. However, for education, the actual difference was smaller among those more educated, but the rate in the general population was smaller, yielding a higher risk ratio. Those with under a high school education had 54% unemployment after TBI vs. 14% expected (difference=40%, RR=3.8) while college graduates had 24% unemployed after TBI vs. 4% expected (difference=20%, RR=5.6). *Conclusions:* After correcting for population risk for unemployment, unemployment is substantially higher after TBI for people who were employed when they were injured. The excess varies depending both on the characteristics of the injury and of the person injured. For characteristics associated with rates of unemployment in the general population such as education, risk ratio and excess percent unemployed give different views of what groups are more severely affected.

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**P. J. YATES, B. JENKINS, L. ELLETT, A. HARRIS & H. WILLIAMS. An Epidemiological Investigation Of Head Injury Presentations Over Six Years In A Local UK Health District Population.**

A descriptive analysis was carried out of data collected over six years on up to 8,000 head injury presentations at an Accident & Emergency Department serving a local health population of approximately 350,000. Too few UK studies on the epidemiology of head injury exist to make for meaningful interpretation at a local level. The literature does however suggest that significant local and regional variation in incidence can occur, and that service provision should reflect this. This paper describes two phases of analysis undertaken in order to derive a local incidence rate. Initial trends were identified according to severity, sex, age, area of residence, and case follow-up. Significant variation was found on these factors. A provisional estimate of annual incidence was calculated at 361 per 100,000 (335/100,000 for minor cases; 26.3/100,000 for moderate-severe cases). A second phase of analyses was carried out on the data to refine these estimates. This will be presented in detail and includes measures of social deprivation to further understand the nature of case presentations. The implications of the findings for clinical neuropsychological services will be considered.

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**S. AL-ADAWI, A. S. DORVLO, L. JACOB, D. T. BURKE, C. C. HUYNH & A. AL-HUSSAINI. Apathy And Affective Functioning In Cross-Cultural Survivors Of Traumatic Brain Injury.**

Disturbance of motivation and its relationship to depression continues to spark contradictory findings among European and North American populations. Could a cross-cultural study shed some light on the situation? This study aims to detect the prevalence of apathy and to test whether the Apathy Evaluation Scale (AES) can detect the presence of depression in survivors of traumatic brain injury (TBI) in Oman. Eighty subjects who sustained a TBI were given an Arabic version of the AES and were also interviewed with the semi-structured Composite International Diagnostic Interview (CIDI). The authors found that, based on CIDI, the incidence of apathy and depression in the TBI in Oman is similar to that reported

elsewhere. However the AES has poor discriminatory power in identifying cases of depression in this population. Could this imply that the AES is not culture sensitive? The results of this study emphasise the importance of developing assessment tools that are culturally sensitive in the light of the rising incidence of TBI in developing countries such as Oman.

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**N. TEMKIN, J. MACHAMER, J. FANN, C. BOMBARDIER & S. DIKMEN. Valproate For Altering Mood After Traumatic Brain Injury.**

Mood disorders such as irritability, depression, and anxiety are commonly reported after traumatic brain injury. Valproate is frequently used as a mood stabilizing drug. *Objective:* To determine whether valproate has any effect on mood in those with traumatic brain injury *Design:* Randomized, double-blind, clinical trial to compare the effects of valproate and phenytoin for seizure prophylaxis. Assessments were done during valproate treatment at 1 and 6 months after injury. *Setting:* Level I trauma centre *Patients:* 189 patients on their assigned, blinded drug tested at 1 month and 145 at 6 months. Participants were at least 14 years old and had complicated mild to severe injuries. *Interventions:* 1 week of phenytoin (followed by placebo) or 1 month or 6 months of valproate. *Main outcome measures:* Brief Symptom Inventory (BSI) *Results:* Despite depressive symptoms being quite common, there was no effect of valproate on depressive symptoms reported (37% >1sd above on BSI depression at both 1 and 6 months,  $p = .84$  and  $.44$  comparing groups). BSI hostility scale reflecting irritability indicated somewhat fewer problems overall, but again no treatment effect (about 25% >1sd,  $p = .72$  and  $.79$ ). Results on anxiety are less clear. Cross-sectionally, there was no treatment effect ( $p = .78$  and  $.84$ ), but an analysis of change from 1 to 6 months suggested a positive impact of valproate on anxiety ( $p = .04$ ). *Conclusions:* Despite some elevations, there is no indication valproate decreases depression or irritability. There is a suggestion of a positive effect of long-term valproate use on anxiety.

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**S. BASSI, A. TUCKER, V. ANDERSON, S. MORSE, F. HARITOU, C. CATROPPA & J. ROSENFELD. Pragmatic Communication Skills in Children following Traumatic Brain Injury.**

Traumatic brain injury (TBI) is one of the most common causes of acquired disability during childhood. Most of the literature to date has used standardized tests to explore the impact of TBI on children's cognitive skills, with little exploration of children's higher level functional skills, especially in the language/communication domain. Difficulties in these areas are likely to contribute to persisting social and academic difficulties often associated with TBI. The aim of the present study was to explore the impact of TBI on children's pragmatic communication skills, their ability to effectively use language in a social context. A longitudinal design was used to compare the pragmatic communication skills of children who had sustained mild ( $n = 10$ ) and moderate-severe ( $n = 14$ ) TBI between the ages of 3 and 7 years to a group of uninjured children ( $n = 12$ ). The children were matched on age, gender, Full Scale IQ and pre-injury Vineland Adaptive Behavior Score. Children were asked to explain how to play a popular children's game initially after injury, with follow-ups at 6 and 30 months. Explanations were rated on the quantity and quality of information supplied as well as the organisation and efficiency of responses. Results are discussed in terms of the development of executive skills and the heterogeneity in outcome following childhood TBI.

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**M. L. BELLON. Management of Posttraumatic Epilepsy in People with Brain Injury: A Psychoeducational Perspective.**

Aim: This study identifies the behaviours of 18 adults with posttraumatic epilepsy (PTE), and examines the effects of a psychoeducational interven-

tion on participants' personal management and lifestyle, incidence of seizures, as well as measured psychosocial and cognitive functioning. *Method:* Participants were assigned to the intervention group through self-selection ( $n=9$ ), with a matched no-treatment control group established for valid comparison ( $n=9$ ). The intervention involved 6 months of weekly 2-hour workshops plus counselling, addressing PTE management. Data was collected from medical records, interviews, participant observation, seizure diaries and questionnaires (Washington Psychosocial Seizure Inventory, Stigma Scale, Perceived Wellness Survey and San Diego Questionnaire), completed independently by participants and their nominated family member/friend. Data collection occurred at baseline and post-intervention, forming a repeated measures design. A third round of data collection will be conducted at a 6-month follow-up. *Results:* Discrepancies between participant and significant other's perceptions reduced following the intervention, indicating an improvement in self-awareness by participants. Results demonstrate the effects of isolation, lack of understanding and support, and influence of structured networks in facilitating effective management of PTE. *Discussion:* PTE is a serious complication of acquired brain injury, affecting long-term rehabilitation outcome, and educational, vocational and personal achievement. Skill development and effective management of PTE requires careful nurturing of participants allied to sensitivity of their needs. This builds self-awareness and confidence such that seizures are better managed, participation in community activities is established, and the rehabilitation process is enhanced. This research was conducted during the tenure of a research scholarship from the Epilepsy Association, Australia.

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**D. W K MAN, Z L DOU, S F TAM & C. W Y HUI-CHAN. Efficacy Of Computer-Assisted Memory Rehabilitation Programme For Persons With Traumatic Brain Injury: Development And Evaluation.**

Background: Efficacy of computer-assisted cognitive rehabilitation (CACR) for persons with traumatic brain injury (TBI) is increasingly being recognised. The present randomised clinical trial examined a new CACR strategy in treating persistent short-term memory (working memory) deficits. The strategy adopted an eclectic approach that integrated errorless learning and multi-sensory environment enrichment concepts. *Method:* Sixty persons with TBI were recruited from a treatment programme and randomly divided into three groups: CACR group underwent 20 one-hour computerised remediation sessions, a second group (non-CACR) underwent a time-matched face-to-face therapist-led memory training task, and a third control group received no research intervention (only presented with non-specific cognitively demanding tasks). They all completed the various treatment conditions as well as a battery of computerised and neuropsychological tests (e.g., RBMT) designed for longitudinal measurement of changes in memory and outcome measures. *Results:* Initial findings indicated that both CACR and non-CACR had significant improvement in memory following treatment and 1-month follow-up. Though the results did not support differential efficacy between CACR and the conventional programme in augmenting the memory process, feasibility of the CACR was evidenced. Methodological considerations of cognitive remediation paradigms will also be discussed.

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**F. F. LEFEVER & J. HASENKAM. Neuroimmune Processes And Categories Of Performance Variability Within Or Across Sessions After Mild Head Trauma (MHT).**

Intrasubject variability of cognitive performance within or across sessions is common in brain trauma. In mild head trauma (MHT), evidence of structural brain damage may be lacking or ambiguous, as may be objective evidence of significant cognitive deficits; but in variability across time, MHT patients resemble those with moderate-severe TBI. Neuroimmune responses to experimental MHT resemble those in a wide variety of brain insults (ischemia, seizures, infection, etc.) and provide a basis for several

types of long-term alterations in specific basal or phasic neuroimmune activities with potential for causing chronic but fluctuating dysfunction. Fluctuations have been categorized according to modulating conditions and time course: (1) brief and task-specific ("mental fatigue" with lapses of seconds or minutes; LeFever, 1996); (2) longer and not necessarily task- or situation-specific (precipitated by somatic as well as emotional stress, lasting a day or so; LeFever, Society for Neuroscience 1998); (3) much longer, unrelated to task or situation (days or weeks, due to IL-1beta response to systemic or local non-brain infection; e.g. Kelley, Bluthé, Dantzer et al, 2003). To these, we add sleep disturbance and/or desynchronization among various independent but normally coordinated circadian rhythmic processes. Neuroimmune sequelae involving upregulation or disordered production of cytokines has been shown to influence circadian mechanisms. Although they have been shown to have direct effects on synaptic activity and on cognitive functions, if they impair synchronization of separate systems which normally have parallel circadian rhythms at levels which in themselves might have relatively minor direct impacts on neural/cognitive function, there are several possibilities for sporadic or periodic effects on mood, overt behaviour, or cognitive functions (e.g. asynchrony of peak overt activity and peak slow-wave power in the EEG; Roky et al. 1999).

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**L. J. RAPPORT, R. A. HANKS, R. D. COLEMAN & C. KOVIK.**  
**Barriers To Driving After Traumatic Brain Injury.**

Driving status and perceptions of barriers to the resumption of driving after traumatic brain injury (TBI) were examined among 51 TBI survivors. Perceptions of barriers to driving provided unique information in predicting subjective and objective indices of community integration, such as sense of belonging, social mobility, and occupational integration, even after accounting for social support, negative affectivity, and use of alternative transportation. Moreover, survivors who had not resumed driving showed poorer community integration than those who had resumed driving. Survivors' perceptions of their barriers to driving accounted for substantial variance in driving status. Physical, cognitive, psychological, and resource-oriented barriers were modestly related to driving outcome; however, social barriers such as directives against driving from significant others accounted for the most variance in survivor driving status. Drivers and non-drivers did not differ in perceptions of general social support, or in levels of positive or negative affectivity. Although general perceived social support and negative affectivity converged with subjective indices of community integration, they were unrelated to both perceptions of social barriers to driving and driving outcome. Thus, survivors distinguished between social support, which was generally perceived as adequate by this sample, and social barriers imposed by the same network that hindered their resumption of driving. The findings support prior research indicating that significant others have substantial influence in post-TBI driving outcome and highlight the importance of independent driving to community integration.

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**L. SEIBERT & R. K. HEATON.** **Behaviours Suggestive Of Frontal-Subcortical Dysfunction 1 - 6 Years After Traumatic Brain Injury: A Comparison Of Patient Versus Knowledgeable Informant Report.**

Behavioural changes associated with disturbance to frontal-subcortical circuitry are frequently reported sequelae of traumatic brain injury (TBI). The Frontal Systems Behaviour Scale (FrSBe), a behavioural rating scale with demonstrated validity to assess these changes, was administered to 27 individuals 1-6 years post TBI and independently to knowledgeable informants (family member/significant other). The FrSBe assesses the frequency of behaviours in three domains: apathy (e.g., initiation difficulties, task impersistence); disinhibition (e.g., irritability, emotional lability), and executive dysfunction (e.g., perseveration, trouble multi-tasking). As groups, the reports of individuals with TBI and informants

indicated comparable rates of clinically significant behavioural problems after injury, for each domain (per TBI-affected individuals: 30% showed signs of apathy, 37% disinhibition, and 33% executive dysfunction; per informants, 33%, 41%, and 26%, respectively) and overall (per TBI-affected individuals, 37%; per informants, 33%). Both groups reported more signs of apathy, disinhibition, and executive dysfunction after affected individuals injury as compared to before. These group results are qualified, however, by the finding of no significant correlations between the ratings of TBI-affected individuals and the ratings of informants for any domain and overall. The two groups disagreed on the classification of TBI-affected individuals as clinically impaired overall or not after injury for 11 of the 27 (41%) affected individuals. The two groups were also in disagreement on the classification of TBI-affected individuals as clinically impaired overall or not before injury, for 6 of the 27 (22%) affected individuals. The reasons for the poor concordance between the reports of TBI-affected individuals and those of knowledgeable informants is an area in need of further investigation.

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**R. C. CHAN, J. M. LINACRE & B. D. WRIGHT.** **Using Rasch Statistics To Rescale Neuropsychological Performance In Patients With Post-concussion Symptoms.**

In analyzing clinical or educational data, subjects or patients may already be characterized with a specific set of "numbers" that are asserted to be linear measures that could be compared with one another directly. However, it is not clear that what is the linear transformation between the measure and logits. It is not even known what the specific "number" in one neuropsychological test tells you in comparing with the exact "number" in another test of similar measure. The traditional approach of using the standardized z-score or T-score within a specific sample, however, limits to single inventory. In clinical practice, however, psychological and neuropsychological tests are usually assessed with a wide range of measures on the same construct. This approach thus still overlooks the direct comparison of measures of different inventories. This study aims to take the common metric into consideration and to optimize direct comparison of neuropsychological measures in a group of patients with traumatic brain injury using Rasch Model Analysis. In this technique, one first transforms the different performance scores to a "logits" metric. Then, each performance score is transformed to a logit scale of "difficulty" along which different levels of difficulty could be directly compared with one another. In doing so, a common profile score can be established to locate the subject's performance within the set of neuropsychological measures. Correspondence: Prof Raymond Chan, Sun Yat-Sen University, Department Of Psychology, GUANGZHOU 510275, P.R. CHINA, [rckchan2003@yahoo.com.hk](mailto:rckchan2003@yahoo.com.hk)

**K. CONNELL, E. GORDON, K. FALLAHPOUR, C. DAVIS & R. CLARK.** **Evidence Based Assessment of Brain Dysfunction in Head Injury.**

This study serves to elucidate evidence-based changes in electrical brain function and psychometrics, in patients with a head injury referred for Medico-Legal evaluation. The subject group consists of 7 patients with a history of head trauma (age range 34-52). The normal control group was age matched and drawn from the Brain Resource Standardised International Brain Database. Measures of electrical function (EEG eyes closed, auditory oddball and working memory paradigms), and a battery of psychometrics (including assessment of sensory-motor-spatial, memory, attention, language and executive functions) were evaluated. MANOVA and ANOVA analysis of the data showed significant differences in EEG power, amplitude of the late component oddball and working memory event related potentials (ERP's) - which highlighted significant disturbances in context processing (P300). The pattern of psychometric disturbances highlighted significant differences in all five core domains of cognitive functioning. Insights of the inter-relationships between psychophysiological and psychometric data, from over 1000 normal subjects in the Inter-

national Brain Database, were used as a frame of reference to interpret the potential functional significance of these findings. The frame of reference also allowed individualised patterns of dysfunction to be elucidated, with respect to the controls in the International Database.

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**R. GREEN, B. MELO, L A NGO & C. SKENE. Environmentally Induced Transient Cognitive Improvements In Healthy Subjects: Implications For Neurorehabilitation Following Brain Injury.**

Our program of research examines whether it is possible to measure (1) the transient improvement in cognitive functioning that people anecdotally report after periods of intensive mental activity (e.g. studying for exams), and (2) subsequent regression to pre-intensive activity levels of cognitive functioning. If such transient improvements occur, this would have significant implications for neurorehabilitation following brain injury. The stimulating neurorehabilitation environment may promote transient neuroplastic changes; upon discharge from the environment, transient improvements may dissipate. Preliminary findings from our traumatic brain injury recovery study reveal that some patients do indeed decline after discharge from neurorehabilitation. We present here the results of our first experiment: Can performance of normal controls be enhanced by intensive cognitive stimulation? Ten normal controls were administered memory, attention and speed of processing tests before and after a two-week intervention, using alternate forms to minimize practice effects. The intervention entailed daily memorization of prose passages and speeded mental calculations (intended to tap effortful processing). Sixteen control subjects performed the pre- and post-assessments, without the intervention. Both groups improved significantly on speed of processing tests, suggesting practice effects; however, only the intervention group showed significant improvements on memory and attention tests. Consistent with anecdotal report, results suggest it is possible to transiently enhance cognitive functioning in normal controls through stimulation. Follow-up assessment will be undertaken to provide further confirmation that cognitive improvements were transient. If intensive stimulation confers transient benefits, then post-discharge, ongoing cognitive stimulation may be necessary to maintain rehabilitation benefits.

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**Paper Session 12/1.30pm-3.00pm**

**MEMORY**

**H. WARD, D. SHUM, L. MCKINLAY, S. BAKER-TWENEY. Development of Prospective Memory from Middle Childhood, through Adolescence to Early Adulthood.**

Prospective memory is the memory for future intentions (e.g., remembering to ring someone tomorrow). To date, few studies have examined its development. This study aimed to assess the development of prospective memory, and test the frontal-lobe model, which assumes that prospective memory is mediated by the prefrontal cortex. Given that the prefrontal regions probably have capacity limits; that individuals allocate limited cognitive resources according to the salience of competing tasks; and that the prefrontal regions mature from puberty (Marlowe, 2001), it was hypothesized that prospective-memory performance would be better: (1) when the cognitive demand of an ongoing task was low than when high (Kidder, Park, Hertzog & Morrell, 1997; Maujean, Shum, & MacQueen, in press); (2) when the salience of the task was emphasized, rather than under-emphasized (Kliegel, Martin, McDaniel & Einstein, 2001); and (3) in adolescents and young adults compared with young children. Further, given that the prefrontal regions are also believed to mediate executive functions, it was hypothesized that performance on executive function tests (i.e., Self-Ordered Pointing Task, Tower of London, and Stroop)

would predict performance on prospective memory. Participants were three groups each of thirty, aged: 7 to 10 years, 13 to 16 years, and 18 to 21 years. The main study was a 3 x 2 x 2 mixed-factorial design, with the independent variables of Age (between subjects), Task Salience (between subjects), and Cognitive Load (within subjects). The dependent measure was the percentage of prospective memory actions executed correctly. Preliminary results show that prospective-memory performance is adversely affected by increases in the cognitive load of the ongoing task, and that this is more noticeable in young children than in adolescents or young adults. On completion, this study should contribute significantly to the literature on prospective memory development.

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**A. INGRAM, M. SALING, I. SCHWEITZER, C. NG & G. SAVAGE. Retrograde Amnesia Associated With Electroconvulsive Therapy (ECT).**

Retrograde amnesia has frequently been described as one of the most persistent and disturbing side effects of ECT. It is more severe after bilateral than right unilateral ECT and despite improvement over time, enduring impairments have been reported up to seven months after treatment endpoint. Previous research has revealed retrograde memory deficits for both personal and impersonal information after some forms of ECT. In addition, a temporal gradient whereby recent memories are more vulnerable to disruption and loss compared with more remote memories, has been reported in some studies. To date, however, there has been no comprehensive examination of the impairment consistent with current neuro-psychological theories of retrograde memory. The general aim of the current research was to characterize retrograde memory after ECT in accordance with current theories of retrograde memory. Four depressed patients were recruited from a private psychiatric hospital. In conjunction with two standardized instruments, the Autobiographical Memory Interview (Kopelman, Wilson, & Baddeley, 1989) and the Test of Famous Faces and Public Events (Shum & O'Gorman, 2001), the current study employed a novel and intensive assessment in the form of individually-tailored recall and forced-choice recognition tests, which enabled theoretically important distinctions to be made (e.g., between semantic and episodic memory) as well as the detection of temporal gradients. The results indicate the presence of significant and clinically distressing retrograde memory impairments associated with particular ECT types. The case studies will be discussed in relation to current theories of retrograde memory and important assessment-related issues.

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**D. M. FOGARTY & K. MCFARLAND. The Assessment Of Phonological And Semantic Memory Processes: Neuropsychological Comparisons Of Brain Injury Patients And Healthy Controls.**

Phonological and semantic aspects of verbal short-term or working memory were examined using refined versions of the cued-recall procedures previously presented at INS (Fogarty & McFarland, 1999). Participants were presented with both semantically and phonologically related sets of words and required via semantic and phonological cues to retrieve a particular presented word. For each test, the derived scores were the total number correct, a semantic/phonological discrepancy score and a score that reflected the build-up of proactive interference across trials. As expected, overall semantic performance was found to be superior to phonological. The phonological test also showed build-up of proactive interference with successive trials while the semantic did not. These tests clearly measured different components of short term memory (STM). The cued-recall tasks were also administered to 18 brain injury patients. Again, similar differences in phonological and semantic cued recall were evident and it was found that the brain injury patients were more impaired on both tasks, had larger discrepancy scores and demonstrated proactive interference on both tests with the phonological effect being the strongest. These deficits

are thought to have functional implications for language comprehension and the learning and retention of new words. The relationships between performance on these tasks and other commonly used standardized neuropsychological tests, including attention, verbal memory, learning and fluency e.g. WMS-III, CVLT-II, COWAT, were also examined. Modest significant relationships were found between the phonological test and other tests of verbal working memory. The present studies confirmed that the cued-recall procedures provided effective measures of phonological components of (STM) in healthy controls and established their clinical utility with brain injury patients that both supplements and improves upon other methods such as non-word repetition and serial span.

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#### **E. VAKIL & A. WASSERMAN. The Development Of Perceptual And Conceptual Memory In Different Memory Systems.**

The literature on the development of memory from childhood to adulthood is inconsistent. The literature on memory that shows it to be a complex phenomenon could account for this inconsistency. This literature indicates that memory consists of different systems composed of different cognitive processes such as explicit vs. implicit memory processes or perceptual vs. conceptual memory processes. In this study, we tested the hypothesis that conceptual memory tasks are more sensitive to age than are perceptual memory tasks regardless of whether explicit or implicit memory is involved. Three groups aged 7, 14, and 22 participated in this study. Each group consisted of 32 persons. Six tests were administered to each participant; a conceptual and a perceptual test of explicit memory (category cued recall and pictorial cued recall), priming (category production and picture fragment identification), and skill learning (Tower of Hanoi puzzle and maze master). As predicted, in general, conceptual memory tasks were more age dependent than perceptual memory tasks. These results are interpreted as a reflection of the relation between conceptual memory processes and the frontal lobes and of the age related maturation of the frontal lobe.

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#### **R. P. KESSELS, S. BOEKHORST & A. POSTMA. The Contribution Of Implicit And Explicit Memory To Errorless Learning In Young And Older Adults.**

Preventing the occurrence of errors during learning has been found to be an effective method to overcome memory problems, both in amnesia and in age-related memory loss. Originally, it had been suggested that errorless learning (EL) works through intact implicit memory function. Others, however, have suggested that it is residual explicit memory function that is responsible for the beneficial effects of EL. The current study investigated the contribution of implicit and explicit memory to EL of spatial information in a group of young adults (N=40, ages 20-29) and a group of older people (N=40, ages 60-75, MMSE>27). A computer paradigm was used in which the locations of objects in a room had to be remembered. In the EL condition, the correct location was immediately shown during the learning phase. In the errorful learning (EF) condition, the correct location had to be guessed out of three possible locations. After a 15-minute delay, the instruction in the test phase was varied according to the process dissociation procedure to estimate the contribution of implicit and explicit memory (Jacoby, 1998). The overall result showed that the young group performed better than the older group ( $p < .001$ ). Moreover, the overall memory performance after EL was better than after EF, but only for the young adults ( $p < .05$ ). With respect to the estimates of implicit and explicit memory, there was no difference between the two age groups on implicit memory, while explicit memory function was higher in the young group ( $p < .001$ ), as expected. Furthermore, the contribution of explicit memory was higher in EL compared to EF, but only in the young group ( $p < .05$ ). These findings indicate that residual explicit memory plays an

important role in the efficacy of EL. Also, the clinical applicability of EL in the spatial domain, as well as in age-related memory in general, will be discussed.

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#### **A. D. SANDERS, E SHANNON NEELEY & E. D. BIGLER. Memory Performance in Autism.**

Background and Objectives: Examination into the memory differences between autism and controls have identified significant findings. Support for a working memory deficit has been shown but not with consistency. Some consensus seems to exist for deficits in verbal memory, with relatively preserved visual memory. Greater cohesion within this literature may be gained by examining verbal and nonverbal memory functioning. *Methods:* In the current study, memory performance was assessed using the Test of Memory and Learning (TOMAL) with 12 subjects (age range 7 to 13 years). Two groups were studied, an autistic group (N = 6) and a control group (N = 6). All subjects were male and all autism subjects met Autism Diagnostic Interview, Autism Diagnostic Observation Schedule, and DSM-IV criteria for autism. Each subject was administered 17 subtests of the TOMAL, yielding three indices of memory: verbal (VMI), nonverbal (NVMI) and composite memory index (CMI). *Results:* Significant differences in the VMI,  $t(9) = -4.006$ ,  $p \leq .003$ , were found using an independent samples *t*-test. Significant differences were not found in the NVMI,  $t(9) = -.232$ ,  $p = .822$ , or the CMI,  $t(9) = -2.174$ ,  $p = .058$ . *Conclusions:* Autism subjects evidenced significantly poorer performance in verbal memory abilities than normal individuals. Implications for temporal lobe dysfunction and lateralization of function will be discussed.

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### **Symposium 12/1.30pm-3.00pm**

#### **THE NEUROPSYCHOLOGY OF MENTAL DISORDERS IN YOUNG PEOPLE**

*Chair:* Stephen Wood

Neuropsychological evaluation of people with mental disorders bridges the gap between brain and behaviour. An understanding of the cognitive performance of young people with mental disorders is critical to establishing aetiological theories, especially given the strong emphasis on the role of aberrant neurodevelopment in these illnesses. In this symposium, we will address the neuropsychological features of emerging psychiatric illnesses, and examine the similarities and differences of their presentation. In particular, we will concentrate on the adolescent period, since many psychiatric disorders have their first presentation at this time. Following Pennington (2002), our symposium will consider: 1) The neuropsychological phenotype of specific psychiatric disorders. 2) The aspects of that phenotype which are specific to disorders. 3) How the phenotype changes with development and with continued illness. 4) What aspects of the phenotype predate the onset of illness and are predictive of it.

#### **S. WOOD, C. R. DE LUCA, V. ANDERSON, C. PANTELIS. Cognitive Development In Adolescence: Cerebral Underpinnings, Neural Trajectories And The Impact Of Aberrations.**

The development of cognitive function is a lengthy process that is not complete until early adulthood, and during which different domains mature at different rates and times. An understanding of normal cognitive development is particularly important in order to appreciate the pattern of impairments in children and adolescents who suffer from illnesses of putative neurodevelopmental origin. In this presentation we will discuss the gains in function made during adolescence, a time of major upheaval in

behavioural and social domains. First we will review the structural brain changes that occur during this time, after which we will explore neuropsychological development, with a special focus on executive functions. The development of these skills is characterised by 'spurts' beginning from as young as twelve months of age, with the majority of functions coming online around the age of eight. However, evidence from our own and others' studies suggest that working memory in particular is slow to mature and may not reach maximal levels until early adulthood. We will then discuss links between cognitive and cerebral development, with an emphasis on the impact of developmental lesions. Finally, we will put forward a hypothesis explaining the neuropsychological deficits in schizophrenia as an interaction between the timing of illness onset and the timing of normal cognitive development. Specifically, we suggest that cognitive functions that mature around the time when the illness first presents, such as working memory, are more impaired than those functions that mature earlier.

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**M. YUCEL, D. LUBMAN, S. J. WOOD, C. PANTELIS, P. D. MCGORRY. Substance Abuse, Development Of The Human CNS And Cognition During Adolescence.**

Adolescence is a period of transition from childhood to adulthood - a developmental phase that promotes the acquisition of skills and behaviours necessary for independent living, and this is reflected by the pattern of maturational processes evident within the adolescent brain. In particular, changes occur within cortical and subcortical brain regions that regulate drive, affect and cognition. Disturbances within these same regions are associated with many psychiatric conditions, including substance use related disorders. Whilst the majority of teenagers experiment with alcohol and drugs, for most this is brief or recreational and typically they do not suffer long-term consequences. However, for a small but significant proportion of adolescents, there is a significant morbidity and mortality associated with drug and alcohol use. Within the context of the CNS and cognition, high rates of experimentation with psychoactive substances is suggested to be associated with normal increases in reward sensitivity (e.g., novelty-seeking, risk-taking behaviours) during adolescence. However, problematic substance use is thought to occur when this reward sensitivity is disturbed and/or the cognitive/executive control systems required to regulate this drive are insufficient (i.e. immature). At the same time, there is increasing evidence that compared with the mature adult, adolescents have differential behavioural responses to acute drug administration, as well as increased sensitivity to their neurotoxic effects. These differential effects on CNS function have significant implications for the maturation of cognitive/executive control systems, as well as for the development of future psychopathology, especially in individuals who are already vulnerable.

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**W. J. BREWER, S. J. WOOD, P. D. MCGORRY, S. F. FRANCEY, L. J. PHILLIPS, A.R. YUNG, V. ANDERSON, C. PANTELIS. Olfactory Identification Ability And Limbic-Prefrontal Development: What Do Smell Deficits Tell Us About Adolescence When It Becomes Compromised?**

Previous investigations have revealed stable olfactory identification deficits in neuroleptic-naive patients with first-episode psychosis (Brewer et al, 2001), and in patients at ultra high-risk for psychosis who later develop schizophrenia (Brewer et al, 2003). These findings implicate compromise of fronto-striatal networks and may represent a biological substrate for behavioural disturbances that are mediated by these regions. Indeed, similar approaches have been utilised to examine development of these networks in Aspergers Syndrome, OCD, and impulsive aggression. We provide an overview of the hierarchical nature of olfactory neural pathways. In addition, we discuss the structure of the University of Penn-

sylvania Smell Identification Test (UPSIT) and examine its potential utility for exploring the development of clinical disorders that implicate fronto-striatal compromise such as Autism, ADHD and Borderline Personality Disorder. Applications for assisting differential diagnosis will be explored. (Brewer et al, 2001 Am J Psychiatry, 158, p107-115; 2003 AMJP, 160, p1790-94)

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**T. PROFFITT, S. J. WOOD, G. E. BERGER, P. EIDE, P. CONUS, D. J. SMITH, C. PANTELIS, D. VELAKOULIS, P. D. MCGORRY & W. J. BREWER. Cognitive Function In First-Episode Psychosis: Relationship To Diagnosis, Treatment & Time.**

Since the mid 1990s our group has been conducting comprehensive neuropsychological assessments of first-episode psychosis patients recruited into the research program at the Early Psychosis Prevention & Intervention Centre at ORYGEN. The data collected has been both cross-sectional and longitudinal in nature. The initial aim was to shed light on the pathophysiology of schizophrenia, however, we have more recently begun a more fine-grained analysis of the cognitive profiles of different diagnostic subgroups, defined either by phenomenology, response to treatment, or biology i.e., measures of niacin sensitivity (a proxy for lipid metabolic status), structural and functional imaging, and genetic polymorphisms. Data will be presented showing a lack of specificity of several traditional neuropsychological measures in differentiating bipolar and schizoaffective patients, and groups of affective and non-affective psychosis patients will also be compared. Finally, we will examine the utility of the newer biological measures in predicting cognitive outcome following a first episode of psychosis. The implications of these findings to our understanding of the trajectory and nature of cognitive change occurring in young people with psychosis will be discussed.

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**S. FRANCEY, W. J. BREWER, S. J. WOOD, L. J. PHILLIPS, T. PROFFITT, H. J. JACKSON, A. R. YUNG, P. D. MCGORRY & C. PANTELIS. Neuropsychological Functioning in Young People at Ultra High-Risk of Developing Psychosis: Findings from the PACE Clinic.**

Clinical criteria defining ultra high-risk for psychosis have been developed at the PACE Clinic, and prospective research has demonstrated that approximately 35% of young people meeting these criteria will develop psychosis within 12-months. Examination of the neuropsychological functioning in this group can contribute to the growing body of knowledge about the neurodevelopmental processes underlying psychotic illnesses and assist in the search for neurocognitive predictors of psychosis. Neuropsychological functioning, with a particular focus on proposed vulnerability indicators, has been assessed in the ultra high-risk group since the PACE Clinic was first established. This paper will present an overview of the neuropsychological research conducted to date, describe the neurocognitive profile of the ultra high-risk group, and indicate which deficits have been found to be specific to those young people who develop psychosis within a short follow-up period.

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**B. AGIN & N. ALLEN. Facial Emotion Processing In Students At Risk For Depression, Psychosis And Anxiety: A Psychophysiological Study.**

Psychophysiological aspects of social emotion processing were investigated in individuals at risk for psychopathology. Individuals prone to depression, psychosis, or anxiety disorders were identified using trait-based psychometric measures of risk. Participants viewed pictures of happy, neutral and angry faces in two experiments; one using a free-viewing condition and one using a backward masking paradigm with individually



established emotion recognition thresholds. Psychophysiological measures of attention and emotion included startle eyeblink modification, event-related brain potentials, and facial electromyography. In the backward making condition, which probes automatic processes, there were no group differences across measures, suggesting that subcortical bottom-up processing of social emotional cues is intact in individuals at risk. In contrast, in the free-viewing condition, which allows the measurement of more cortically mediated processes, group differences emerged in both processing and responding to emotional faces. The depression-prone and psychosis-prone groups showed weaker facial muscle responses, inhibited startle eyeblink responses, and reduced late event-related potentials to emotional faces. These effects were strongest when viewing facial expressions turned at a 45-degree angle from the viewer. Our findings indicate that for individuals at risk for serious psychopathology, semantically complex social emotional stimuli impose a particularly heavy burden on cortical systems of attention. Compared to other participants, depression and psychosis-prone individuals allocate greater cognitive resources to the processing of semantically complex social-emotional stimuli. It is possible that these cortical effects reflect disorder-specific deficits such as ruminative processes and inability to disengage from negative stimuli in depression and theory-of-mind deficits in psychosis-proneness.

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### Symposium 13/1.30pm-3.00pm

#### DUAL-TASK METHODOLOGY IN ATTENTION CONTROL IN AGEING AND NEUROLOGICAL DISABILITY

*Chair:* Janet Cockburn

*Discussant:* Barbara Wilson

The ability to divide attention between activities depends on a number of factors, including the nature of the tasks, the modality in which each is presented, the extent to which their attentionally demanding components can be interleaved and the information-processing capacity of the individual. The dual-task paradigm is a potentially useful tool for investigating the current attentional load of previously overlearned activities in older adults or individuals recovering from brain injury. However, difficulties arise in quantifying the extent of the competition between tasks presented in different domains and also in determining salient factors that influence differences in performance across tasks and across individuals. The five papers in this symposium all use dual-task methodology to explore interactions between tasks, with the aim of quantifying and interpreting reciprocal interference that may affect everyday functioning. The first paper discusses the role of the Central Executive of working memory in coordinating attention to two competing tasks, with specific focus on impairments after acquired brain injury. Exploration of the complex interaction between visual conditions and cognitive task difficulty in modulating postural control in older adults is presented in another paper, while a third compares disruption of sitting balance during concomitant oral activities in stroke patients and healthy older adults. Development of a new test to quantify dual-task decrements in cognitive and motor domains is also introduced. The last paper presents a single-case study to illustrate how such a test may be used to document recovery from post-traumatic amnesia. Finally, Barbara A. Wilson leads a discussion into present and future roles for dual-task methodology in neuropsychology.

#### **T. M. ANDERSON & R. G. KNIGHT. Executive Ability Following Traumatic Brain Injury: Is The Dual Task Test More Sensitive Than Traditional Executive Measures?**

Executive abilities are often damaged following Traumatic Brain Injury (TBI). Traditional measures of executive ability are not optimal because

they contain within-task confounds and lack a theoretical basis. Working Memory (WM) models contain executive components that could provide the basis for improved assessment techniques. Baddeley (1986) proposed a model of WM that included a Central Executive (CE) processor that worked to oversee two slave systems, namely the phonological loop, and the visual spatial sketchpad. The CE processor is thought to co-ordinate the two slave systems in the interests of parallel and/or interactive processing. The Dual Task Test was designed to isolate the co-ordinative function of the CE by recording performance on tasks that measure the separable slave functions. A speeded tracing task was developed to engage the visual spatial sketch pad and a verbal digit span task was used to engage the phonological loop. Tasks were completed under individual and dual conditions. The present study aimed to investigate whether the theoretically based Dual Task Test was more sensitive to TBI dysfunction than traditional executive measures. Forty-five TBI and 21 matched control participants completed The Dual Task Test, 3 traditional executive measures, and 5 outcome measures. The Dual Task Test evidenced the greatest sensitivity to injury status, injury severity, and a closer relationship with outcome. It was concluded that theoretically driven measurement techniques that utilize dual-task methodology offer a more injury-sensitive assessment of executive skills essential for successful everyday functioning after TBI.

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#### **C. HARLEY, J. COCKBURN, J. P. WANN, R. M. WILKIE. Visual Control of Posture is Mediated by Cognitive Demands.**

Successful postural control during standing requires integration of visual, vestibular, and somatosensory information to ensure appropriate postural adjustments. Here we examine how this integration is affected by divided attention in healthy adults. Participants adopted a conventional upright stance and performed a range of cognitively demanding reaction time tasks: single tone (simple reaction), discrimination of high-low tones, number discrimination, a clock face choice reaction, or a control task with no secondary task. As these tasks were being completed we presented one of three visual conditions: darkness, a static wall scene, or a wall moving along the participants' anterior-posterior axis (visual sway perturbation). Analysis revealed a positive correlation between cognitive task difficulty and reaction times, and that perturbed visual conditions increased the amount of sway. However, we found that sway was reduced during perturbed visual conditions when participants performed a cognitive task, consistent with a reduced sensitivity to visual information and a tighter control over sway. We consider the results in terms of successful strategies for postural control and discuss the ageing model of cognitive and visuo-motor interference.

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#### **J. BOYD, C. HARLEY & J. COCKBURN. Cognitive Demands Of Unsupported Sitting During Recovery From Stroke.**

A number of studies have identified circumstances in which postural control is affected by simultaneous attention to a cognitively demanding task. This study extends our previous research into dual-task interference after acquired neurological damage by investigating effects during early recovery from stroke. Patients who have regained sufficient postural control to sit unsupported for one minute at a time are recorded in three conditions: sitting alone, sitting plus repetitive speech, sitting plus oral word category generation. Results from a comparison group of healthy older adults showed a progressive increase in movement about the centre of pressure from sitting alone, through repetitive speech to oral word generation. There was no difference in number of words generated during supported or unsupported sitting, suggesting that attention was directed towards the cognitive task. In contrast, preliminary results from eight patients between one and four months post-stroke indicate no consistent evidence for greater move-

ment about centre of pressure during word generation, which demands both thinking and oral output, than during repetitive speech. Nor does unsupported sitting result in fewer words generated than supported sitting. However, there are wide variations in stability of postural control in single-task unsupported sitting, in number of words generated and also in the extent of dual-task decrement. We suggest that in early stages of motor recovery after stroke, sitting balance has not yet become re-automatised. Therefore, unsupported sitting is using overall processing resources to the extent that any form of distraction, even if cognitively undemanding, may disrupt postural control.

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#### **J. J. EVANS, E. GREENFIELD & B.A. WILSON. The Development Of An Ecologically Valid Test Of Divided Attention.**

We describe the development of a new test battery to examine difficulties with divided attention in people with acquired brain injury. Deficits in divided attention are common after brain injury and cause disruption to everyday life and rehabilitation. This is reflected in such comments from patients as “Don’t talk to me while I am walking”. A test battery was developed to include motor and cognitive tasks that can be administered as single or dual tasks. We tested 132 controls (aged 16-65 and covering a range of IQs), and 65 people with brain injury. We demonstrated that the battery was both valid and reliable and also sensitive to brain injury. Not only was the overall performance poorer in the brain injured people, but in every dual task the deficit of at least one component was significantly greater. This was particularly notable with walking when paired with saying “true” or “false” to sentences ( $p=001$ ). However, in the dual cognitive test, the deficits of both components were significantly different to the controls ( $p=001$ ). The effect of age and IQ appeared to be more relevant to the brain injured group. We conclude that this test is a good measure of divided attention and one that can be used both to monitor recovery and measure the efficacy of cognitive rehabilitation.

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#### **E. GREENFIELD, J. EVANS & B. WILSON. Use of a Divided Attention Test to assess emergence from Post Traumatic Amnesia.**

Recent studies have suggested that post traumatic amnesia (PTA) is best characterised as a disorder not just of memory, but includes deficits in attention and speed of information processing. Few studies have, however, prospectively examined recovery of attention during and after PTA. We present a single case study of an 18 year old man (FT) on a new test of divided attention, as he emerged from PTA. FT was assessed using a battery of cognitive and motor tasks that can be undertaken as single tasks or combined to assess dual task performance. We predicted that divided attention performance would be impaired whilst in PTA, but show substantial recovery with emergence from PTA. FT was tested twice while still in PTA and twice after emergence from PTA. His motor status was stable at the time of testing, demonstrated by the walking element of the test. He was able to perform the single tasks, satisfactorily, whilst in PTA. He could also do two motor tasks, and a motor and cognitive task together. However, he was severely impaired in performing dual cognitive tasks. As predicted, as he emerged from PTA (defined by an independent clinician), his performance on dual cognitive tasks showed significant recovery. The results further highlight the need to characterise PTA in terms broader than just memory functioning, and suggest that this divided attention test battery may be a useful tool in monitoring recovery from traumatic brain injury.

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### **Clinical Forum 3/1.30pm-3.00pm**

#### **ASSESSING COMPETENCE FOR LEGAL DECISION MAKING IN ACQUIRED BRAIN IMPAIRMENT.**

*Chair: Alison Ferguson*

The symposium aims to raise the awareness of participants to the range of issues surrounding legal decision-making in acquired brain impairment, and to enhance the ability of participants to think critically regarding these issues as applied to clinical assessment practices. An overview will be presented of the range of legal decision-making issues relevant to the management of acquired brain impairment including the types of decision-making issues (including informed consent for medical interventions, consent to be involved in research, guardianship, and testamentary capacity), and the continuum of formality in determining competence for such legal decision-making. The second part of the overview will discuss examples of relevant research in the area (focusing on testamentary capacity in aphasia), and will reconceptualise the issues as a dynamic social process, reflecting cultural contexts and changing over time and across situations. This overview will relate the issues related to the determination of legal decision-making to the WHO model of social participation. This overview will be presented by a number of speakers with expertise from a range of disciplines, including neuropsychology, speech pathology, medicine, and law

#### **A. FERGUSON. Aphasia And Testamentary Capacity: A Case Study.**

This paper presents a description of the legal judgement in a case of testamentary capacity that involved a challenge to the will of a woman who had severe expressive aphasia at the time when she had made significant changes to her will. The publicly available legal documentation of the judgement provided an explicit account of the reasoning that led to the determination of testamentary capacity, and highlighted the nature and sources of evidence that were seen by the judge to be of key importance in informing his decision. Apart from the legal argumentation and discussion of prior legal cases, the judge was found to rely heavily on the descriptions of the everyday communicative functions of the person with aphasia (including reported discourse samples) that were offered by family members, carers, and nursing and medical staff who knew the speaker. The judge considered that the opinions of expert witnesses (psychiatrist, neuropsychologist) were not such as to convince him to disregard the lay evidence. This case offers a different view of the types of assessment practices and documentation of assessments of people with aphasia that would be of greatest value to the legal processes involved in determining testamentary capacity.

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#### **R. BUSKELL. Clinical Issues In Legal Decision Making: An Introduction.**

Even very competent experienced clinicians can feel daunted when asked to provide reports or appear before tribunals regarding the capacity of clients to make legal decisions. This is partly because of the lack of specific training in how to apply their expertise to these questions and partly because of unfamiliarity with the workings and requirements of the legal system(s). This segment will provide participants with an overview of the issues relevant to practising clinicians around questions of the legal decision-making capacity of their clients. It will review the domains of decision-making that are commonly questioned or affected in clients with such acquired brain injury conditions as dementia, stroke, and traumatic brain injury and will canvass the spectrum of processes, both clinical and legal, commonly utilised in reaching a determination of the capacity of

individuals. Participants will gain some insight into how a relevant tribunal works in relation to the role of professional reports and evidence.

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#### **H. P. BENNETT & P. HALLEN. Dementia, Cognition, and Testamentary Capacity.**

The demographic and scientific context in which Wills are made has changed considerably over the past century, yet the standard set in the 1870 English case of *Banks v Goodfellow* remains the test for testamentary capacity to be applied by the Courts in Australia. The changes include the increasing ageing of the population, together with an increase in knowledge of the prevalence and nature of the brain disorders of old age and of how resultant cognitive deficits might differentially impact upon testamentary capacity. The legal standard for testamentary capacity includes five elements (*Read v Carmody*) which may be reframed as questions for clinicians to address when assessing cognition and capacity: a) If cognitive impairments are present, would they (or any of them) have compromised capacity with respect to the awareness and appreciation of the significance of the act of making a Will?; b) If impairments are present, would they have compromised capacity with respect to the awareness, at least in general terms, of the nature and extent and value of the Will-makers estate?; c) If impairments are present, would they have compromised capacity with respect to an awareness of those who might reasonably have been thought to have a claim upon the Will-makers testamentary bounty?; d) If impairments are present, would they have compromised capacity with respect to the ability to identify, evaluate, and discriminate between the respective strengths of the claims of such persons?; e) Is there a disorder of mind such as delusions or hallucinations which would influence an awareness of facts or reasoning and decision making ability, specifically with regard to the above 4 capacities? This paper will discuss how cognitive impairments in each of the cognitive domains might impact upon these criteria differentially. It will also discuss the role of this information within the broader context of the Courts ultimate decision regarding capacity.

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#### **H. TINSON, D. FOGARTY, J. ORAM & D. SHUM. Decision-Specific Cognitive Capacity In Adult Brain Injury Patients.**

Neuropsychologists in the hospital setting are frequently asked to conduct cognitive competency assessments to assist medical opinion on patients' capacity to make decisions. Recent changes to the Queensland Powers of Attorney and Guardianship and Administration Acts have implications for how these assessments are conducted. Presently, no guidelines, or universally accepted practices exist regarding how to assess decision-making capacity. Much of the published research has been conducted with medical, psychiatric or geriatric patients in overseas countries. A variety of approaches have been tried with mixed success e.g. the Mini-Mental Status Examination (Folstein, 1975). Studies have tended to focus on consent for medical treatment rather than the range of issues for which patients with brain injury are commonly required to make decisions. The primary aim of this project is to develop brief comprehension and reasoning tasks specific to decisions about assigning an Enduring Power of Attorney and post-discharge living arrangements. The second aim is to compare decision-specific task performance with performance on more general tests of cognitive and executive functions as well as with clinical opinion about an individual's decision-making capacity. The development of decision-specific measures will be described including examples of the types of questions generated to assess capacity and the use of alternative response formats (e.g., multiple choice) which may enable individuals to circumvent particular cognitive impairments and demonstrate capacity. Preliminary

data from brain injury patients demonstrates the utility of the decision-specific measures in discriminating between patients with and without decision-making capacity. Deficits in attention, working memory, new learning, reasoning, and self-awareness contribute significantly to reduced capacity. Ultimately, this research will guide future clinical practice and safeguard patients from misclassification.

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#### **J. COWDROY. Evidentiary Aspects Of Assessing Competence For Persons With Acquired Brain Injury.**

Assessing competence for decision making in persons with acquired brain injury occurs in a number of settings and by a range of professionals. This paper examines the different arenas in which assessment of competence for decision making occurs.

In the legal setting, it most frequently occurs in the context of assessment for the purposes of determining testamentary capacity, the capacity to enter into a contract and the capacity of the client to provide instructions in relation to legal matters. It also arises when substitute decision makers are being considered in relation to guardianship and administration matters.

This paper traces the historical development of legal principles in relation to capacity (competence) in the common law (case law) through to the enactment of various legislative provisions which regulate such matters, with particular emphasis on the Queensland Guardianship and Administration Act 2000. The powers given to substitute decision makers under that Act and other Australian legislation are discussed.

It also examines judgments of significance in various Supreme Court of Australia jurisdictions. The paper addresses the various tests which the legal profession utilise in assessing evidence of competence, together with a discussion on the reliance placed by the legal profession on the opinion of practicing clinicians.

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#### **INS Presidential Address/3.30pm-4.30pm**

#### **J. BRANDT. Very Early detection of Degenerative Brain Disease: The Case of Huntingtons Disease.**

The aging of the world's population has resulted in an increased prevalence of degenerative brain diseases causing dementia. Despite phenomenal neuroscientific progress in the past few decades, many of these conditions remain incurable and the sources of significant morbidity. Early diagnosis of these dementias, before there is massive neuronal loss and functional incapacity, is essential for testing interventions to slow their progression and for implementing care measures to maximize functioning. In many ways, Huntington's disease (HD) is an ideal disease for studying the evolution of cognition from normal functioning to profound dementia: 1) Its mid-life onset means that the dementia is not confounded by normal cognitive aging or other diseases prevalent among the elderly. 2) Its neuropathology is relatively stereotyped and well-understood, allowing for clinicopathological correlations. 3) Its etiology is a known mutation in a single, dominant gene, permitting the certain identification of normal individuals destined to become afflicted.

This address will review 20 years of research from the Baltimore HD Research Center on the neurological and cognitive characteristics of patients with HD, their differences from those of other dementias, and their relationship to genetic factors. Specific neuropsychological and neuroimaging paradigms have revealed highly selective brain changes in some persons with the *huntington* mutation several years before onset of clinical symptoms. These will be described, as will the implications of these morphological, physiological, and cognitive changes for the design of treatment trials and programs of care.

SATURDAY MORNING, JULY 10<sup>TH</sup>, 2004

## Poster Session 5/9.00am-12.30pm

LANGUAGE, SEMANTIC MEMORY,  
MEDICAL CONDITIONS**S. TOMASZEWSKI FARIAS & G. HARRINGTON. The Presurgical Evaluation Of Language Localization And Lateralization Using fMRI.**

The intracarotid amobarbital procedure (IPA), or Wada test, is currently the gold standard in determining language lateralization in the presurgical assessment of epilepsy and other CNS lesions. Functional MRI is fast approaching as a viable alternative with good concordance between the two methods. Additional benefits of fMRI include intra-hemispheric localization of specific language abilities. However, fMRI has yet to achieve its full potential as a clinical tool in this regard. In this study we present data on the development of a comprehensive language lateralization and localization fMRI protocol in a sample of 38 right-handed controls. Language paradigms examined included: confrontation naming, verb generation, auditory and visual sentence reading, semantic decision-making, and story listening. We compared the laterality index (LI) for each task across anterior and posterior language zones to examine: 1. how laterality indices differ for each paradigm across cortical regions of interest, and 2. which groups of paradigms would produce activation in both regions of interest in 100% of subjects. Results showed that LIs varied considerably between tasks and were heavily dependent on the region of interest. Some of the paradigms that had a stronger receptive component produced stronger LIs for the posterior language zone. Verb generation was the single best task, both in terms of generating activation in a high percent of subjects, and in producing high LIs across both cortical regions. Various combinations of tasks are presented which provided activation in 100% of the sample and produce strong activation in both anterior and posterior language zones.

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**GREG S. HARRINGTON, D. FARIAS & C. DAVIS. Neural Correlates Of Semantic Drawing: An fMRI Study.**

Drawing familiar objects is a complex motor skill with high visuospatial demands that requires access to semantic memory. However, there have been few neuroimaging studies investigating the neural substrates for drawing. Drawing can be used to communicate non-verbally and has been utilized in the clinical setting with aphasic patients to help facilitate the naming of objects. Farias et al. (2003) compared the mental imagery of drawing versus writing and found similar activation patterns for the two tasks with stronger activations for drawing in regions involved in visuospatial and language processing. The goal of the present study was to investigate the semantic aspects of drawing objects by comparing the drawing of familiar objects versus unfamiliar objects using simulated drawing. For the fMRI experiment, the subjects (n=9) simulated (imagined) drawing either a familiar object or an unfamiliar object that they previously viewed on a screen. The two conditions were compared with a general linear test. There were multiple areas in the left hemisphere that were more active for drawing familiar objects compared to unfamiliar objects. These areas include the inferior posterior temporal (BA37), anterior inferior frontal (BA 46), anterior cingulate, precentral, inferior parietal and supplemental motor areas. We hypothesize that the BA 46 activation is due to the selection of specific semantic features of the object as well as retrieval of information regarding the perceptual input of the object versus the stored memory. This activation is linked to BA 37, which is involved in object recognition as well as semantically mediated speech.

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**Y. NAKAGAWA, M. OTSUKI & M. INOKAWA. Brain Process On Single Tool Use.**

The underlying mechanism of apraxia on single tool use is still on debate. To specify which kind of tool cannot be used, we theoretically classified tools into familiar and unfamiliar tools. Then, to specify which kind of process for performing single tool use can be damaged, they were divided into two distinctive phases; (1) a phase for evoking or organizing usage of familiar or unfamiliar tools; (2) a phase for realizing movements according to the evoked or organized usage. Utilising these theoretical distinctions, we investigated two patients, showing deficits on process for single tool use following left hemisphere damage. As a result, the underlying mechanisms for apraxia on single tool use (ideational apraxia) can be attributed to a deficiency in the process for evoking movements for using familiar tools. In addition, "familiar" tools should be actually restricted to the "tools supported by repetitive or symbolic movements." Manipulation of the tools supported by these repetitive or symbolic movements could facilitate action-somatosensory feedback linkage (i.e., skill). Thus, failure of evoking this linkage may result in apraxia of single tool use (ideational apraxia). Use of other tools lacking this linkage may be mediated by another strategy.

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**M. RAI, M. OTSUKI, B. HYON, H. MORIWAKI & H. NARITOMI. Frontal Pure Agraphia. The Mechanism Of Writing Related To The Frontal Lobe.**

*Background and Purpose:* Frontal lobe lesions can cause pure agraphia, although the mechanism of writing disturbance remains unknown. We evaluated patients with frontal agraphia to clarify the issue. *Methods:* We examined three Japanese patients who developed writing impairment after brain infarction limited to the frontal lobe. All lesions were assessed by MRI. Western Aphasia Battery and other cognitive tests were administered within one month after onset. We assessed writing errors by writing single letters, single words, several words, and sentences, using kana (syllabograms) and elementary school levels of kanji (morphograms). *Results:* All patients presented pure agraphia. Their common lesions were located in the precentral gyrus of the dominant hemisphere. They wrote well-formed letters and all single kana letters correctly. However, they made 1.3 - 16.6% errors in writing single words. There was no significant difference in frequency of errors between kana and kanji. The most frequent errors were paraphasia and no response. They tended to make more mistakes when they wrote longer words or sentences. Paragraphic errors were frequently observed with spontaneous writing. In writing kana words, the more letters were comprised of the words, the more paragraphic errors resulted. *Conclusions:* Two points are considered to be impaired in the writing processes. The first is evoking the visual image of letters and the unit of letters which consists of words. The second is selection and arrangement of the appropriate letters for writing words and sentences. The latter one appears to be more severely impaired in frontal pure agraphia.

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**L. SCHMALZL & L. NICKELS. Treatment of Acquired Dysgraphia: Selective Benefit from Visual Mnemonics.**

In contrast to the numerous treatment studies of spoken language deficits, there have been relatively few studies concerned with the treatment of spelling disorders. Among these, there have been only a small number that have targeted specific components of the spelling process. We describe a successful single case treatment study for FME, a woman with acquired dysgraphia, which was conducted within a cognitive neuropsychological framework. Pre treatment assessment revealed a semantic deficit, impaired access to output orthography and probable additional degradation of the actual representations within the orthographic output lexicon. The

treatment study was therefore directed toward relearning spellings by strengthening, and facilitating access to, specific orthographic representations for writing. In order to maximize the functional outcome for FME, treatment was focused on high frequency irregular words. The treatment program was carried out in two phases, one without and one with the use of mnemonics, and the results showed a selective training effect with the mnemonics alone. Treatment benefits were item specific but long lasting, and a significant improvement in FME's spelling performance was still evident at 2 months post treatment. The current study confirms how cognitive neuropsychological theories and methods can be successfully applied to the assessment of acquired spelling impairments, and exemplifies how treatment with carefully designed mnemonics is of benefit if the inability to retrieve orthographic representations for writing is aggravated by a semantic deficit.

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**J. M. GLOZMAN, A. V. VARTANOV, & A. A. KISELNIKOV. Brain Mechanisms Of The Readiness To Speak.**

The readiness to speak is an important component of the verbal functional system. Component disturbances form the main mechanism of stuttering. This paper is a cross-disciplinary cognitive and neural analysis of the mechanisms of speech in normal and stuttering subjects. It is aimed to identify the neural and neuropsychological mechanisms of stuttering, a frequent and stable disorder of speech, revealed in about 3.5% of the population, both children and adults, severely interfering with their cognitive and social functioning. The original method of analysis of electrical brain waves images preceding pronunciation combining: the 16 channel electroencephalography (EEG) with spectral analysis; event related brain potentials with multimodal approach to source reconstruction; the dipoles model of space localization of cerebral activation with differentiation of cortical and subcortical components of this activation; mapping methods - together with the magnetic resonance imaging (MRI) and the comprehensive neuropsychological assessment using Luria methods reveal the neural mechanisms of readiness for speech (verbal action preparation). The preliminary cerebral activity is synchronized both with verbal sounds perception and with word pronunciation. A comprehensive neuropsychological assessment proves that the neural organization of the readiness to speak is related to individual patterns of cognitive functioning and the cerebral dominance of subjects. Both inter- and intrahemispheric interactions of brain structures realize the readiness potentials. A longitudinal follow-up proves that these interactions are the subject of changes during speech rehabilitation. It opens possibilities for neural analysis of different levels of conscious representation, as well as for studying coordination and integration of cerebral structures, providing verbal regulation and mediation of human conscious activity.

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**L. A. PETCOPOULOS & J. DOUGLAS. The Impact of Speech Impairment Upon Subjective Identity Construction During Treatment.**

The present study was designed to evaluate the impact of speech impairment upon one man's subjective identity construction before, during and after an intensive treatment program. The intensive treatment program was designed to improve speech intelligibility by encouraging and developing the participant's self-monitoring skills. The study involved two main aims. The first aim was to evaluate the effectiveness of an intensive treatment program upon speech intelligibility for a man with severe-chronic mixed spastic-ataxic dysarthria. The second was to develop an insight into the participant's current psychosocial level of functioning by monitoring impairment, subjective identity construction and social participation before, during and after an intensive treatment program. Subjective identity construction was viewed as a dynamic process through social interaction. The treatment evaluation for speech intelligibility employed a quantitative method using single case time series analysis. Subjective identity construction was analysed through a qualitative method involving thematic analy-

sis of in-depth interview transcripts. The findings revealed a significant increase in speech intelligibility scores at post-test and follow-up. They also revealed a reconstruction in subjective identity occurred for the participant over the length of the treatment program. It was concluded that the nature of the intensive treatment and the focus on his self-monitoring skills improved his speech intelligibility. It was also concluded that speech impairment impacted negatively upon the participant's identity at four years post-onset and that this changed over the length of the treatment program.

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**M. OTSUKI, Y. SOMA, Y. NAKAGAWA, A. MATSUMOTO & H. NARITOMI. The Role Of The Left Insula For Language Function.**

Background and Purpose: Little is known about the role of the left insula cortex regarding language function. Several reports suggest that the area is related to articulation and auditory recognition. We examined the language function of 9 patients who had infarction in the left insula, Broca's area or both to clarify the role of the left insula for language function. Methods: 9 right-handed Japanese patients (6 males, 3 females) who had language impairment after infarction were examined. Their lesions were assessed by MRI, and we administered the Western Aphasia Battery first within a month and followed it up to for several months to years. Results: All the patients did not show articulatory impairment. All the patients showed difficulty in comprehension of sentences but not words. The patients whose lesions were involved the left middle frontal lobe showed comprehension impairment of words. The patients whose lesions were restricted to Broca's area demonstrated difficulty in word generation, but it was not severe and improved in several months. The patients who had lesions in the left anterior insula showed severe disability in word generation, while, those who had lesions in the left posterior insula showed only trivial difficulty. Conclusion: 1) The left insula and Broca's area are not related to articulatory impairment. 2) Word comprehension impairment is found only when the lesions include the left middle frontal lobe. 3) Both Broca's area and the left insula cause difficulty in word generation, and the involvement of the left anterior insula makes the symptom severe and persistent.

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**S. NISHIYAMA, M. MATSUI, S. TANIGUCHI & M. KURACHI. Neural Mechanism For Selective Impairment Of Reading Following Occipital Lobe Damage.**

The purpose of this study was to examine the neural mechanism of the selective impairment of reading. We evaluated two patients with left occipital lobe lesions in different locations. Patient1 (with pure alexia, associative visual agnosia and right homonymous hemianopia) had a lesion in the left medial occipital lobe and the splenium of the corpus callosum on MRI. His Full Scale IQ was 67 (verbal IQ=79, performance IQ=57) and he showed pure alexia without aphasia on assessment with the Western Aphasia Battery (WAB). Patient2 (with right homonymous hemianopia) showed a lesion in the left lateral occipital lobe on MRI. Her Full Scale IQ was 101 (verbal IQ=101, performance IQ=83) and had no aphasia on assessment with the WAB. We examined the ability to read 46 kanji (single ideograms), 46 kana and 26 alphabet letters (single phonograms) to investigate whether phonograms and ideograms are dissociated in oral reading. Patient 1 demonstrated a reading score for kanji that was significantly higher than that for kana ( $p < .01$ ) or that for alphabet letters ( $p < .01$ ). The scores for kana were not significantly different from those for alphabet letters. Moreover, there were no significant differences between the scores for high complexity kanji (>6strokes) and low complexity kanji (<6strokes). Patient2 showed a perfect score on each task. This study revealed that a lesion in the left medial occipital lobe and the splenium of the corpus callosum can impair the ability to read phonograms indepen-

dently of the complexity of the letters. We suggest that the process of phonogram reading is mediated by these regions.

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**M. A. ROBISON, N. A. LAMBERT, D. CAINE & L. A. MILLER. Semantic Knowledge Impairment In Patients With Unilateral Temporal Lobe Damage: Effect Of Aetiology Of Lesion On Access And Storage.**

In a study of patients with temporal lobe lesions of different etiologies we found the right temporal (RT) group was impaired at recognising photographs of famous faces, but not of famous buildings, and the left temporal (LT) group was poor at naming people, buildings and everyday objects from pictures and description. In the present investigation, we explored whether aetiology affects the ability to access knowledge from these semantic categories on the basis of pictures versus descriptions. Patients with LT (2 lobectomy, 4 stroke, 2 focal atrophy) and RT (3 lobectomy, 5 stroke, 1 atrophy) lesions were compared to 12 normal control subjects. Patients with temporal lobe atrophy of either hemisphere (LTA and RTA) demonstrated near-pervasive deficits in recalling names and specific semantic details about people, buildings and objects from both pictures and description as well as in recognising which face or building was famous. LT lobectomy (LTL) patients had difficulty naming people, buildings and objects, largely irrespective of whether presented with pictures or definitions, whereas LT stroke patients were only impaired at naming pictures of buildings. The LTL and LTA patients were also deficient at recognising which object name fit a description. RT lobectomy and RT stroke caused no impairments. Hence, aetiology of temporal lesion had a significant impact on pattern of semantic knowledge deficit, with focal atrophy causing the most dramatic impairments. Given that the temporal pole was spared in the stroke cases, it is argued that the LT anterior neocortex is a repository for knowledge about common objects.

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**N. A. LAMBERT, M. A. ROBISON, L. A. MILLER & DIANA CAINE. The Effect Of Unilateral Temporal Lobe Lesions On Face Recognition And Access To Person Specific Knowledge.**

The roles of the right and left temporal lobes in the processing of faces and person-specific knowledge are still to be clearly defined. Does access to person knowledge differ from other kinds of objects with respect to laterality of lesion effects? Are laterality effects mediated by stimulus modality (i.e., pictures versus descriptions)? This study aimed to investigate these questions by comparing patients with left temporal (LT) (n=8) and right temporal (RT) lesions (n=11) to normal control subjects (n=12) on verbal and visual tests of people, buildings and objects. The RT group was impaired at recognising which was a famous face, but not at choosing pictures of famous buildings or famous names from non-famous distractors. The LT group was impaired at naming people, buildings and objects, when presented with either a picture or a verbal description of the item. If face recognition per se is controlled for, there was no difference between right and left temporal patients in producing person-specific knowledge to faces or names. Thus the right temporal lobe seems to be important for the perceptual processing of faces (face recognition per se) but not the visual recognition of other kinds of objects. The left temporal lobe is important for naming, irrespective of category, or stimulus modality. There was no evidence from these results that the RT lobe differs from the left in accessing information about people across modalities.

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**K. SAITO, M. OTSUKI, K. NAGATSUKA & H. NARITOMI. Impairment Of Visual Knowledge And Imagery Of Other's Belongings: A Case Study Of Partial Disturbance Of 'Categorical Attitude'.**

We report a patient who suffered impairment of visual knowledge and imagery of other people's belongings. The patient was 74-year-old right-

handed Japanese woman who had an infarction in the left temporo-occipital lobe and hippocampus. Neurological examinations revealed that she had right upper quadrantanopia but no motor or sensory impairment. General intelligence was preserved, and her memory disturbance was not significant. Formal language examinations demonstrated that she had two-way anomia, pure alexia and agraphia of Kanji (Japanese morphograms). Prosopagnosia and topographical amnesia were not present. Detailed examinations revealed her characteristic impairment. First, she had difficulty in confrontation naming, but she was able to name from tactile and auditory information and name by word definition. However, this symptom was not attributed only to visual agnosia because she was not able to spontaneously draw pictures nor retrieve any visual information (shape, colour and so on) of the objects, although she was able to copy the drawings well. There was only one exceptional category: her own belongings. She visually recognized all her belongings and retrieved their visual information. For example, when the photo of her wardrobe was presented, she immediately named it 'wardrobe', while when the examiner's wardrobe was presented, she hesitatingly named it 'hatch'. Goldstein described the possibility of disturbance of 'categorical attitude' (abstract attitude) as one of the mechanisms of anomia (1948). We concluded that presumably the patient had the disturbance of partial 'categorical attitude' limited to visual knowledge and imagery.

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**D. FARIAS & C. DAVIS. The Relatedness Of Drawing Quality And Naming In Aphasia.**

Previous research with aphasics has demonstrated a conceptual link between drawing and language such that drawing reflects the integrity of the semantic-lexical system. Our current research suggested that drawing can be used to access the semantic-lexical system thereby facilitating naming. The purpose of this study was to determine the relationship between drawing quality, naming, handedness of drawing and classification and severity of aphasia. We proposed the following hypotheses: 1) more detailed drawings would be related to higher naming scores by systematically accessing the perceptual features of the object which would activate the semantic-lexical network to a threshold sufficient for accurate word selection and production; 2) higher word-picture match scores would be related to drawings that were rated higher on quality and detail reflecting the integrity of the semantic-lexical system; 3.) drawing quality would be unrelated to severity or classification of aphasia. Twenty-two aphasic patients were administered a modified version of the Reading Comprehension Battery for Aphasia. Scores on confrontational naming, naming while drawing and picture-word match were obtained. Drawings were analysed by multiple-raters to assess the quality and detail of their drawings. Results supported previous findings that severity and classification of aphasia were unrelated to drawing quality. Contrary to our predictions drawing quality did not correlate to semantic-lexical measures, nor was quality related to naming abilities. However there was a significant correlation of handedness to naming with dominant handedness producing more accurate naming, but not better drawing quality. The role of drawing in a language model is discussed.

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**D. M. MAHALICK, J. P. GREENBERG & J. MCGINLEY. Neuropsychological Sequelae of Exposure to Toxic Anhydrous Ammonia.**

Objective: Currently, there is no literature that describes the neurological, and neuropsychological sequelae of toxic exposure to anhydrous ammonia. The purpose of this study is to outline the symptom complex secondary to significant exposure to anhydrous ammonia.

Method: The study group consisted of 17 males between the ages of 27 and 57. Subjects were physician referred to rule out suspected neurological/neuropsychological deficit secondary to toxic exposure. The group was divided into those subjects who sustained "High Exposure" versus "Moderate Exposure." Subjects underwent Neuropsychological and Neurologi-

cal Examination (including EMG). Performances of the "High and Moderate" exposure groups were compared on various neuropsychological and neurological examinations. Performances were also compared to the general "normal" population. Various a priori assumptions were established regarding performances between the two study groups and the normal population.

Results: Preliminary statistical analyses utilizing T-tests demonstrated significant differences between clinical and normal populations on neuropsychological functioning, usually at levels less than  $p < .05$ . Most subjects in this study demonstrated abnormalities on neurological examination as well as on EMG studies. Comparisons between "High Exposure" and "Moderate Exposure" groups demonstrated performances in the predicted direction, with T-tests usually significant far below the  $p < .05$  level.

Conclusions: Given the known effects of hyperammonaemia on brain functioning resulting from other etiologies, our a priori predictions (viz., that patients who were exposed to toxic anhydrous ammonia would demonstrate neurological and neuropsychological dysfunction) were confirmed upon statistical analyses. Moreover, those with high levels of exposure performed more poorly than those with only moderate levels.

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#### **J. ORAM & H. TINSON. Mitochondrial Encephalomyopathy, Lactic Acidosis and Stroke-Like Episodes: A Case Study.**

Mitochondria are organelles that are scattered throughout the cytoplasm of cells. They contain enzymes that are necessary for cellular respiration, and represent the energy source of the cells throughout the body. There are a broad range of diseases that have in common, a dysfunction of mitochondrial metabolism. Multiple organs and systems of the body may be affected, including the central nervous system, resulting in a very diverse clinical picture. Mitochondrial Encephalomyopathy, Lactic Acidosis and Stroke-Like Episodes (MELAS) is a variant with symptoms that include: poor growth, focal or generalised seizures, recurrent acute episodes that resemble strokes or prolonged ischemic attacks, migraine-like headaches, vomiting and episodic lactic acidosis. Some studies of the neuropsychological effects of MELAS show a generalised cognitive deterioration. Others have shown a distinct pattern of impairment including difficulties in language, perception, attention and executive skills, and sometimes memory. This study describes a 28-year-old male, referred for neuropsychological assessment following an ischemic event and subsequent diagnosis of MELAS. Neuropsychological assessment indicated strength in the areas of language, verbal memory and verbal reasoning. Weakness was identified in the areas of attention, working memory/executive skills, speed of processing and the ability to process, organise and recall visuospatial information. Evidence for a pattern of specific cognitive deficits, rather than a global dementia is discussed, along with the functional implications of the identified cognitive deficits.

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#### **K. L. RIDER, D. J. HARDY, S. A. CASTELLON, R. SCHUG & C. H. HINKIN. Latency, Accuracy, and Meta-Cognition of HIV Positive Individuals in the Performance of Complex Tasks.**

Prior research on simple reaction-time tasks suggests that HIV positive individuals perform more slowly than HIV negative individuals. We were interested in whether this effect occurred on more complex tasks and in potential reasons why latency and accuracy might differ between these individuals. We administered items 4 through 19 of the WAIS-III Matrix Reasoning test to 47 HIV positive and 50 HIV negative participants and recorded response, response latency, and confidence on a four-item Likert scale for each item. For each group of participants, we calculated average accuracy and average log latency on each item, prepared Brinley charts and conducted a series of regression analyses using items as the data points. We found that both groups took similar times to answer each item correctly, with latency increasing as item complexity increased. However, the HIV positive group tended to make proportionately more errors (about

33%) on each item. This result is in contrast to performance on simple reaction time tasks where both groups tend to be equally accurate, but where HIV positive individuals tend to be slower. Further analysis comparing items answered correctly to item answered incorrectly for each group suggested that HIV positive individuals were sacrificing accuracy for speed. We also found that compared with negative individuals, positive individuals tended to be unrealistically optimistic about the accuracy of responses they rated as "quite sure" and unrealistically pessimistic about responses rated as "just a guess." These results suggest a less effective metacognition on the part of HIV positive individuals.

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#### **S. J. COCKSHELL & J. MATHIAS. Neuropsychological Problems Associated with Chronic Fatigue Syndrome: A Meta-analytic Review.**

Chronic fatigue syndrome (CFS) is characterised by long-standing excessive fatigue, which cannot be explained by known medical or psychiatric conditions, is not substantially alleviated by rest, and is disproportionate to the level of exertion. CFS is often also associated with subjective reports of cognitive problems. Neuropsychological investigations of CFS have reported deficits in the areas of memory, learning, and information processing speed, with normal levels of intellectual and executive functioning. However, the research findings are inconsistent and have not been adequately consolidated, thereby limiting the extent to which they inform clinical practice. The current study therefore provides a meta-analysis of research conducted between 1988 and 2004, which examined the neuropsychological consequences of CFS. A comprehensive search of the psychological and medical literature databases and 21 relevant journals was undertaken, using 9 search terms. All identified articles were then screened using detailed inclusion and exclusion criteria. Effects sizes, percentage overlap between CFS and healthy control groups, and fail safe N's (i.e. number of studies with non-significant findings required in order to reverse a significant result) were calculated for these studies in order to evaluate this research independently of the effects of sample size (which influences statistical power) and the bias introduced by a tendency to publish significant results. These statistics enabled a direct comparison of the findings derived from different tests of the same cognitive ability (e.g. memory) and from different cognitive functions, in order to identify the tests and cognitive abilities that best discriminate between groups.

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#### **P. J. HAY & L. A. DENSON. Carbon Monoxide Poisoning As A Suicide Attempt: 12-Month Neuropsychological And Psychiatric Outcomes.**

Aims: To prospectively evaluate neuropsychological and psychiatric outcomes following carbon monoxide (CO) poisoning. A consecutive series of 41 adults, with significant CO exposure as a suicide attempt, underwent neuropsychological and psychiatric assessment within a mean of 3.1 days of hospital admission. They were compared with matched controls, presenting with a non-neurotoxic suicide attempt. The most common psychiatric diagnoses were major depression and adjustment disorder with depressed mood. Many had alcohol abuse or dependence. Initially controls and CO subjects showed similar cognitive impairment (except for 4 CO subjects with very severe impairment), but controls were more depressed. At 2 months, trends were generally towards improvement in all participants, with no between-group differences (reported in 1). Some CO subjects had brain MRI. Twenty-eight (68%) of the CO group were reviewed at 1 year, with further improvement in cognitive functioning, depressive symptoms and general functioning (median Axis V GAF scores 76.5). Three had made another suicide attempt. One had completed suicide. One neuropsychological performance (Rey AVLT delayed recall) predicted outcome on the GAF at 12 months. Conclusions: Except where CO toxic effects were severe, most psychosocial dysfunction at follow-up appeared due to psychiatric disorder. The study did not support CO exposure exacerbating mood disorder in this sample. (1) Hay, P.J. et al (2002)

The neuropsychiatry of carbon monoxide poisoning in attempted suicide: A prospective controlled study. *J. Psychosomatic Research*, Suppl 53(2), 699-708.

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**R. O. HOPKINS, L. K. WEAVER, K. J. CHAN & J. F. ORME. Relationships between Quality of Life, Cognitive and Emotional Function in Survivors of Acute Respiratory Distress Syndrome.**

Background: Acute Respiratory Distress Syndrome (ARDS) affects more than 150,000 people per year in the United States. ARDS is characterized by lung injury and hypoxemia, and has a mortality rate of 11% to 43%. Previous research indicates ARDS survivors have cognitive impairments, depression, and anxiety. However there is no information in the literature regarding which of these factors (i.e. cognitive, depression, or anxiety) are associated with decreased quality of life. The purpose of the study was to assess the relationships between quality of life and cognitive and emotional function in ARDS survivors, 1-year post-hospital discharge. Methods: Sixty-six ARDS survivors were administered a battery of neuropsychological tests, measures of affect (BDI and BAI), and quality of life (SF-36) 1-year post-hospital discharge. Patient demographic and medical data (length of stay, laboratory values, and ventilator data) were recorded. Cognitive impairment was defined as scores on 2 or more neuropsychological tests that were >1.5 SD below the normative population mean. Results: Of 66 ARDS patients, 55% were female, with a mean  $\pm$  SD: age = 46  $\pm$  16.4 years, mean education level = 13  $\pm$  2.2 years, APACHE II score = 17.9  $\pm$  6.2, hospital length of stay = 39.1  $\pm$  21.5 days, PaO<sub>2</sub>/FiO<sub>2</sub> ratio = 104.5  $\pm$  32 Torr. Forty-five percent of the patients had cognitive sequelae; 28%, mild to moderate symptoms of depression; and 28%, mild to moderate symptoms of anxiety. Decreased quality of life was significantly correlated with increased depression and anxiety ( $p=0.000$  to  $0.003$ ). Decreased quality of life was significantly correlated with decreased intellectual function (FSIQ;  $p=0.01$ ). Discussion: ARDS survivors experience cognitive impairments, depression and anxiety, that are associated with decreased quality of life 1 year post-hospital discharge.

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**A. A. SCHOLLES & C. E. MEADE. Neurological, Psychiatric And Neuropsychological Sequelae Over A Three Year Period For A Case Of A Rare Multi-System Degenerative Neurological Disorder: Neuroacanthocytosis**

Neuroacanthocytosis (NA) is a rare multi-system degenerative neurological condition characterised by psychiatric symptoms alongside neurological signs and acanthocytosis in peripheral blood (ie spiked red blood cells) and normal lipoproteins. Diagnosis is complicated by the variable array of NA syndromes, the rarity of the disorder, and the way the symptoms manifest. Initially Learning Disorder, Tourettes Syndrome, OCD and epilepsy are amongst the typical diagnoses made. A case is presented of this rare disorder, demonstrating the psychiatric, neurological and neuropsychological sequelae over a longitudinal (three year) period. This patient (KT) had a history of OCD features, learning difficulty, and tics, which initially led to a tentative diagnosis of Tourettes syndrome. Epilepsy then emerged and it was when he was being assessed for epilepsy surgery that the diagnosis of NA was finally made. He underwent thorough assessment at this time, then again three years later subsequent to a decline in behaviour and physical symptoms, which were causing significant management problems for his family. Neuropsychologically a pattern of ongoing memory impairment, executive dysfunction, behavioural/personality change and reduced insight were evidenced. In regard to his neurological symptoms, his tongue and lip biting, and his feeding dystonia were causing increasing problems over time. MRI scan showed severe bilateral atrophy of the head of the caudate nucleus and some prominence of the frontal horns of the left ventricle. Psychiatrically, he was showing symptoms of a depressed mood, irritability, anger outbursts, as well as a period of shoplifting. Notably his OCD symptoms had resolved over the

three year period. This represents another case to add to the limited literature around this rare disorder.

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**T. NOVAKOVIC-AGOPIAN, S. GYSENS & R. M. BOWLER. Attentional Functions Following Different Neurotoxic Exposures.**

One of the most common sequelae of neurotoxic exposure involves difficulties in the areas of attention and speed of processing. We compared three groups of neurotoxically exposed workers and a group of 194 control subjects with a computerized Visual Attention Test (VAT) battery. The exposed groups included 15 individuals exposed to nerve gas (sarin and mustard gas), 176 hazardous waste workers exposed to ethylene dichloride (EDC), and 40 welders exposed to manganese fumes. The VAT battery includes computerised attentional tests that assess speed of processing information, ability to orient and covertly shift attention, and ability to inhibit automatic orienting. These tests are based on the cognitive neuroscience and neuroimaging attentional research. All exposed groups had slower reaction time (RT) relative to controls. This finding was significant for welders and EDC exposed workers; a trend was observed for nerve gas exposed workers. Whereas EDC exposed workers and welders had more difficulty inhibiting automatic orienting than control subjects, this was not true for individuals exposed to nerve gas, who showed the same pattern as controls. The nerve gas exposed group had a disproportionately large slowing of RT at brief interval durations for the inhibition of automatic orienting task as compared to controls and other exposed groups. Both EDC exposed workers and welders had more difficulty on the automatic orienting task than controls and individuals exposed to nerve gas. They had a larger validity effect; their RT was disproportionately slower when their attention was misguided to a location different from the one where the target appeared. While both controls and nerve gas exposed individuals showed a normal pattern of inhibition of return at longer interval durations, both EDC exposed workers and welders did not show this pattern. On longer cue-to-target interval duration (800ms), they continued to have longer RT on invalid trials than on valid ones.

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**Symposium 14/9.00am-10.30am**

**FUNCTIONAL PLASTICITY OR VULNERABILITY FOLLOWING CHILDHOOD BRAIN INSULT? FACTORS THAT MAY INFLUENCE OUTCOME FOLLOWING EARLY BRAIN INJURY.**

*Chair:* Vicki Anderson

*Discussant:* Bryan Kolb

The question as to whether it's better to sustain a cerebral injury in childhood or adulthood has been debated for several decades. Animal models suggest that such an argument is too simplistic, demonstrating a non-linear relationship between age at injury and outcome such that some developmental periods may be associated with relatively better outcome, while damage at other times results in significant impairments (e.g. disorders of neuronal migration). These brief 'windows' for relatively better outcome have been associated with changes in synaptic organisation (e.g. Kolb, Gibb & Gorny, 2000). However, whether such re-organisation at a structural level translates into 'good' functional recovery, remains controversial. Some researchers document relatively better recovery (e.g. Basser, 1962; Kennard, 1936, 1940; Teuber, 1962; Vargha-Khadem et al., 1997), while others argue for greater impairment (e.g. Anderson et al., 1997; Ewing-Cobbs et al., 1997; Hebb, 1949) following early cerebral insult. In particular, longitudinal studies show a pattern of cumulating deficits over



time, with deficits becoming more apparent as children fail to make the expected developmental gains (e.g. Anderson & Moore, 1995; Eslinger et al., 1992; Taylor & Alden, 1997). In humans, the relationship between age at injury and outcome is complicated by factors such as injury severity, family characteristics (e.g. family functioning, levels of stress), medical complications (e.g. presence of seizures, age at seizure onset, whether seizures can be effectively controlled through medication), and time since injury. This group of papers examines these issues in a range of paediatric populations with brain injury of various aetiology and timing in an attempt to improve our understanding of why such variability in outcome occurs following childhood cerebral insult.

**A. DA COSTA, I. WALTERS, J. WRENNALL, A. TUCKER, J.G. MEARA, R. SAVARIRAYAN & A.D. HOLMES. Craniofacial Anomalies In Children: A Neuropsychological Study.**

Craniofacial anomalies refer to skull or facial deformities and arise from craniosynostosis, the early fusion of the skull sutures. Craniosynostosis occurs in isolation (nonsyndromic craniosynostosis; NSC), or within a broader pattern of anomalies (e.g. cardiac, hearing/vision difficulties), as in the syndromic craniosynostosis (SC) conditions. Treatment includes surgery, usually during infancy, to expand the cranium. Craniofacial conditions can be associated with central nervous system anomalies. Whilst SC is frequently characterised by intellectual impairment of varying severity, NSC is considered a relatively benign condition with respect to the risk of cognitive dysfunction. The long-term cognitive outcomes in these conditions are poorly described, and few experimental studies have characterised the wide spectrum of neuropsychological abilities of this population beyond global intellect. The present study sought to address these gaps in the literature and described the neuropsychological profiles of 34 children with SC (n=13) and NSC (n=21) who had undergone cranial expansion surgery. Participants were aged between 7 and 16 years (mean age 11 years), and were evaluated on standardised measures of intellectual, attention, memory, academic achievement, executive and social and emotional functioning. Results were consistent with expectations in showing that children with SC displayed weaker intellectual abilities than children with NSC and their nonafflicted peers. However, despite performing within the normal range for intelligence, the NSC children displayed subtle neuropsychological deficits in attention and executive skills. These results, which suggest that NSC is associated with functional repercussions, have been interpreted in the context of the early brain injury literature.

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**J. WRENNALL, A.S HARVEY, J. FREEMAN, J. ROSENFELD & W. MAIXNER. The Impact Of 'Age Of Onset' Of Severe Gelastic Epilepsy On The Functioning Of Children With Hypothalamic Hamartoma, Pre- And Post-Surgery For Epilepsy.**

Gelastoc epilepsy associated with hypothalamic hamartoma may evolve into a devastating form of epileptic encephalopathy associated with multiple daily seizures, developmental regression and severe behaviour disturbance. Complete surgical removal of the hypothalamic hamartoma may reverse this encephalopathic process leading to reported improvements in functioning. Younger age of onset of the severe epilepsy is likely to be associated with greater disruption to the child's ongoing development, and a greater functional impairment. As a result, it is also likely to reduce the effectiveness of the surgery in reversing the decline in cognitive functioning associated with this severe form of epilepsy. These issues will be explored in a group of patients who have undergone surgery at the Royal Children's Hospital, Melbourne, using an innovative transcallosal approach to resection of the hypothalamic hamartoma. Thirty children and young people, aged 2 years, 5 months to 23 years, 4 months (mean age 9 years, 7 months), have undergone this surgery since 1996. Significant improvements in behaviour and adaptive functioning have been documented following surgery using a behaviour questionnaire, the Behaviour Assessment System for Children: Parent Report Scales (BASC). How-

ever, documenting the impact of surgery on subsequent cognitive functioning has proved much more challenging.

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**C. CATROPPIA, V. ANDERSON, S. MORSE, F. HARITOU & J. ROSENFELD. Functional Plasticity Or Vulnerability Following Early Brain Injury?**

Traumatic brain injury (TBI) is a common, acquired childhood disability, and may have a profound impact on development. Severity and timing of injuries may be important predictors of recovery and long-term outcome. This study used a prospective, longitudinal design to examine cognitive recovery. 122 children, divided according to (a) injury age: 'young' (3-7 yrs), 'old' (8-12 yrs); (b) injury severity (mild, moderate, severe), were evaluated acutely, at 12 and 30 months post-TBI, using intellectual measures. Results showed a relationship between injury severity and cognitive performance. Age at injury was not predictive of outcome for children with mild/moderate TBI. For severe TBI, younger injury age led to minimal recovery, with better recovery from later injury. Findings suggest that children sustaining severe TBI in early childhood may be vulnerable to residual cognitive impairment.

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**E. NORTHAM, D RANKINS, D. BOYCE, M. WELLARD, G. WERTHER & P. ANDERSON. Neuropsychological And Brain Metabolite Profiles In Children With Type 1 Diabetes 12 Years After Disease Onset.**

In 1990, a study commenced at the Royal Children's Hospital, Melbourne to examine prospectively the impact of type 1 diabetes on neuropsychological functioning in a cohort of children enrolled at diagnosis. Six years after disease onset, children with early onset (4 years) disease performed more poorly than age matched controls (from whom they had not differed at baseline) on composite measures of attention, processing speed and executive skills. The current phase of the study (12-13 years post-diagnosis) combines neuroimaging (MRS/MRI) and neuropsychological assessment to document functional outcome in the entire cohort, most of whom have reached CNS maturity. Preliminary analyses indicate that the early-onset group perform more poorly than healthy control participants on Performance IQ, and tests of conceptual reasoning and attention. In addition, significant differences in brain metabolite profiles were found. Higher levels of myoinositol, trimethylamines and glutamate + glutamine were evident in the frontal lobes of patients, compared to controls. Patients had lower levels of total N-acetylaspartyl (NA) in basal ganglia. Myoinositol and glutamine are putative osmolytes and their presence may be a marker of fluid imbalance resulting from regular disruption of glucose homeostasis. Myoinositol is also associated with increased gliosis, while lower NA suggests reduced neuronal population or function. The regions showing altered metabolite profiles are consistent with the neuropsychological deficits observed in patients. Findings suggest that type 1 diabetes with onset in early childhood may result in altered brain metabolite profiles and long-term cognitive effects.

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**Paper Session 13/9.00am-10.30pm**

**PSYCHOSOCIAL RECOVERY AFTER FOCAL LESIONS**

**A. CLARKSON, L. TIPPETT & J. OGDEN. Factors Related to Psychosocial Adjustment After Temporal Lobectomy.**

Surgery may be conducted to treat medically refractory epilepsy, particularly for individuals with temporal lobe epilepsy (TLE). It is increasingly

recognised that psychological and social outcome following surgery is not only determined by reduction or elimination of seizures but by a host of other factors. The nature of chronic severe epilepsy can interrupt social, educational and vocational development, which is likely to affect the development of personal resources and possibly social networks and support systems. These have been shown to affect psychosocial adjustment and quality of life in a variety of chronic and acute health conditions including cancer, rheumatoid arthritis and diabetes. Thus outcome from TLE surgery may be influenced by these factors (personal and social resources) independent of seizure outcome. This cross-sectional study explores the relationship of personal and social resources to coping strategies and psychosocial adjustment following temporal lobectomy for chronic refractory epilepsy in 55 individuals who have had surgery within the last 7 years. Personal resources examined include measures of generalised self-efficacy beliefs, dispositional optimism, locus of control and learned resourcefulness. Psychosocial adjustment was measured using measures of subjective handicap, functional outcome and mood. Coping strategies were assessed to identify their relationship with personal and social resources and the extent to which they mediate psychosocial adjustment. Quantitative correlational and regression analyses examined the relationships between seizure outcome, personal resources, social resources, coping and psychosocial adjustment. These results and their implications for rehabilitation will be discussed, together with the findings from qualitative interviews conducted with each participant.

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#### **T. W. TEASDALE & A. ENGBERG. Psychosocial Consequences Of Stroke: A Long-Term Population-Based Follow-Up.**

**Objectives:** To investigate psychosocial status among representative stroke patients at long intervals post-stroke. **Methods:** From a Danish national register of hospitalisations three representative groups of surviving patients were selected who had suffered a stroke 5, 10 and 15 years previously ( $n = 271, 118$  and  $61$  respectively) and their hospital records were reviewed. Two postal questionnaires were sent to all patients, a tailored questionnaire concerning symptomatology, functioning and social conditions, together with the Nottingham Health Profile (NHP). Response rates were 79%, 72% and 77% for the three groups. **Results:** Time since stroke (TSS) was negatively associated with age at stroke (65, 59 and 52) and positively with functioning at discharge (Rankin score = 'slight disability' or less, 74%, 82%, and 85%). The proportion of ischemic strokes, relative to haemorrhage strokes, decreased with TSS (65%, 57% and 46%). At follow-up the majority of patients reported difficulties with attention, memory and emotional control. The proportions did not vary with TSS. Return to employment, social relations and leisure activities were affected, but were comparatively better at longer TSS, as was a self-rated Rankin score ('slight disability' or less, 67%, 74%, and 85%). TSS was also negatively associated with the NHP symptom scales for difficulties concerning energy, emotional reactivity, social interaction and physical mobility. In a multivariate analysis, good outcome was predicted by earlier age at stroke, shorter duration of hospitalisation, the absence of aphasia and good functioning at discharge, but not by sex, diagnosis or TSS. **Conclusions:** Despite the relatively good general status at discharge, symptomatology, functioning and social conditions remain affected in long-term stroke survivors.

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#### **C. S. ERNEST, D. G. ANDREWES, N. B. ALLEN, C. KILPATRICK, M. MURPHY & M. COOK. The Study of Emotional Reactivity following Unilateral Temporal Lobectomy.**

This study examines the contribution of the left versus right anterior temporal lobes to emotional reactivity. **Methods:** Emotional reactions of 21 left temporal lobectomy patients (LTL), 20 right temporal lobectomy patients (RTL) and 20 normal controls (NC) were measured in response to positive, negative and neutral mood induction conditions using standard-

ised film clips. Emotional reactivity following each mood induction condition was assessed using patient self-report, spontaneous facial expressions and heart rate responses. Also subjects were asked to rate the expected reactivity of others for each condition to assess insight into their own reactions. **Results:** In comparison to NC, the LTL group reported significantly lower negative reactions and higher positive reactions in response to negative stimuli. The ratings of expected reactivity on negative conditions were similar, with the ratings of the LTL group being less negative and more positive than NC. Additionally, LTL patients displayed smaller heart rate changes than NC, in response to the fear condition with a similar trend being observed on all negative conditions. However, on ratings of facial expression, the RTL group displayed significantly less negative facial expressions, specifically fearful expressions, than LTL, while viewing fearful stimuli. **Conclusion:** Left temporal lobectomy patients exhibit lowered emotional responses to negative stimuli and are unaware that their reactions are discrepant. In the presence of a negative emotional elicitor, left anterior temporal lobe appears to mediate the experiential aspects of emotion, while the right is dominant for spontaneous emotional facial expressions, particularly in response to fearful stimuli.

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#### **L. STIERMAN, N. L. DENBURG, M. MARTEL, K. MANZEL, J. D. DAWSON, S. W. ANDERSON. Recovery of Cognitive Function Following Stroke.**

Stroke is the leading cause of disability in the United States, with an incidence of 700,000, and cognitive dysfunction is among the most frequent and serious consequences. To date, however, few studies have addressed issues of recovery of higher-order cognitive functions following stroke. Consequently, there are sparse empirical data to answer a patient or family member's question when they inquire about prognosis (e.g., "What can we expect in one year?"). In the study reported here, we explored clinical (e.g., hemorrhagic vs. non-hemorrhagic, stroke severity), neuro-anatomical (e.g., lesion location, size), and patient (e.g., age, gender, comorbid medical conditions) characteristics that might affect the extent and course of recovery of cognitive abilities. A sample of 111 stroke patients (mean age = 55 years) was evaluated with a comprehensive battery of neuropsychological tests (attention, orientation, anterograde memory, language and visuospatial abilities, and executive functions) on two occasions: acutely (within the first three months post-stroke; mean = 10 days after stroke) and chronically (3 months or more post-stroke; mean = 9 months). Using multiple statistical approaches (e.g., Wilcoxon Signed Rank tests, Spearman correlations, random effects models), significant recovery in multiple aspects of higher-order cognition was revealed, with over 46% of patients displaying recovery on multiple indices. This longitudinal investigation of higher-order cognitive functions (i.e., memory, visuospatial skills, and executive functions) revealed that a considerable degree of cognitive recovery is possible in the months following stroke, and that the pattern of recovery may be influenced by certain clinical and neuroanatomical patient characteristics.

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#### **D. G. ANDREWES, J. TAN, K. JOBLING, P. DISLER, S. DAVIS & A. KAYE. An Investigation into Emotional Dysfunction and Quality of Life in Stroke Patients and the Effect this has on the Primary Caregivers.**

While depression is often the focus of studies of stroke patients, this research takes a broader perspective using both partner and self ratings of 18 stroke patients and 35 non-cerebral surgical controls. Patients were assessed on the Emotional and Social Dysfunction Questionnaire (ESDQ), an eight scale measure developed using factor-analytic techniques with a brain damaged population. Also assessed was the emotional well-being of the primary caregiver using the Depression Anxiety Stress Scale (DASS) and the Australian Quality of life (Aqol) instrument. But significant dif-

ferences were found between the patient group and the controls on the Anger, Helplessness Indifference and Emotional dyscontrol self and partner scales ( $p < .05$ ). Primary caregivers rating comparison showed increased depression and stress ( $p < .05$ ) on the DASS. No differences were found between left and right hemisphere strokes. Caregivers rated themselves as being more socially isolated (social relationships scale) and needing more assistance on the independent living scale of the Aqol. The patient results are discussed both in terms of the profile of these patients compared to other patient groups from past studies and the special therapeutic support requirements of this group. The need of carer support is also discussed at a time when more patients are being treated in the community.

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**D. W. HARRIS, J. M. DOUGLAS & P. B. DISLER. Understanding the Quality of Life of Stroke Survivors with Aphasia.**

This study investigated the influence of a range of life domains including illness, impairment, functional ability, participation in life, social support, and socioeconomic status upon global quality of life and other mental health-related outcomes for survivors of stroke. A prospective, cross-sectional follow-up investigation was undertaken with 56 post-rehabilitation, community-dwelling, left-hemisphere stroke survivors who demonstrated a linguistic capacity to comprehend a series of outcome measures. Quality of life was directly influenced by levels of physical function, social support and socioeconomic status. Depression was directly influenced by levels of communicative / cognitive impairment. Positive affect was directly influenced by levels of illness, communicative / cognitive impairment, physical function, and social support. A complex pattern of associations exists between different psychological outcomes and domain ratings. Domains were generally poor predictors of psychological distress (depression or negative affect). By contrast, all domains predicted at least one component of psychological well-being (quality of life or positive affect). Domains that directly influenced the quality of life reported by stroke survivors enabled individuals to influence their environment and therefore complete daily activities regardless of the level of communication difficulty.

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**Paper Session 14/9.00am-10.30am**

**FACIAL AND VISUOSPATIAL PROCESSING**

**K. RICHARDSON & D. CAINE. Interactions Between Visual Information And Task Demands In Face Processing.**

The task of determining the sex, age, or familiarity of a face creates different, and often competing, perceptual processing demands. The task-information approach (Rakover, 2002) was used to investigate the characteristics of these subordinate-level judgements - by manipulating the available facial information and assessing the effects on task performance (ie. successful categorisation or recognition). Overall, a combination of internal and external features produced more accurate results than either of these feature types alone. However, on a specific task level, contrasting patterns of feature saliency were observed, supporting the claim that the level of object classification selectively modifies the perceptual information extracted from identical stimuli. Further, these effects interacted with the familiarity and rated-distinctiveness of stimulus faces. The results are considered in relation to the problematic distinction between featural and configurational information, and the implications for underlying representational processes are discussed. Rakover, S. S. (2002). Featural vs. configurational information in faces: A conceptual and empirical analysis. *British Journal of Psychology*, 93(1), 1-30.

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**C. SKILBECK. Face Processing Abilities & Double Dissociations following Subarachnoid Haemorrhage.**

The present study involved 70 subarachnoid haemorrhage (SAH) patients who underwent neuropsychological testing, including completion of the Benton Face Matching Test, The Recognition Memory Test (RMT) and a test of emotional processing using photographs of faces. Other testing included WAIS-R performance subtests, the NART, and Visual Patterns Test. The data indicated only low inter-correlations for the face processing variables, although RMT score was significantly related to NART PIQ, WAIS-R Digit Symbol & Picture Arrangement, and to Visual Working Memory. Benton score correlated significantly with both Picture Arrangement and Visual Working Memory, and Emotional Expression score with NART PIQ and Picture Arrangement. Further analyses on patients attending the 6-month follow-up ( $n=44$ ) showed significant gender effects only for Emotional Expression, reflecting a female superiority. Benton performance was significantly poorer in those sustaining a right hemisphere SAH and identification of Emotional Expression was poorest in those suffering a middle cerebral artery aneurysm. Double Dissociations were demonstrated for the face processing variables.

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**B. A. WILSON, E. L. BERRY & A.W. YOUNG. A Case Of Topographical Egocentric Disorientation: Support For A New Taxonomy.**

In 1999 Aguirre and D'Esposito suggested there are four types of topographical disorientation: egocentric disorientation; heading disorientation; landmark agnosia and anterograde disorientation. We describe a patient who appears to have the first type namely egocentric disorientation. Our purpose here is to describe the characteristics of this patient, compare his anatomical and neuropsychological characteristics with 5 other patients reported in the literature since 1919 and determine whether or not he fits the pattern described by Aguirre and D'Esposito. We then present new data to show that our patient is impaired on additional tests sensitive to egocentric disorientation while showing normal performance on tests sensitive to heading disorientation, landmark agnosia and anterograde disorientation. The results show that this patient is very similar to five others described with egocentric disorientation. He demonstrates normal performance on a test of famous landmarks. He can identify photographs of places in his own town yet cannot say how to get from one known place to another. When asked which of two places is nearer to a recognised location he has no difficulty. His performance on tests sensitive to heading and anterograde disorientation is similar to that of age matched controls. We suggest that our patient fulfills the criteria for egocentric disorientation in that he shares the characteristics of five other people described with this deficit. We have assessed in greater detail than previous researchers his ability to recognise landmarks and his performance on tests sensitive to other kinds of topographical disorientation and thus provide support for Aguirre and D'Esposito's taxonomy.

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**M. NICHOLLS, G. HUGHES, J. B. MATTINGLEY, J. L. BRADSHAW. An Investigation Of The Importance Of Object- And Space-Based Attentional Biases To Pseudoneglect.**

Unilateral neglect patients over attend to stimuli in the right hemisphere and neglect stimuli that fall to the left. In contrast, normal participants attend more to the left: A phenomenon known as pseudoneglect. Two experiments examined whether pseudoneglect is based upon object- or space-centered coordinates. Right-handed participants ( $n = 38$  &  $22$ ) made luminance judgments for two left/right mirror-reversed luminance gradients (greyscales task). The relative lateral position of the greyscales stimuli was manipulated so that object- and space-based coordinates were congruent or incongruent. A baseline condition was also included where both stimuli were placed along the midline of the display. Pseudoneglect,

observed for the baseline condition, was not evident for the incongruent condition; demonstrating an opposition of object and space-based biases. The leftward bias was reduced in the congruent condition where object and space-based biases were expected to be additive. This effect was attributed to extraneous factors, which were avoided in the second experiment by presenting the greyscales stimuli sequentially. Once again, no bias was observed in the incongruent condition where object and space-based biases were opposed. Pseudoneglect for the congruent condition was the same as the baseline condition. The second experiment demonstrates that both greyscales stimuli do not need to be physically present in order for pseudoneglect to occur. Together, the experiments demonstrate that object and space-based reference frames are both important to the manifestation of pseudoneglect. This dual reliance is reminiscent of neglect, which also relies on object and space-based reference frames.

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### **G. SAVAGE & M. WILLIAMS. Implicit Processing Of Faces In Progressive Prosopagnosia.**

Frontotemporal dementia which predominantly affects the right temporal lobe has been suggested to represent a right hemisphere analogue of semantic dementia; cases in the literature have demonstrated deficits in terms of person-specific knowledge, and also in face recognition. We present a 59 year old case of frontotemporal dementia who had a recent tendency to misrecognise acquaintances, and whose interpersonal skills were consistent with failing to appreciate nonverbal communication in others. She had MRI evidence of right-sided temporal lobe atrophy, and a PET study indicated bilateral hypometabolism with a right temporal lobe emphasis. Neuropsychological assessment revealed only mild impairment in most cognitive domains, apart from dysnomia and inability to inhibit verbal responses. Her inability to select photographs of famous faces on a forced-choice recognition task was profound, but her knowledge about the famous identities appeared intact. She also showed mild impairment in matching photographs of non-famous faces. We investigated her face processing skills using a novel experimental paradigm which has demonstrated sensitivity to configural or feature-based analyses of facial structure and expressions (Williams, Bradshaw, & Moss, in press). She was correct in making simple judgments (e.g., eyes: open or shut?; expression: happy or sad?), and reaction times were influenced by rapidly presented and visually masked stimuli which were either congruent or incongruent with her button-press responses. The data suggest reliance on first-order configural processing, and while she showed sensitivity to the basic emotions of happiness and sadness, she was slower to respond to sad faces. The experimental data are interpreted in the light of her clinical presentation and history. Williams, M. A., Moss, S. A., & Bradshaw, J. L. (in press). A unique look at face processing: The impact of masked faces on the processing of facial features. *Cognition*.

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### **N. J. BULL, A. TURNER, M. HUNTER, C. LEVI & C. SELMES. The Visual Form and Motion test (VFM), A New Neuropsychological Tool.**

The visual form and motion test (VFM) is a computer based neuropsychological test designed to measure visual object detection and recognition. The VFM software package employs adaptive methods to find thresholds for detection and recognition of variously camouflaged letters. The test stimuli are designed to measure the functioning of the higher-order, extrastriate visual pathways. The test allows for dissociation of motion and luminance processing deficits. We have demonstrated that patients with posterior watershed infarction perform poorly on this test, sometimes demonstrating a complete inability to perceive motion defined letters. Normative values and test-retest reliability analysis in healthy elderly and healthy young groups have been obtained. There is a mild age effect for motion defined stimuli, but not for luminance defined stimuli. Test-retest analysis had demonstrated good reliability. In a prospective study of brain injury post cardiac surgery, the VFM test was found to be a sensitive and specific

marker of posterior watershed territory brain injury. The VFM software package is offered free to academic institutions.

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## **Paper Session 15/11.30am-12.30pm**

### **MEASURING RECOVERY AFTER TRAUMATIC BRAIN INJURY**

#### **J. PONSFORD. Substance Use Following Traumatic Brain Injury: A Prospective Study.**

Whilst a number of studies have documented substance use in individuals with traumatic brain injury (TBI), few studies have examined substance use in relation to pre-injury levels and relative to the general population. The present study aims to identify substance use patterns following TBI, relative to pre-injury patterns and relative to demographically matched controls, factors associated with substance use, and the relationship between substance use and outcome following TBI. Pre-injury alcohol and drug use have been documented using the AUDIT and DAST questionnaires shortly after admission to rehabilitation. These questionnaires have been administered again at 1 and 2 years post-injury. Of the 240 participants with moderate to severe TBI recruited prospectively, 75 have so far completed the AUDIT and DAST at 1 and 2 years post-injury. Thirty-three percent of the group drank within the harmful or dependent ranges pre-injury, a percentage similar to that shown by a demographically-matched control group. Alcohol and drug use had declined somewhat at 1 year, but had returned to pre-injury levels by 2 years post-injury. Those drinking at harmful levels after injury were younger, were more likely to be males, in employment, who had shown high levels of alcohol and/or drug use pre-injury and who showed higher levels of anxiety and lower self-esteem. Examination of substance use in a separate sample of 98 severe TBI individuals followed up at 10 years post-injury, indicated that 30% were drinking at harmful or dependent levels. There is a need for educational programs targeting those most at risk for heavy post-injury drinking.

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#### **G. WILLIAMS, K. GREENWOOD & V. ROBERTSON. Development Of A High-Level Mobility Scale For Use In Traumatic Brain Injury.**

Existing methods of measuring high-level mobility following traumatic brain injury (TBI) are inadequate. The aim of this study was to develop a high-level mobility scale for use in the TBI population that measures mobility from independent walking to the prerequisites for participation in leisure and sporting activities. High-level mobility items were generated from a review of adult and paediatric neurological mobility scales and a consensus method involving expert physiotherapists. Data were collected from 103 TBI patients, aged 14-60, on each of the 20 items generated. Objective scores and subjective ratings on quality of performance were made for each item. Data were analyzed for unidimensionality and discriminability using factor analysis and Rasch analysis. Results: Cronbach's alpha was high at .99. Factor analysis identified several balance items as belonging to a separate dimension to the mobility items and were consequently excluded. Rasch analysis further discriminated several misfitting items that were also excluded. Analysis of logit scores showed the objective data were less susceptible to a ceiling effect than the subjective ratings. The resulting items form a new high-level mobility scale that is less susceptible to a ceiling effect and more discriminative than existing scales. Inter-rater reliability for all objective scores (ICC's > .97) and subjective ratings (multi-Kappa > .5, p<.001) was very high. This high-level mobility scale is intended to describe higher level deficits, assess

previously immeasurable changes, and guide treatment and goal setting as current scales do at a lower level of mobility.

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**R. L. TATE, A. PFAFF, A. T. LANE-BROWN, L. ELLIS, I. BAGULEY, J. A. GURKA, A. E. HODGKINSON, A. C. KING, J. E. MAROSSZEKY. Patterns Of Emergence From Post-Traumatic Amnesia After Traumatic Brain Injury.**

Post-traumatic amnesia (PTA) is a transient state after traumatic brain injury with widely variable duration, ranging from minutes to months. Previous work has demonstrated the difficulty in determining precisely when PTA ends in some patients (Tate et al., 2000; Wilson et al., 1992). An aim of this multicentre trial was to examine variations in emergence from PTA, comparing commonly used instruments, the Galveston Orientation and Amnesia Test (GOAT), Westmead and Modified Oxford (MO) PTA scales. One advantage of the Westmead and MO scales is that they provide an objective assessment of the memory component. Patients in the early stages of PTA (n=74) were recruited and tested daily until emergence from PTA. A composite PTA scale was used, comprising items from the three scales. There was no statistically significant difference in duration of PTA as measured by the Westmead (mean 84 days) or MO (mean 74 days) scales, but each was significantly longer than the GOAT (mean 64 days). Considerable variation was observed among patients in the later stages of PTA, particularly after the maximum score (12/12) was obtained on the Westmead/MO scales, but before criterion (3 consecutive days of 12/12) was reached. Two-thirds (n=50) obtained criterion without difficulty (average interval between first 12/12 and criterion was 0.68 days), but one-third (n=24) had a much longer interval (mean 22.5 days). When they first scored 12/12, 74% and 79% of patients from these respective groups had already emerged from PTA according to the GOAT, raising validity issues that require further examination.

References:

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Wilson BA, Baddeley AD, Shiel A, Patton G. (1992). *Neuropsychol Rehabil.* 2: 231-243.

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**N. M. WEIR, A. WIEMERS, J. FLEMING, E. DOIG. Objective And Behavioural Assessment Of The Emergence From Post Traumatic Amnesia (PTA).**

**ABSTRACT:** Post Traumatic Amnesia (PTA) is a stage of recovery following a traumatic brain injury (TBI) identified by the presence of confusion and difficulty with continuous memory and new learning. Behavioural disturbance is another noted characteristic of PTA which is rarely evaluated in formal PTA assessments. Traditional practice is to use emergence from PTA as a guide for when active rehabilitation should commence. However, emerging evidence suggests new learning may occur during PTA. The presence or absence of typical PTA behaviours may also influence participation in rehabilitation throughout this period. Study Purpose: To determine the profile of the resolution of typical PTA behaviours; to determine whether new learning occurs during PTA; and to identify the points on the Westmead PTA scale at which new learning and independence in self-care first occurs. Design: Prospective study of 50 people (data collection continuing) with TBI admitted to the Princess Alexandra Hospital. Procedure: Daily assessment of patients using the Westmead PTA scale, a behavioural checklist and a functional learning task. Results: Preliminary data have been analysed using descriptive statistics. Trends indicate that on average, inappropriate behaviours resolved before independence in self-care was achieved; and learning was demonstrated earlier using functional tasks in context rather than a formal assessment. Discussion: Preliminary results suggest that people are capable of new learning

during PTA and certain behaviours are associated with emergence. These findings have implications for better monitoring of PTA emergence and earlier involvement in the rehabilitation process.

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**E. BIGLER, D. K. RYSER, P. GANDHI, J. KIMBALL & E. A. WILDE. Day-of-Injury Computerized Tomography, Rehabilitation Status, and Long-term Outcome as They Relate to Magnetic Resonance Imaging Findings After Traumatic Brain Injury.**

**Objective:** To compare day-of-injury (DOI) computerized tomography (CT) findings to disability status at acute hospital admission, at admission and discharge from inpatient rehabilitation, and at more than one year post-rehabilitation discharge. Injury severity markers and degree of post-acute cerebral atrophy on magnetic resonance imaging (MRI) were also examined by DOI CT findings. **Design:** Retrospective chart review. **Setting:** Inpatient rehabilitation within a Level I trauma centre. **Patients:** 240 consecutive traumatic brain injury (TBI) admissions. **Intervention:** Standard acute inpatient TBI rehabilitation. **Main Outcome Measures:** Disability Rating Scale (DRS) at the time of acute hospital admission, and at rehabilitation admission and discharge. Functional Independence Measure (FIM) at rehabilitation admission and at discharge. Cerebral atrophy was quantified by the ventricle-to-brain ratio (VBR). CT abnormality was rated by a 7-level clinical rating scale. **Results:** CT classification resulted in non-significant differences in DRS and FIM ratings at the time of discharge from the rehabilitation unit, with the exception of the brainstem injury subjects. However, increased cerebral atrophy was associated with greater disability. **Conclusions:** Other than brain stem injury, DOI CT findings relate poorly to rehabilitation outcome. In contrast, presence of cerebral atrophy, in post-acute chronic imaging, is related to rehabilitation outcome.

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**Paper Session 16/11.00am-12.30pm**

**NEUROPSYCHOLOGICAL INDICATORS OF MEDICAL, PSYCHIATRIC AND NEUROLOGICAL CONDITIONS**

**A. I. TROSTER, J. A. FIELDS. Verbal Memory Changes Are Related to Apolipoprotein E-4 in Healthy Elderly but not in Parkinson's Disease without Dementia.**

The apolipoprotein E (ApoE) E-4 allele is associated with increased risk for Alzheimer's disease (AD). Because only some studies have reported an association between E-4 and memory decrements in elderly, ApoE genotype and impoverished memory may be independent risk factors for AD. The role of ApoE in PD is less clear. The possession of one or two E-4 alleles probably does not confer increased risk for Parkinson's disease dementia (PDD) per se, but it may be associated with dementia in some PD cohorts (given the frequent co-existence of PD and AD pathology in PD patients with dementia). Similarly, if ApoE does have a direct influence on memory, one might expect poorer memory among PD patients with than without E-4 alleles. This study compared the California Verbal Learning Test (CVLT) performance of 44 healthy elderly with at least one E-4 allele to that of 102 age- and education-matched elderly without an E-4 allele. The group with one or two E-4 alleles showed significantly poorer immediate and long- (but not short-) delay recall. Semantic clustering was diminished, suggesting that shallow encoding may have a role in the E-4 group's poorer recall. In contrast to the elderly groups, the CVLT performance of 42 PD patients with E-4 alleles and that of 20 PD patients without E-4 alleles did not differ. When age and gender were covaried, only marginally slower learning was observed in the PD group

with E-4 alleles. Findings suggest that either ApoE genotype and impoverished memory are independent predictors of dementia (AD), or that PD sets in motion a pathophysiologic cascade that obscures subtle memory changes associated with Apo-E genotype. The role of the E-2 and E-3 alleles in PD cognition remains to be clarified. The possibility that persons with very early AD (and subtle memory impairment) are overrepresented in the elderly E-4 group cannot be excluded, but this would not account for the differential impact of ApoE genotype on memory in healthy elderly and PD.

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#### **L. RIDGEWAY. Apnoea Diving: Long Term Neurocognitive Effects of Repeated Hypoxaemia in N = 22 Elite Freedivers.**

There are currently no published studies on the neurocognitive aspects of the increasingly popular apnoea diving sports. This paper examines the neurocognitive effects of repeated exposure to hypoxaemia in apnoea (breath-hold) divers. An introduction to apnoea sports and the physiological and neurological adaptations involved in the Human Diving Reflex is presented as well as the results from a baseline neuropsychological examination of N = 22 elite apnoea divers. Standard neuropsychological tests, with known sensitivity to mild brain insults, included speed of visuo-motor responding, speed of language comprehension, response inhibition, and visual and verbal attention, and recall tasks. Results indicate that the breath-hold divers performed tasks at or slightly above that expected for their age norms. We suggest that 2-20 years of repeated exposure to hypoxemia (including those who have experienced shallow water blackouts and post-hypoxic motor convulsions) in elite freedivers has not impacted on performance on standard neuropsychological tasks providing support for adaptive mechanisms associated with the Human Diving Reflex. This research challenges our understanding of clinical presentations of hypoxaemia in disorders such as sleep apnoea and metabolic and cardiac conditions. Further studies are examining the acute neurocognitive effects from deep apnoea diving (current world record 92mtrs) and long duration breath holds (current world record 8 mins 6 secs).

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#### **D. M. TAYLOR, J. A. OGDEN & I. J. KIRK. Can Neuropsychological Tests and/or EEG Detect Early Solvent Effects? A Pilot Study of Boat Builders using Styrene.**

Recent research found boat builders had the third highest incidence of Organic Solvent Neurotoxicity (OSN) in New Zealand. OSN involves cognitive deficits and mood changes, generally resulting from prolonged exposure to organic solvents such as styrene, which is commonly employed in boat building. Styrene workers have been reported to show deficits on neuropsychological tests and prolonged P300 event-related potential (ERP) latencies have been found in electroencephalographic (EEG) studies. 29 boat builders sampled in this study reported a high incidence of solvent-related symptoms. Six boat builders and 7 control subjects underwent neuropsychological and EEG testing on four occasions at monthly intervals, following an ABAB design. Condition A was conducted on Monday morning after 2 days non-exposure to solvents, and condition B occurred on Thursday afternoon when boat builders had worked with styrene. Urine analysis indicated styrene exposure was generally low. Boat builders performed more poorly on the majority of neuropsychological tests, but the difference was non-significant for all but 3 tests. Boat builders P300 latencies were significantly more prolonged than the control participants in condition B only. Both groups showed significantly longer P300 latencies and smaller amplitudes in condition B as compared to condition A. These results will be interpreted in relation to the literature, and their implications for worker safety.

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#### **A. KNEEBONE, M. A. LUSZCZ, R. A. BAKER & J. L. KNIGHT. Incidence And Predictors Of Self-Reported Memory Function Following Coronary Artery Bypass Graft Surgery.**

Background: Cross-sectional studies with various clinical populations have found an association between self-reported memory dysfunction and depressive symptomatology on the one hand and deficit unawareness and executive dysfunction on the other. This study employs a prospective longitudinal pre- post-treatment design in a coronary artery bypass surgery sample (CABG; n=66, mean age 65.1 ± 9.3) and normal matched group (n=47) that provides a more powerful test of these relationships. Method: Standardised regression-based methodology was used to define the incidence and magnitude of meaningful change 6-months postoperation on measures of memory self-report and family-report (Memory Assessment Clinic questionnaire), memory performance (CVLT), executive function (TMT B/A, COWAT) and depression (Depression Anxiety Stress Scale). Hierarchical regression was employed to define the predictors of both self-reported memory decline and deficit unawareness (self-report/family-report discrepancy). Results: There were no significant differences between CABG and control participants in the incidence of both self-reported memory decline and deficit unawareness (Self-report: CABG 6.3%-9.4%; Unawareness: CABG 5.5%-7.3%). Self-reported decline in memory ability and to a lesser extent frequency of memory failure was predicted by increased depressive symptomatology (15.6% and 5.4% of variance, respectively). No variable, including measures of executive function entered as a significant predictor of deficit unawareness. Conclusions: The incidence of self-reported memory decline and deficit unawareness following CABG is no different from that of normal controls. Consistent with previous literature self-reported memory decline was associated with a concurrent pre- to post-operative increase in depressive symptomatology. However, contrary to expectation deficit unawareness was unrelated to diminished executive function.

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#### **E. BOSSEMA, A.N. BRAND, F.L. MOLL, R.G.A. ACKERSTAFF, E.H.F. DE HAAN & L.J.P. VAN DOORNEN. Cognitive Impairment in Patients with Severe Occlusive Disease of the Carotid Artery is Related to Transient Ischemic Symptoms.**

Restorative cognitive effects are generally expected from carotid endarterectomy (CEA) in patients with severe atherosclerotic disease. The purpose of this study was to examine the existence of preoperative cognitive impairment in (subgroups of) these patients. Therefore, 24 asymptomatic and 45 symptomatic atherosclerotic patients with a haemodynamically significant stenosis of one or both carotid arteries were assessed one day before CEA with a neuropsychological test battery. Patients with recent major stroke were excluded. Performance was compared to that of 40 healthy controls. Mood was assessed to control for its possible influence on neuropsychological performance. The analyses showed that patients were cognitively impaired on tests of visual memory, attention, and executive functioning. Motor speed and visuo-spatial function were not affected. Correction for negative mood did not alter these results, so the impairments could not be attributed to mood states before surgery. Cognitive impairment was higher in patients with a recent history of transient ischemic symptoms, but not in patients with severe bilateral stenosis. Besides, all patients with severe cognitive impairment had highly severe stenosis. These findings leave open the possibility of cognitive restoration after CEA as a result of recovery from subtle brain damage or due to improved blood supply to the brain.

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## Symposium 15/11.00am-12.30pm

**MEASUREMENT OF EXECUTIVE FUNCTIONING  
IN TYPICAL AND ATYPICAL DEVELOPMENT***Chair:* Rebecca Bull*Discussant:* Kimberley Espy

Executive function skills, such as the ability to inhibit information, to shift attention, and to hold and manipulate information in working memory, show continued protracted development into adolescence. This symposium focuses on the assessment of executive function skills in normal development, in children born prematurely, and children diagnosed with attention disorders. The aims of the symposium are to a) highlight some of the difficulties encountered when attempting to measure pure executive function skills, and b) examine normal and atypical development of such skills (in particular, inhibition) using behavioural and neurophysiological techniques. Two of the papers (Bull & Espy, and Smidts & Anderson) will examine the characteristics and construct validity of the Shape School (Espy, 1997), a task designed to measure inhibitory and shifting skills in normally developing young children. Wright will describe adapted measures used to examine inhibitory function in normally developing children and children with attention deficits, and methods by which impulsivity can be reduced. The final two papers will present evidence from children born prematurely and children with ADHD, linking performance on executive function measures with brain volume (Howard & Anderson) and cortical activation (Carter).

**R. BULL & K. A. ESPY. Complexity of Rule Use in the Shape School.**

The Shape School is designed to assess the development of inhibitory and shifting skills in children aged 3 to 6 years. First, the patterns of normative performance on the Shape School will be reviewed. Task performance then is considered in light of rule use complexity and the support by specific underlying cognitive skills. Sixty-nine children (4.2 to 5.4 years) were administered the Shape School and a battery of tasks selected to measure specific cognitive skills; short-term memory (digit span), behavioural inhibition (NEPSY statue), cognitive inhibition (AB task), flexible shifting (colour reversal), and visual attention (NEPSY visual attention). In the Shape School inhibit condition, virtually all children in this age range were able to apply the simple, single rule; therefore, not permitting further analyses. In the shift condition, a pair of rules must be considered simultaneously, where children were categorised into 3 groups; those who used only one rule, those who used 2 rules with difficulty, and those who successfully used 2 rules. MANOVA comparing the groups on the cognitive tasks revealed that children who relied on a single strategy were younger, and performed more poorly on the short-term memory and behaviour inhibition measures. In the both condition, children must employ an embedded rule at the settings level, again resulting in 3 groups; those who successfully embedded 1 rule (colour or shape) into the setting level (inhibit); those who successfully used two rules within the setting level, and those who tried to use the rules within this complexity level but had difficulty. MANOVA comparing the groups revealed that whilst there was no difference in age, the groups differed in behaviour inhibition and visual attention. Children differ markedly in the types of strategies used on this task. The use of complex strategies changes with age, even in this limited age range, is related to specific cognitive skills that subservise executive control.

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**D. P. SMIDTS & V. ANDERSON. Cognitive Flexibility In Children Between Three And Seven Years.**

Cognitive flexibility is required in a number of daily situations, such as adapting to a changing environment, solving problems, and making decisions. The ability to think flexibly is dependent on several cognitive pro-

cesses, such as concept generation, shifting, feedback utilization, and working memory. Although a number of studies have investigated cognitive flexibility in school-age children, relatively little is known about the development of switching abilities in younger children. In the present study, cognitive flexibility was investigated in children between three and seven years, by using the Shape School (Espy, 1997), the Object Classification Task for Children (OCTC: Smidts & Anderson, in press), and the Comprehension of Instructions and Tower tasks from the NEPSY (Korkman, Kirk, & Kemp, 1998). Participants were children from the metropolitan area of Melbourne, Australia, and were divided into five age groups. Findings from this study show that processes within the domain of cognitive flexibility appear to undergo considerable development during the early childhood years, with relatively rapid developmental gains between the ages of four and five years. It also appears that, by the age of five years, children are able to extract information from nonidentical items, suggesting that by this age, children have acquired basic concept generation skills. However, the ability to combine abstraction with more complex cognitive activities, such as shifting, does not seem to emerge until the age of six years. These results suggest different developmental trajectories for specific executive skills. Findings will be discussed within the broader context of executive function development.

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**K. A. ESPY & R. BULL. The Nature of the Central Executive in Young Children.**

The role of the central executive in working memory was examined early in ontogeny, that is, in young, preschool children. Inhibition of prepotent responding and flexible shifting among verbal response sets were measured in a large sample of 219 typically, developing preschool children (3- to 6-year-olds) with varying verbal working memory storage capacities. The Shape School (Espy, 1997), a task designed to better parse different executive components in an engaging, age appropriate format, was used to assess these executive abilities. Only flexible shifting differed among children of different verbal working memory storage capacities. Children with low storage capacities were less accurate in shifting among rule sets, where children with high storage capacities were more efficient in shifting, as demonstrated by reduced latencies for task completion. These results suggest that even in very young children, the central executive appears to play a prominent role in inhibiting one response set in favour of activating another. This role in inhibition appears to be independent from the more basic and automatic inhibition of a prepotent response in these preschool children. Developmental implications of these findings are discussed.

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**K. HOWARD, P. ANDERSON, H. WANG, V. ANDERSON, M. KEANE, M. BEAR & T. INDER. Relationship Between Executive Behaviors And Brain Volumes In Preterm Children.**

It has recently been reported that children born preterm display executive dysfunction (EDF) as early as 2 to 3 years of age. These impairments are likely to be associated with brain injury as a result of periventricular leukomalacia (PVL) and intra-ventricular hemorrhage (IVH). Neuroimaging research indicates that white matter injury in preterm children disrupts myelination as well as the maturation of cortical grey matter structures. Furthermore, children born preterm without brain injury have also been shown to have reduced brain volumes. The primary objective of this study was to examine the relationship between executive behaviors and brain volumes in 24 children born very preterm (<32 weeks gestation) or very low birth weight (<1250g). These children underwent advanced magnetic resonance imaging (MRI) techniques at 40 weeks gestation, and developmental assessments at 2 years corrected age. The Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P) was used to

assess executive behaviors. In comparison to age/gender norms, our preterm sample exhibited specific deficits in working memory and plan/organize, which are elements of the emerging metacognition domain. Both working memory and plan/organize scores correlated significantly with total brain volume ( $r > 0.5$ ) and cortical grey matter ( $r > 0.5$ ). In addition, the flexibility index score correlated moderately with the volume of myelinated white matter. In summary, we found that preterm children display EDF at 2 years of age, and that these deficits were related to reduced brain volumes. These findings support the clinical validity of the BRIEF-P and the clinical utility of advanced neuroimaging with preterm children.

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**J. D. CARTER, M. FARROW, R. B. SILBERSTEIN, C. STOUGH, A. TUCKER & A. PIPINGAS. Prefrontal Processing In Children With And Without ADHD During Performance Of The Stop Task.**

Inhibitory control is essential for regulating human behaviour. It evolves late, both phylogenetically and ontogenetically, as do the brain regions considered responsible for its function - the frontal and prefrontal lobes. Subsequently, inhibitory control is susceptible to impairment in neuro-

developmental disorders such as attention-deficit / hyperactivity disorder (ADHD). In the present study, steady-state probe topography (SSPT) was used to record the brain electrical activity of 14 ADHD children and 14 control children - aged between 8 and 12 years - during performance of the stop task. SSPT provides a dynamic measure of brain activation that is virtually insensitive to movement artifact. Results indicated that the control group displayed prefrontal, steady-state visually evoked potential (SSVEP) latency reductions during successfully inhibited stop trials but not during failed stop trials, suggesting that successful engagement of response inhibition processes may be indexed by prefrontal, SSVEP latency reductions. In comparison, the ADHD group did not display such prominent, prefrontal latency reductions and displayed a significantly lower level of inhibitory control. Results suggest that in normal children, excitation within prefrontal networks leads to the initiation of inhibitory processes. The results further suggest that ADHD children may not be able to modulate prefrontal activity in the same manner as controls, in response to the demands of an inhibitory control task. These findings are consistent with the theory that impaired inhibitory control may underlie the symptoms of ADHD.

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