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Poster Session 1

CHILD NEUROPSYCHOLOGY

S. CRAFT, D. WHITE, T.S. PARK, & G. FIGIEL. Visual Attention in Children With Perinatal Brain Injury: Asymmetric Effects of Bilateral Lesions.

The questions of how visual attention develops and how it is affected by disruption during development are beginning to be addressed. In the present study, a covert orienting task (Posner et al., 1982) was administered to 33 children with bilateral perinatal injury to anterior, posterior, or diffuse brain regions and 36 normal children to determine the effects of such injury on visual attention. Children with bilateral anterior lesions showed lateralized impairment indicating compromise of left hemisphere early attentional processes. In contrast, children with posterior lesions that typically disrupt attention in adults showed no differences in right or left visual field performance or deficits in specific attentional operations. These results suggest that anterior brain regions play an important role in the development of visual attention, and that left hemisphere attentional processes are particularly affected by disruption of anterior function.

T. HERSHEY, S. CRAFT, L. GOTTLIEB, & T.S. PARK. Temporal Lobe Involvement in Working Memory During Early Childhood.

The possibility was examined that declarative memory (DM) and working memory (WM) systems are initially interdependent and become individuated during development. This system specification may occur as connections between frontal and temporal regions are refined between age 4 and adolescence. We hypothesized that temporal lobe lesions (TL) in younger patients would produce deficits in DM and WM, and that TL damage in older patients would produce deficits in DM only. A group of children, ages 4–16 with unilateral TL ($n = 5$) and a group of normal controls, ages 5–15 ($n = 11$), were tested on working and declarative memory tasks. Our results indicate that 1) TL children are impaired on tests of declarative memory and that 2) only younger TL children showed impairment on a working memory task. In summary, our hypotheses that TL damage in younger children will disrupt WM function was supported.

J. SCHATZ, S. CRAFT, D. WHITE, T.S. PARK, & G. FIGIEL. Bilateral Perinatal Lesions Produce Lateralized Deficits in Inhibition of Return.

Inhibition of return is a normal tendency to orient attention away from previously attended locations and toward novel locations. This effect is believed to be mediated by midbrain structures, including the superior colliculus. This study compared inhibition of return in cerebral palsy (CP) children with perinatal brain injury ($n = 25$) to normal control children ($n = 40$). MRI was used to identify CP children with bilateral anterior ($n = 4$), posterior ($n = 8$), diffuse ($n = 7$), and no observable lesions ($n = 6$). The results suggest that bilateral damage is associated with unilateral deficits in inhibition of return. Anterior damage appears to have the most profound effects upon inhibition of return, while posterior damage has no apparent effect. The results are consistent with previous speculations that connections from the frontal eye fields to the superior colliculus may be important in the development of collicular inhibition.

B. BANWELL, T. PRESTON, R.H. REID, J.M.R. GILLETT, & T. BROWN. HMPAO SPECT and Neuropsychological Deficits in Pediatric Brain Injury.

Tc-99m HMPAO SPECT, detailed neuropsychological and neurological evaluations, and traditional CT were performed on 16 children with traumatic brain injury. Examination results with each diagnostic instrument were rated by each examiner as suggesting frontal, fronto-temporal, cerebellar, and diffuse injury. Raters were blinded to the results found by other examiners. Tc-99m HMPAO SPECT perfusion deficits were correlated more strongly in all cases with reported neurologic and neuropsychologic deficits than were CT scan results, both in terms of the nature and estimated location of the deficits. In addition, CT scan results were reported significantly more often as "normal" in patients with residual neuropsychologic sequelae even when HMPAO SPECT results suggested perfusion deficits. Results suggest that HMPAO SPECT may be a more accurate predictor of residual brain injury, and its cognitive and behavioral sequelae in children, than is CT.

C. MOORE & V. ANDERSON. Pediatric Head Injury: The Relationship Between Age at Injury and Neuropsychological Sequelae.

Despite the incidence of pediatric head injury (HI), there is a dearth of research examining possible effects of age at injury on neuropsychological outcome. This study investigates the theoretical stance that young children are more vulnerable to neuropsychological sequelae following head injury than are older children. Two groups were evaluated: 1) children experiencing significant head injury aged <7 ($n = 15$); 2) children experiencing significant head injury aged ≥7 ($n = 15$). The groups were matched on sex, socioeconomic status and severity of injury. Analysis revealed that the young HI group performed poorly on a number of measures and that the neuropsychological recovery profiles of the groups differed greatly. Findings indicate that the young children fail to main-

tain an initial recovery period and fall increasingly behind their non-HI peers. The older children continue to recover, gradually catching up to their same age peers.

L. CHAPIESKI, K. ZELMAN, K. CULHANE, W. HUCKEBA, K. EVANKOVICH, & A. ALEXANDER. Cognitive and Academic Characteristics of Children With Newly Diagnosed Epilepsy.
This study investigated cognitive and academic functioning in a group of children with newly diagnosed epilepsy and a group of siblings. Children with epilepsy were divided into three groups by seizure type: Complex-partial seizures (CPS), complex-partial seizures with secondary generalization (CPS w/2G) and generalized tonic-clonic seizures (GTC). The test battery included measures of intelligence, verbal ability, spatial skills, memory, attention, motor skills and academics. The CPS w/2G and GTC groups had significantly lower scores than the other two groups on measures of intelligence and verbal ability and the GTC group had significantly lower scores of tests of memory. There were no other significant group differences but the GTC and CPS w/2G groups tended to be lower functioning overall. Siblings were found to have attentional problems.

L. CHAPIESKI, K. CULHANE, K. ZELMAN, K. EVANKOVICH, W. HUCKEBA, & A. ALEXANDER. Emotional and Behavioral Adjustment in Children With Newly Diagnosed Epilepsy.
This study investigated emotional and behavioral functioning in a group of children with newly diagnosed epilepsy and their siblings. Children with newly diagnosed epilepsy were predicted to display more conduct problems and hyperactivity. Some problems such as anxiety, depression, social incompetence and dependence may develop over time as a result of psychosocial factors related to the diagnosis of epilepsy. These types of problems were not expected to be significantly elevated in children newly diagnosed with epilepsy. Mothers, but not teachers, reported more conduct problems and hyperactivity in the children with epilepsy. Problems with anxiety, depression, social incompetence or dependence were not found. Surprisingly, both mothers and teachers reported higher levels of cognitive and academic problems in the children with seizures even though the two groups were similar on measures of intelligence and academic ability.

B.K. CHRISTENSEN, R.R. HENRY, J.M. COSCIA, & P. WALSH. Domain-Specific Neurocognitive Functioning in Children With Vertically Acquired HIV-1 Infection.
Pediatric HIV-1 infection is suggested to have deleterious neurocognitive consequences. However, previous studies rely primarily on global indices of neurocognitive functioning. A global score, although informative, is not necessarily an accurate index of neurocognitive integrity. Moreover, few studies control for the effects of environmental and medical factors. This study examined domain-specific neurocognitive functioning in 31 children, ages 2.5–8.5 yr, using the McCarthy Scale of Children's Abilities. Children were all born to infected mothers, and were divided into two groups: (1) children with HIV-1 infection ($n = 15$) and (2) children not infected ($n = 16$). Significant group differences in verbal, quantitative and motor performance were found, while no group difference in global cognitive functioning was obtained. Results support the use of multiple domain-specific neurocognitive measures in pediatric HIV-1 infection instead of a single global index.

C. DYWAN, J. BYRNE, & J. CONNOLLY. Assessing Receptive Vocabulary in a Cerebral Palsy Patient: An Alternative Strategy.
An ERP paradigm using a computer-based adaptation of the Peabody Picture Vocabulary Test-Revised (PPVT-R) measured the perception of semantic match and mismatch between picture-word pairs to assess the receptive vocabulary of a 17-year-old severe cerebral palsy patient. The patient showed ERP components that differentiated matching picture-word pairs from mismatching pairs for receptive vocabulary within his acquired range. ERPs were not differential at vocabulary levels above age range. The present case study clearly illustrates the clinical use of ERPs in the linguistic and cognitive assessment of individuals who are unable to provide verbal or motor responses due to their multiple handicaps.

S.N. MATTSON, J.V. FILOTEO, E.P. RILEY, D.C. DELIS, & K.L. JONES. Cognitive Deficits in Children Exposed to Alcohol Prenatally.
Fetal alcohol syndrome (FAS) is known to be associated with a variety of behavioral and cognitive deficits. However, the majority of children born to alcohol abusing women do not meet the formal criteria for FAS and it is not known if the cognitive abilities of these children differ quantitatively or qualitatively from those of children with FAS. Using a set of neuropsychological and intellectual tests, this study compared three groups of children: (1) children with FAS; (2) children who were born to alcohol abusing women but who did not meet the formal criteria for FAS (the PEA group); and (3) normal control children. The results indicated that, relative to normal children, the FAS and the PEA groups were impaired on tests of intellectual, language, and nonverbal problem solving abilities. In contrast, only the FAS group evidenced significant impairments on a test of memory functioning. These results suggest that there may be both quantitative and qualitative differences between the cognitive abilities of FAS and PEA children.

A. UECKER & L. NADEL. Spatial but not Object Memory Deficits in Children With Alcohol Related Birth Defects (ARBD).
Fifteen children with ARBD ($\bar{x}$ age = 9.7 ± 2.40) and 15 control children ($\bar{x}$ age = 9.8 ± 3.2) performed an object and spatial recall task at immediate and delay intervals. In object recall, only the effect for time of administration ($p < .01$) was significant. In spatial recall, a significant effect for both group ($p < .01$) and time ($p < .0001$) resulted. An age*group ($p < .05$) interaction in the spatial task indicated that age facilitated performance in the control group but not the group with ARBD. Hippocampal dysfunction in children with ARBD is suggested by 1) animal models of ARBD, 2) spatial memory deficits in animals with lesions to the hippocampus, and 3) the present spatial memory deficit.

A. UECKER & L. NADEL. Spatial Locations Gone Awry: Behavioral Evidence of Hippocampus Pathology in Children With Alcohol Related Birth Defects (ARBD).
The Smith and Milner (1981) spatial localization task was administered to fifteen children with ARBD ($\bar{x}$ age = 9.7 ± 2.40) and 15 control children ($\bar{x}$ age = 9.8 ± 3.2). A general spatial memory deficit ($p < .05$) and differential forgetting in delayed object recall ($p < .05$) in children with ARBD indicates the presence of hippocampal pathology. In addition to the deficit in forming object-location associations, the children with ARBD significantly distorted ($p < .05$) the spatial array. The important role of the hippocampus in learning and memory is undisputed. Further investigation could lend insight into neurodevelopmental learning phenomena.

D.P. WABER & J.H. BERNSTEIN. Performance of Normal and Learning Disabled Children on the Rey-Osterrieth Complex Figure Test (ROFC): Validation of the Waber-Holmes Developmental Scoring Procedure.
Performance on the Rey-Osterrieth Complex Figure Test of 361 learning disabled children and 383 public school children was assessed by the Waber-Holmes scoring system. Aims were to determine how well the task discriminates the groups and to describe developmental trends. LD children produced less well organized designs and did not show the developmental trend seen in the normative sample. Their productions were less configurational and they recalled less of the structural components of the figure than did controls. They also committed more errors. Differences between the two groups became evident at nine years of age and increased thereafter. In conclusion, the Waber-Holmes scoring of the ROCF discriminated well between LD and control children at 9 years of age and over. Poor organization of the figure among the LD group

is associated with failure to focus on the structural components of the figure and adopt a configurational approach.

J.S. HAUT, D.A. WARREN, & Y. BRETZMAN. Performance Differences of Older Children on the WRAML Story Memory Subtest: Are Stories B and C Different?
The WRAML is a recently developed memory test for children and adolescents. The Story Memory subtest of the WRAML consists of three narrative prose passages, two of which are presented orally depending on the child's age. Older children are assessed on their immediate and delayed recall of stories B and C, which appear to be qualitatively different. In this study, a mixed clinical sample demonstrated significantly greater proportion recall of story B both immediately following presentation and after a delay. Further, recognition memory after the delay was significantly better for story B than for story C. This is thought to reflect differences in the prose structure of the stories, suggesting that performance on the stories should be considered separately when interpreting WRAML Story Memory scores.

J. KASHDEN, J.S. HAUT, S. WONG, & M.D. FRANZEN. Commission Errors on the WRAML Picture Memory Subtest: Relation to Performance.
This archival study investigates the relation between commission errors made on the Picture Memory subtest of the WRAML and other WRAML indexes. It also examines the relation between these commission errors and other attentional and frontal lobe measures. The results provide evidence supporting the use of commission errors as a potential measure of attentional deficit and possible frontal lobe dysfunction. Consideration may also be given to the formal inclusion of commission error frequency in the scoring of the WRAML.

M. WILLIAMS, C. LOPRESTI, C. HINKIN, P. SATZ, W. VAN GORP, E.R. STIEHM, & Y. BRYSON. Neurodevelopmental Functioning in HIV Infected Infants.
Investigations of neurodevelopment in HIV infected children have typically not focused on children under the age of 18 mo. This paper describes initial cross-sectional results from a prospective longitudinal study in which the Bayley Scales of Infant Development were used to assess level of mental and motor functioning in 19 infants between the ages of 5 and 16 mo. Data analysis reveals a marked difference in mental and motor skills between infected and uninfected groups. Infants with HIV infection are more likely than those who are uninfected to demonstrate neurodevelopmental impairment. However, among infected children, a large variability in scores was observed. Half of the infected subjects obtained scores more than 2 standard deviations below the mean in their mental and/or motor index. The remaining children performed within normal limits. This marked variability in degree of developmental delay among infected infants may be explained by timing of transmission of HIV from mother to child, with those infected in utero more likely to be delayed than those infected at the time of birth.

S.N. KLEINMAN & D.P. WABER. Prose Memory Strategies of Children Treated for Leukemia: A Story Grammar Analysis of the Anna Thompson Passage.
Cognitive and linguistic processes used to perform a standard prose memory task were examined in children who are long-term survivors of acute lymphoblastic leukemia (ALL) and age and sex-matched controls. The *Anna Thompson* passage from the WMS-R was scored in the standard fashion and by a story grammar analysis. The patient group performed more poorly by the standard scoring. The story grammar analysis revealed that the ALL group produced fewer T-units, but there were no differences in order of elements or completeness of episode. Error types differed: All patients generated more incomplete/ambiguous errors; controls generated more addition/assumption errors. This pattern suggests that the ALL patients do not have comparable access to the story schema, even though story grammar use is comparable. The findings implicate the relational processing with which connections are made between what is known and what is to be known.

S.L. MILLER & P. TALLAL. Auditory Temporal Processing Performance in Family Members of Language Impaired Children.
The ability to perceive rapidly presented auditory information has been shown to differentiate language impaired (LI) and control children (Tallal et al., 1985). In addition, temporal processing deficits are more severe in LI subjects with a positive family history for LI (Tallal et al., 1991). Data are presented which examine the auditory processing abilities in 155 "normal" subjects, with or without a family history for LI. Results show a dissociation in the rate of temporal processing performance among subjects differing in family history for LI. At slower rates of auditory presentation, inter stimulus interval (ISI) of 500 ms, task performance was relatively high and failed to differentiate the groups. At faster rates of stimulus presentation, ISIs of 10 and 70 ms, performance was significantly worse in the family history positive, as compared to family history negative, group. Supported by grants from NIDCD RO1-1854 and NINDS F32-NS09424.

Z. GOLDBERG & J. MULLIN. Behavioral Correlates of GDS Performance: Parent and Teacher Ratings.
Objective measures of sustained attention and impulse control are becoming more widely used as part of the diagnostic evaluation of Attention Deficit Hyperactivity Disorder (ADHD). The Gordon Diagnostic System (GDS) is a microprocessor based assessment device designed to provide standard measures of sustained attention and impulse control. In a sample of 100 children and adolescents referred for possible ADHD, significant (but low) correlations were obtained between GDS performance and teacher and parent ratings of conduct problems, impulsivity, and hyperactivity. Children who performed in the abnormal or borderline range on the GDS Vigilance Task obtained significantly higher scores on the Conduct Problem and Impulsive-Hyperactive scales from the Conners Parents Rating Scale and obtained significantly higher scores on the Externalizing scale from the Child Behavior Checklist than children who performed normally.

D.L. MOLFESE, V.J. MOLFESE, & L. GILL. Brain Responses at Birth Predict Language Skills at Five Years-of-Age: A Longitudinal Study.
Recent longitudinal studies report relationships between brain activity at birth and later language skills at 3 years-of-age. This study replicates and extends one such study through 5 years-of-age by recording auditory evoked responses (AERs) from the left and right hemisphere frontal, temporal, and parietal regions of 79 newborn infants to consonant-vowel syllables. Discriminant function analyses correctly classified over 80% of these infants at five years of age as belonging to either a Low group with language performance measures one standard deviation below the group mean, a mean group, or a High group with language scores one standard deviation above the mean. This approach should greatly facilitate early assessment strategies designed to detect learning disabilities.

D. DEWEY. A Case Study of Developmental Ideational Apraxic Dysgraphia.
This study investigated the printing, spelling, cognitive, language, praxis, visual-motor and fine motor skills of an 8 yr 4 mo old boy, A.H., who demonstrated developmental dysgraphia. Results indicated that A.H. had an IQ in the normal range. Language and memory skills were found to be above average. Further, A.H. demonstrated good copying ability for words and sentences, good praxis, age level reading and oral spelling abilities, normal visual-motor skills and normal fine motor skills, but very poor letter production with spontaneous printing and printing to dictation. Thus, A.H. was found to have a selective impairment in his ability to print words in the absence of difficulty in copying letters and words. He appeared to have difficulty accessing the correct motor programs or sequences for printing which Baxter and Warrington have referred to as ideational apraxic agraphia.

J. ROVET, C. SZEKELY, & M. HOCKENBERRY. Dyscalculia in Turner Syndrome.

Turner Syndrome (TS) is a genetic disorder affecting only females, which occurs as a result of a loss of some X chromatin material, most usually a single X chromosome. Phenotypic characteristics include short stature, ovarian dysgenesis, skeletal abnormalities and a neuropsychological profile with strengths in the verbal domain and deficient spatial and math abilities. Using a model derived by McCloskey et al. (1985) to decompartmentalize math processing skills into basic subcomponents, we conducted error analyses on math problems solved by TS subjects. Our goals were to document the extent and severity of their impairment, factors contributing to poorer math performance, and the relationships between math and spatial processing. From an initial sample of 45 TS and 80 control subjects (age = 7.4 to 16.8), 40 matched pairs who completed the WRAT-R were derived. Results revealed comparable reading skills but significantly poorer arithmetic achievement. Error analysis revealed that TS had a higher error rate for Fact but not Procedure problems. Similar analyses on a subset of 10 TS and 37 controls given the Keymath revealed that TS made more Procedure but not more Fact errors. Results are discussed in terms of the different constraints of the two tasks and the implications of such for the use of different strategies. We conclude that math difficulties in TS are not due to poor spatial ability but to less adequate procedural skills combined with poorer fact retrieval in timed testing situations.

J. ROVET, K. KREKOWICH, K. PERLMAN, & R. WEKSBERG. Savant Characteristics in a Child With Developmental Delay and Deletion in the Short Arm of Chromosome 20.

Deletion of the short arm of chromosome 20 is a rare condition described in fewer than 20 cases. It is associated with characteristic facial and skeletal malformations, abnormal liver function, developmental delay and mental retardation. We describe presently a 4 yr 10 mo boy with a number of medical problems including growth hormone deficiency, hypoglycemia, febrile convulsions, mild ventriculomegaly, 6th nerve palsy, dysmorphogenesis and micropenis. Genetic studies revealed a deletion of chromosome 20 between p11 and p12. He demonstrated delayed motor and language milestones and was receiving physical and speech therapy. Since 2.5 yr, he has been reading (self-taught), and is currently proficient with the computer, shows exceptional memory for maps and spatial locations, and has an extremely rich and active fantasy life. Detailed neuropsychological evaluation revealed low average intelligence with a scattered profile, normal language, memory and attention skills, impaired visuomotor integration and graphomotor skills, and slow processing speed. Academically, decoding, reading comprehension and oral spelling skills were at the 7.5 yr level (>99.99 percentile) with good phonetic skills. Math and general knowledge were average while writing was significantly delayed. Results will be discussed in light of other savant syndromes, including disabilities with preserved or exceptional talents. Competing explanations will be weighed in light of current interpretations on savant abilities and genetic and other biological-related causes.

C.G. KOVAR, B.F. PENNINGTON, M.M.M. MAZZOCCO, & R.J. HAGERMAN. The Neurocognitive Phenotype of Girls With Fragile X Syndrome.

The neurocognitive phenotype of fragile X syndrome in school age girls was examined among 12 fragile X girls ages 8–16 yr with <2% expression, and contrasted with the cognitive profile of 12 dyslexic girls matched for age. Measures were obtained for intellectual ability, achievement, verbal, nonverbal, memory and executive functions. Preliminary results indicate that after controlling for IQ, there were significantly different cognitive profiles in the two groups. Fragile X girls performed better than dyslexic girls on verbal measures, whereas dyslexic girls performed better than fragile X girls on nonverbal and executive function measures. These findings do not support previous work suggesting that females with fragile X syndrome have a cognitive phenotype similar to dyslexia, but are consistent with our results from fragile X female adults.

LOISA BENNETTO, BRUCE F. PENNINGTON, & SALLY J. ROGERS. Working Memory in Autism.

This study presents evidence of a working memory deficit in autism. High-functioning autistic children were compared to IQ- and age-matched controls on a variety of memory tasks. The autistic children demonstrated significant deficits on several tasks that involved on-line storage and processing of information. In contrast, they were not different from control subjects on standard verbal short-term memory tasks. This pattern of results suggests that autistic children have marked difficulty maintaining and utilizing appropriate context across a variety of cognitive tasks. These results help to provide a foundation for understanding the broad range of cognitive and social deficits found in autism.

K.R. KRULL, J.C. ELBERT, K. HAMES, C. BLANCO, & L.T. SMITH. Event-Related Potentials During Selective Attention in Children With Attention Deficit Disorder.

Auditory and visual event-related potentials (ERPs) were collected during a bimodality selective attention task from controls (CNT), dyslexics (DYS), and children with Attention Deficit Disorder with (ADD+) and without (ADD−) hyperactivity. Reaction times indicate faster responses for ADD+ and ADD− groups, with more false alarms and missed signals. ERPs suggest the ADD+ group responded poorly to the auditory stimuli in both the attended and nonattended modalities. The DYS group displayed a large response to the auditory stimuli during both the attended and nonattended conditions. The CNT group processed the stimuli more efficiently, displaying appropriate responses to relevant stimuli and suppressions of irrelevant stimuli.

R. BARANES, S.C. LEVINE, & E. PITTS. The Effects of Individual Differences in Characteristic Hemispheric Arousal Asymmetry on Young Children's Calculation Skills.

This research examines the differential effects of characteristic hemispheric arousal asymmetry on young children's performance on verbal and nonverbal calculation tasks. Kindergartners solved verbal and nonverbal calculation problems, and their levels of performance and strategy choices were analyzed. Children who were right hemisphere aroused solved more verbal problems correctly than children who were left hemisphere aroused, though there was no difference for the nonverbal problems. Right hemisphere aroused children used more finger counting and fewer retrieval strategies on verbal problems than did the left hemisphere aroused children. The findings suggest that right hemisphere aroused children may be better able to access representations of quantities on verbally presented problems than left hemisphere aroused children, and that this ability may be related to better performance on verbal calculation tasks.

B. BROOKSHIRE, I. BUTLER, L. EWING-COBBS, J. FLETCHER, & D. LACHAR. Psychosocial Characteristics of Children With Tourette Syndrome.

This study examined the psychosocial characteristics of 31 children, aged 6–16 yr who had been diagnosed with Tourette Syndrome (TS). Children with TS were diagnosed by the same pediatric neurologist using currently accepted clinical criteria. A comparison group consisted of 20 similarly aged siblings. Parents completed the Personality Inventory for Children (PIC) for both the TS child and sibling. In comparison to a normative population and the sibling group, children with TS were described as having increased developmental/academic problems and as being generally maladjusted. Parents described children with TS as evidencing increased behaviors associated with somatization, depression, anxiety, and emotional lability, but not hyperactivity. Children having more severe TS symptoms evidenced increased behavior problems. However, comparison to other clinical populations revealed the behavior problems of the TS group to be relatively mild. These results will be discussed in relation to the literature on TS as well as research using the PIC to determine patterns of psychosocial functioning in children with learning disabilities.

C.A. LEAVELL, J. FRANKHAUSER, R.S. FISCHER, & W. DEBASSIO. Patterns of Learning Interference in Attention Deficit Disorder (ADD).

The purpose of the present study was to determine if Attention Deficit Disorder (ADD) children present with executive deficits and sensitivity to interference similar to those difficulties observed in adults with frontal system pathology, when learning complex verbal and nonverbal information. Children diagnosed with ADD were matched to controls on the basis of sex, age and FSIQ and administered the CVLT and $\frac{7}{24}$. Measures of learning efficiency, proactive and retroactive interference, and the number of intrusions, perseverations and semantic clusters were calculated. Results indicate that the ADD children showed comparable learning performance to the controls, but on the CVLT demonstrated increased susceptibility to both proactive and retroactive interference as well as other signs of executive dysfunction, such as decreased tendency to semantically cluster and increased perseverations. Findings are supportive of the notion that ADD children exhibit executive problems specific to tasks which require sustained organizational capacity, but do not exhibit a generalized deficit in information processing.

S. CAMPBELL, W.O. DINGWALL, & S. GORDON-SALANT. Hemispheric Processing of Affective and Linguistic Prosody in Children.

The present study investigated the laterality effects (hemispheric participation) in second, fourth and sixth grade elementary school children during dichotic listening tasks involving two types of prosody, linguistic and affective intonation and two types of linguistic information, words and CV nonsense syllables. Both types of prosody elicited a significant left ear advantage. The advantage was more pronounced for affective than linguistic prosody ($p < .0001$; $.0174$). There was no significant group or sex effect. The CV nonsense syllables elicited the expected right ear affect, ($p < .016$). These findings support previously documented evidence of right hemisphere (RH) involvement in the processing of prosody in adults (Ley & Bryden, 1982; Blumstein & Cooper, 1974; Shipley-Brown et al., 1988) and suggest that a similar pattern of RH participation is evidenced in children. Developmental implications are addressed.

M. APPLEBY, J. CRONIN, C. HARDING, & M. BRIGELL. Neuropsychological and Psychosocial Functioning in Subgroups of Learning Disabled Children.

An extensive literature exists supporting the validity of a WRAT-R typology for classifying LD children. There is also an emerging literature exploring psychosocial differences among subgroups. This study explored neuropsychological and psychosocial functioning in children who were classified as reading or math disabled, employing rigorous, regression-corrected, IQ-achievement criteria. The study sample included ten reading and ten math disabled children, ages 8 through 10. The children were assessed with a broad set of neuropsychological measures, computer- and video-based social-perceptual tasks, and clinical measures of social functioning in the home and school environments. Results support conceptually-relevant group differences on neuropsychological tasks and, in contrast to most of the existing literature, greater psychosocial problems among reading disabled children.

L. BLACKBURN. Factors Associated With Language Outcome in Landau-Kleffner Syndrome.

Data from 74 cases of Landau-Kleffner Syndrome (LKS) reported in the literature, and 4 cases personally seen was analyzed to identify factors predictive of language outcome. Early age of LKS onset, failure of language to recover in the first year, and presence of behavioral change was associated with poor prognosis for language recovery. Variables related to convulsive disorder (seizure type, seizure control, relationship of seizures to onset, EEG characteristics) were not related to outcome. Results support the view that the convulsive aspects of the disorder are a symptom of some other underlying etiology for most cases reported. Results suggest that LKS is being applied to a mixture of acquired childhood aphasias, with clearer diagnostic criteria needed as a first step in understanding this syndrome.

M.J. COHEN & C.A. RICCIO. Neuropsychological Profiles of Children With Specific Language Impairment.

Specific language impairment affects up to 12% of children, 3–21 years of age, with an estimated 5–10% of children evidencing difficulties of significant severity to warrant intervention. Diagnosis of specific language impairment is often hampered because the child may appear to be mentally handicapped or autistic-like. Retrospective data is reported here relative to the neuropsychological profile of 28 preschool and 37 school-age children with specific language impairment. Results indicate that at the preschool level, these children demonstrate significant impairment specific to language abilities. As children get older, however, the discrepancy between verbal and nonverbal abilities decreases and academic achievement declines. Implications of these findings as they relate to diagnosis and intervention are discussed.

K.O. YEATES, E. BLUMENSTEIN, C.M. PATTERSON, & D.C. DELIS. Verbal Learning and Memory Following Pediatric Closed-Head Injury.

The effects of pediatric closed-head injuries on verbal learning and memory skills were examined using the children's version of the California Verbal Learning Test (CVLT). The test was administered to 47 children, 5–16 years of age, who had sustained a closed-head injury. The relationship between injury severity and CVLT performance was analyzed after controlling for age at testing and the interval between injury and testing. Severity of injury predicted several measures, including total recall and consistency of recall across learning trials. However, it did not predict the rate of acquisition, learning strategies, or primacy/recency effects during the learning trials. Severity predicted short- but not long-delay recall, and the number of intrusions during cued recall. It also predicted the number of correct responses, but not false positives, during recognition. Finally, severity predicted the percent decline in recall from short to long delay, but did not predict proactive or retroactive interference or retrieval difficulties during long-delay free recall.

S.G. CRAWFORD, B.J. KAPLAN, & L.L. FIELD. The Relationships Among Insulin-Dependent Diabetes Mellitus, Learning Difficulties, and Handedness.

This study examined the relationships among insulin-dependent diabetes mellitus (IDDM), learning difficulties, and handedness. Subjects were 27 children with IDDM and their families, and 27 age- and sex-matched control children and their families. Parents were asked to report the child's personal history, and any familial history of learning difficulties, immunologic dysfunction, and nonrighthandedness. Results from several MANOVAs showed no significant differences in the overall familial prevalences of learning difficulties, or autoimmune disorders between the two groups. There was, however, a slight tendency for children with IDDM and their families to have more inflammatory bowel disease, and more thyroid problems. Nonrighthandedness also tended to be more common in females with IDDM and their families, as well as in male control children and their families. Results are discussed in terms of Geschwind and Galaburda's theory of cerebral lateralization.

S.G. CRAWFORD, B.J. KAPLAN, & L.L. FIELD. Learning Difficulties in Children With Insulin-Dependent Diabetes Mellitus and Their Unaffected Siblings.

Hansen et al. (1986, 1987) reported that people with insulin-dependent diabetes mellitus (IDDM) have a lower prevalence of dyslexia than their nondiabetic relatives. Their studies were, however, compromised by several problems, including lack of control families, and an inadequate definition of dyslexia. Because of the great amount of interest in the relationship between immunologic disorders and learning disabilities, we attempted to replicate Hansen's findings. Rather than focusing on a specific type of learning difficulty such as dyslexia, we examined the

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general relationship between IDDM and learning, using a broad assessment of cognitive skills and some motor skills. Subjects were 27 children with IDDM, and their unaffected siblings. Results of a series of sign tests showed that, contrary to the initial hypothesis, there were no significant differences between the children with IDDM and their unaffected siblings on any of the cognitive skills that were assessed. Results are discussed in terms of the relationship between immunologic dysfunction and learning difficulties.

C. JIRON, J.W. DELUCA, & R.D. WHITMAN. Receptive Nonverbal Communication Skills in Learning Disabled (LD) Subtypes and Non-LD Psychiatric Patients.

Deficits in nonverbal communication skills have been implicated in the development of lifelong psychosocial disruption. One subtype of LD children who are thought to be especially vulnerable to receptive nonverbal communication deficits is the Nonverbal Learning Disability (NLD) group. NLD children exhibit a specific pattern of performance characteristics including mathematical skills deficits in the context of intact language skills, visuospatial and visuoconstructional deficits, psychomotor deficits, increased risk for internalizing psychopathology, and social skills deficits. This research (1) investigated the relationship between receptive nonverbal skills and psychosocial adjustment in NLD, general learning disabled (GLD) and non-learning disabled child psychiatric controls, and (2) examined whether NLD children are more deficient in these skills than the other two groups. Results were nonsignificant overall, with the psychiatric controls showing poorer performance on nonverbal receptive skills than the LD groups. We propose that future research focus on measures of social interaction which access higher level processing, and that the role of emotional disturbance be considered in investigations of nonverbal processing.

P. SIMOS, D.L. MOLFESE, & R. BRENDEN. Innate Bases for the Perception of Voicing Contrasts: Electrophysiological Correlates.

Previous reports suggest that the perception of voicing cues may be based on acoustic mechanisms that change little across development. To test this hypothesis, auditory evoked brain responses (AERs) were recorded from the left and right hemisphere frontal, temporal, and parietal regions of 16 newborn infants in response to speech and nonspeech sounds which varied in temporal onset. Analyses indicated that the newborn infant brain discriminated between temporal contrasts occurring in nonspeech but not speech sounds. Results are discussed in terms of the ontogenesis of temporal cue processing.

S. DEMARCO & T. SUNDER. Childhood Kinesthetic Verbal Dyspraxia.

Attempts have been made to draw parallels between adult and childhood phonologic disorders. Bilateral lesions in the temporal lobes result in verbal auditory agnosia and disruption in phonologic decoding. Frontal lesions result in verbal dyspraxia arising from disruption in speech motor programming. Another form of phonologic impairment in adults but rarely discussed relative to children, is kinesthetic verbal apraxia, which results from inferior parietal lesions and is characterized by disruption in afferent motor organization and motor movement memory for speech. Presented is a clinical case study on a 4-year-old boy who exhibits many of the characteristics of kinesthetic verbal apraxia. Extensive neurologic, neuropsychologic and speech and language assessments were conducted. MRI demonstrated an inferior parietal infarct. The diagnostic test results will be contrasted with those reported on brain damaged adults with kinesthetic verbal dyspraxia.

S. DEMARCO, L.G. HEIDENREICH, & M.S. HOUGH. Neuropsychological Assessment of Moderate to Severe Phonological Disorders in Children.

This study sought to determine if twenty preschool and early school-aged children diagnosed as having a developmental language disorder with moderate-to-severe phonological problems could be subtyped through multivariate analysis. Furthermore, if subtypes emerged, would they correspond to Rapin and Allen's classification system that included the phonologic-syntactic syndrome, phonological programming, and verbal dyspraxia. A neuropsychological test battery that included measures of oral motor performance, oral sensory performance, speech diadochokinesis, speech sound discrimination, language comprehension, expressive grammar, expressive vocabulary, prosody, fluency, visual-motor copying, and fingertapping were subjected to single linkage cluster analysis. Three groups emerged: Group 1 representing a planning group, Group 2 representing a somatosensory group, and Group 3 representing a motor control group. Qualitative analysis of behaviors also differentiated the groups to some extent. Group 1 corresponded to the phonologic-syntactic syndrome subtype, Group 2 corresponded to the phonological programming subtype, and Group 3 corresponded to the verbal dyspraxia subtype, thus lending some support to Rapin and Allen's classification system.

L. O'DONNELL & J.D. WASSERMAN. Convergent Validation for the Memory Subtest of the Children's Category Test.

The final subtest of the Category Test has historically been thought to be a measure of recognition memory although limited research support for this contention has been provided. The purpose of this investigation was to explore the convergent validity of the memory subtests for the most recent adaptation of the Category Test, the Children's Category Test (CCT; Boll, 1993) through a series of correlational analyses with the California Verbal Learning Test for Children (CVLT-C; Delis, Kramer, Kaplan and Ober, in press). A total of 920 children between the ages of 5 and 16 years of age were administered the appropriate form of the CCT and the CVLT-C. Results indicated that CCT memory subtest and CVLT-C indices of recognition memory were significantly correlated, providing convergent validity evidence for the use of the CCT memory subtest as an index of recognition memory.

K.J. HOFMAN, E.L. HARRIS, J. MOHR, M.M.M. MAZZOCCO, & M.B. DENCKLA. Specific Reading Deficits Associated With Neurofibromatosis Type 1 (NF1).

NF1 is a common genetic disorder affecting the cutaneous and nervous systems. The more common cognitive impairment reported for NF1 is Nonverbal Learning Disability (NLD). In this study, we examine the incidence of verbal deficits and reading disability (RD) among NF1 children and unaffected siblings of NF1 children. Our results show a significant difference in the incidence of RD, with a higher incidence of RD among NF1 children (57%) relative to their siblings (14%). However, there were no group differences in performance on phoneme segmentation tasks. These findings lead us to question whether the NF1 phenotype includes RD independent of NLD, or whether there is a link between these two types of learning disabilities in children with NF1.

J.D. WASSERMAN & D.A. NILES. Developmental Trajectories for Semantic and Phonemic Fluency.

Verbal fluency tasks have demonstrated utility in the identification of brain-injured individuals and rank among the most commonly used measures to assess language in neuropsychology. Recent investigations have suggested that two specific subtypes of verbal fluency, semantic fluency and phonemic fluency, have distinctive neurodevelopmental curves, with concomitantly different neuroanatomical implications. The purpose of this investigation was to examine the normal development of semantic and phonemic fluency in early childhood and to establish trajectories in the maturation of these abilities. A total of 274 children between the ages of 3 and 12 were administered selected semantic and/or phonemic fluency tasks. Results support the contention that children are slower to acquire phonemic fluency than semantic fluency and that through age 12, phonemic fluency consistently lags behind semantic fluency. The difference in development between these two types of fluency suggests that they should not be used interchangeably.

J.D. WASSERMAN & J.L. SPARKS. Neurodevelopment Trends in Verbal Information-Seeking Strategies With the Twenty Questions Task.
The following investigation sought to elucidate the qualitative processes and strategies involved in the early development of verbal information-seeking and problem-solving abilities. Sixty subjects between the ages of 4 and 12 performed a modified version of the Twenty Questions task. Examiners recorded questions verbatim and provided appropriate feedback. Results indicate that there is a generalized improvement in performance with age that appears largely unrelated to task completion time. Changes in question-asking strategies and a proclivity toward more categorical questioning with maturation were demonstrated. These findings are interpreted as suggesting that the Twenty Questions task is developmentally sensitive and that analyses of strategies in questioning may have potential clinical applicability.

V. ANDERSON. Learning Disability: Evidence for Subtypes Characterized by Deficits in Information Processing.
Learning disability (LD) commonly implies specific deficits in reading skill. However careful evaluation suggests that LD children frequently exhibit generalized educational problems. Thus explanations of LD focusing on skills required for classroom learning may be more helpful than the traditional theories implicating isolated cognitive abilities. This study addressed this issue, using a subtyping approach. Two LD samples were evaluated ($n = 208$, $n_2 = 160$) using standard intellectual, educational and neuropsychological measures. Five distinct, stable subgroups emerged: (i) Language Deficit (23 percent); (ii) Non-Verbal Deficit (14 percent); (iii) Attention/Sequencing Deficit (11 percent); (iv) Memory Deficit (35 percent); (v) Generalized Deficit (17 percent). While (i) and (ii) are consistent with traditional models, (iii), (iv) and (v) are characterized by varying patterns of information processing (IP) deficit. Such IP deficits will restrict classroom learning and limit educational development. Implications of findings for understanding, managing and treating LD are discussed.

C.P. LEE & J.E. OBRZUT. Semantic Memory Development in Children With Specific Learning Disabilities.
Investigated taxonomic clustering and use of frequency associations as features in semantic memory development of children with specific learning disabilities (SLD). Second and sixth grade children's free recall organization was analyzed for two types of primary and secondary word lists: (1) items associated with frequency (FA) and (2) items related by category members (CM). In contrast to expected findings, younger, nondisabled children organized words categorically as proficiently as their older peers and categorization abilities of children with SLD were comparable to nondisabled subjects with one exception. Subjects with SLD showed less clustering for secondary FA. These results indicate that when individual, child generated word lists, i.e., those meaningful and familiar, are used, children with SLD may not be impaired in their ability to recognize and utilize semantic structure to facilitate learning.

B. GJAERUM & H. KLOVE. Neuropsychological and Neuromotor Examination of Developmentally Disabled and Mentally Retarded Children. Presentation of a New Method (NPM-X).
A method for neuropsychological and neuromotor examination (NPM-X) of developmentally disabled, including mentally retarded children with mental age below 7, has been developed, aiming to provide a more specific functional evaluation than traditional psychomotor developmental tests. A combined developmental neuropsychological and neuropediatric approach was chosen to meet the challenge of establishing a normative as well as an ideographic functional profile. The test battery is based on both the Halstead-Reitan and the Luria traditions, with specific attention to the methodological problems faced in testing of these children. Test-retest and inter-rater reliability have been studied on 110 children, and the results are satisfactory for most scales. The results will be presented. The clinical utility of the test battery in pediatric rehabilitation and child neuropsychiatry will be discussed.

P.W. KODITUWAKKU, L. FARMER, P. SHAW, & R.A. YEO. Developmental Trends in Planning and Memory for Temporal Order: Preliminary Results.
It has been established that the prefrontal cortex plays a critical role in both temporal organization of events in memory, and in planning. This study investigated the developmental progression of these two functions. Thirty children, age 6–9½ yr, participated. They were administered the Progressive Planning Test (a new "look-ahead" puzzle), the Raven Colored Matrices and two tests of temporal order memory: the Subject-Ordered task and a recency judgement task. Children younger than 7½ years old failed to solve those planning problems that involve mental manipulation. The development of the ability to solve these problems was associated with the emergence of memory for temporal order. The association between planning and temporal order memory remained significant after controlling for intellectual ability.

N.J. MINSHEW, D.J. SIEGEL, G. GOLDSTEIN, & M. NICHOLSON. Patterns of Language Ability in High-Functioning Autistic Children and Adults.
A study was conducted of language abilities in high-functioning autistic children and adults. Nineteen carefully diagnosed autistic children and 12 autistic adults were matched pairwise for age, IQ, gender, and race with controls. An extensive battery of language tests was administered including measures of verbal fluency (FAS and Animal Naming), verbal problem solving tests from the Stanford-Binet, the Test of Language Competence, and Clinical Evaluation of Language Fundamentals. No significant differences in either age group were found for tests of fluency, word knowledge or categorization. Autistic subjects in both age groups performed poorer than controls on tests of verbal reasoning, figurative use of language, and understanding metaphor. Relative to age peers, autistic adults, but not children, demonstrated difficulties with interpretation of complex grammatical structures.

THURSDAY MORNING, FEBRUARY 3, 1994

Paper Session 1

ATTENTION

R.E. GRAVES & B.S. KIRKBY. Automatic Attentional System Compromised by Isoluminant Stimuli.
Human visual attention is typically impaired following lesions to the inferior parietal lobe. Animal studies suggest that this area receives its principal visual input via a neural pathway, originating in the magno-cellular layers of the lateral geniculate nucleus, that responds well to luminance contrast but poorly to color contrast. Twenty normal subjects fixated the center of a green computer screen and then detected small red squares flashed peripherally. Reaction time for correct responses was slower ($p < .001$) and errors more frequent ($p < .001$) to stimuli with the same luminance as the background than to brighter or darker stimuli. Reduced ability to detect and redirect attention to isoluminant stimuli suggests that the neural basis for automatic visual attention involves the magnocellular system.

D. GELDMACHER & H. KONG. Effect of Stimulus Number and Target-to-Distractor Ratio on Letter-Cancellation Tasks.
Cancellation tests are commonly used in the clinical assessment of visuospatial function, but there has been little study of task characteristics

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influencing performance. This study was designed to assess factors which affect cancellation performance. Sixteen healthy subjects sequentially performed four random-array letter cancellation tasks. The forms contained 50 and 100 stimuli and target:distractor (T/D) ratios of 1:4 and 1:9 with target letter "A" and randomly selected letter distractors. Performance was measured as the number of correctly cancelled targets divided by the time to complete the task. There was a strong effect of T/D ratio ($p < .001$), with performance adversely affected by high T/D ratio. There was no effect of stimulus number. This suggests T/D ratio should be considered in cancellation test design and interpretation.

S.L. CREMONA-METEYARD & G.M. GEFFEN. Persistent Deficits in Visuospatial Attention Following Mild Head Injury: ERP and RT Evidence.

Event-related potentials (ERPs) were recorded while subjects completed a cued reaction time (RT) task. Subjects fixated centrally and pressed a button to a peripheral target light. A central warning cue that either indicated the target location (arrow) or was nondirectional (cross) or required no response (vertical line) appeared one second before the target. Eighty percent of directional cues were valid. Footballers (*N*, 8) tested at least one year after sustaining a mild head injury (MHI) showed a reduced RT benefit from valid cues indicating a deficit in directing attention to a cued location. Moderate to severely injured patients also show this deficit.[1] We replicated the RT finding in another nine footballers tested within 2 wk of sustaining their injury and 1 yr later. Furthermore the early orienting phase of the CNV was reduced in the MHI group compared to 12 matched controls at both test sessions. The MHI group's initial reduced information processing speed (delayed P3) and an inability to inhibit response preparation (no go CNV) had recovered by the second test session.

S.E. BLACK, B.H. BUCK, & M. BEHRMANN. Impaired Disengagement of Attention in Alzheimer's Disease.

Alzheimer's Disease (AD) affects parieto-temporal and frontal neocortices, which are key regions in the neural network underlying visuospatial attention. We assessed performance of 15 AD subjects on Posner's covert attention paradigm in correlation with HmPAO SPECT. Group analyses showed slower reaction times in AD subjects compared to normal controls, particularly with invalid cuing on the right. This was most pronounced in patients with parietal perfusion deficits on SPECT. We conclude that Alzheimer subjects showed impaired disengagement of attention, especially for right-sided cues and that the cued reaction time paradigm is sensitive to parietal dysfunction in Alzheimer's disease and may be useful in tracking disease progression and response to therapy.

J.E. OBRZUT, T.A. MONDOR, & A. UECKER. Orienting Auditory Spatial Attention on Dichotic Listening Performance.

This study investigated the extent to which the dichotic REA for CV syllables is a function of attentional factors with normal and learning disabled (LD) children. Attention was manipulated by presenting a lateralized tone cue to the targeted ear at various Stimulus Onset Asynchronies (SOAs). For normal children, sizeable REAs (25%) were apparent at the shortest SOA (150 ms) but were substantially attenuated (17% and 13% respectively) at longer intervals (450 and 750 ms SOA). Although the Ear × SOA interaction did not reach significance for LD children, the magnitude of the initial REA appeared to be attenuated at 450 ms SOA. It is concluded that the precuing technique provides a powerful means for specification of the extent to which attentional factors and hemispheric functional capabilities contribute to ear asymmetries.

[1]Cremona-Meteyard S. & Geffen G. Neuropsychologia, 30(2) 123-132, 1992

A. BELGER & M.T. BANICH. Task Demands Limit Interhemispheric Facilitation.

Previous research (e.g., Banich and Belger, 1990) has demonstrated that interhemispheric processing aids performance of computationally complex tasks. The present study presents evidence that such an advantage is only observed when task demands allow processing load to be divided between the hemispheres. Right and left handed subjects were tested on 3 interhemispheric tasks: one demanding a physical-identity and one a name-identity decision, which could be performed by both hemispheres, and the third demanding a rhyme decision, which relies on the left-hemisphere. The results indicated that interhemispheric processing improved performance for the physical and name-identity tasks, whereas it did not for the rhyme task. These findings suggest that interhemispheric interaction aids task performance by allowing a division of processing between the hemispheres.

Symposium 1

LANGUAGE AND THE BRAIN: INSIGHTS FROM IMAGING STUDIES

Recent advances in technology have provided new tools for investigating in vivo the neural basis of higher cognition. This symposium presents results from recent investigations examining the neural correlates of language using various imaging techniques in normal and language-impaired subjects. First, a series of PET studies measuring blood flow patterns in the brain are presented which re-evaluate the functional role of Broca's area in language processing. Second, the neural aspects of phonological processing will be examined using visually evoked potentials from normal and dyslexic subjects. Next, a study combining simultaneously recorded evoked potential and PET (FDG) data will present a method for integrating these complementary methodologies. Finally, new MRI findings regarding the quantification of the planum temporale will examine the lateralization of this area in normal and language-impaired subjects.

J.A. FIEZ. Pet Studies of Language Processing.

The development of positron emission technology (PET) as a tool to image brain functional anatomy offers the opportunity to enhance theories of language processing that are related to brain structure and function. To illustrate this point, a set of PET language experiments will be discussed. Particular emphasis will be placed upon a region near the boundary between Brodmann area 45 (Broca's area) and the anterior insula, and the role this region may play in some forms of high-level acoustic and phonological processing. This specific example will be used to demonstrate more generally the types of information gained from PET, and how the results can best be interpreted within the context of an interdisciplinary approach.

S.L. MILLER. Neural Aspects of Phonological Processing.

The selective neural processes involved in the phonological processing of letters were investigated with ERPs in normal and dyslexic subjects. Selective neural processes were assessed through an analysis of the topographical distribution and latency changes of an early selection negativity (SN) wave occurring over a period of 180-260 ms, and an enhanced positivity spanning 300-500 ms (DP3) after a centrally presented visual stimulus. Results showed that the selective neural activity associated with letter rhyming was functionally lateralized over the left, as compared to the right hemisphere in the control group. Dyslexic, as compared to control subjects, showed a reduction in selective neural activity which was greater over the left than right hemisphere and larger for letter rhyming than recognition tasks. Research supported by NIH Grant NS19413.

F.B. WOOD, D.L. FLOWERS, C.E. NAYLOR, & J.W. KEYES. Correlated ERP and PET Findings in a Large Normal Sample.
Forty normal subjects were studied with simultaneous ERP and regional glucose uptake (PET) measurements during performance of a continuous yes/no letter versus non-letter recognition task. Results showed unexpected strong correlations between: (a) post-response ERP components and widespread regional glucose values; (b) early stimulus processing ERP components and frontal-caudate glucose activity; and (c) pre-task resting total EEG power and general subcortical glucose activity during the task. The results are discussed not only in terms of the crucial role of frontal-subcortical modulation for even simple letter-recognition tasks, but also in terms of the need to combine multiple sources of physiological activation data in order to achieve a coherent description of regional brain activation.

C.M. LEONARD. Symmetry, Asymmetry and Language: New MRI Findings.
Asymmetry of the planum temporale (PT) is a morphological correlate of functional asymmetry for language and visuospatial function. Leftward asymmetry in the horizontal bank (H) is balanced by rightward asymmetry in the vertical bank (V). These asymmetries were examined in sagittal MRI images of 22 language impaired subjects (L) and 23 controls (C). Both groups showed mean leftward asymmetry for H (C: 15%, L: 16%) and rightward asymmetry for V (C: -36%, L: -22%). There were, however, substantial differences in the distributions. The variance of V was fourfold greater in L than in the controls. We interpret this greater variance as evidence for unregulated growth stemming from neurodevelopmental errors. The role V plays in language development should be investigated.

Paper Session 2

PSYCHIATRIC DISORDERS

P.J. MOBERG, D.A. MCKEOWN, R.L. DOTY, B.E. TURETSKY, R.E. GUR, & R.C. GUR. Olfactory Functioning in Schizophrenia: Relationship to Clinical, Neuropsychological, and MRI Volumetric Measures.
Previous studies have suggested the presence of olfactory dysfunction in schizophrenia. Many of these studies were limited in either the olfactory tests employed or in the clinical, neuropsychological or imaging variables studied. Twenty one schizophrenic patients and 16 matched controls were administered tests of olfactory, neuropsychological and clinical status. Concurrent MRI scans were also obtained. Results indicated a strong relationship between duration of illness and olfactory identification scores in schizophrenics. Patients with high scores on a negative symptom factor demonstrated lower olfactory identification scores. Patients who scored higher on a hallucinations/delusions factor exhibited significantly better sensitivity. While controls demonstrated a significant relationship between left temporal lobe volume and olfactory identification scores, as well as between olfactory thresholds and right frontal lobe volume, no relationship between olfactory scores and regional MRI measures were seen in the patient group.

D. KAREKEN, R.E. GUR, R.C. GUR, S. RESNICK, D. MOZELY, L. MOZELY, & A. SAYKIN. Cognitive Functioning and Ventricular-Brain Ratio (VBR) in Schizophrenia.
MRI scans and neuropsychological tests were administered to 68 schizophrenic patients and 68 demographically balanced healthy controls. MRIs were analyzed with a technique that segments brain from CSF volume. Patients had higher VBR, but CSF was equivalent to controls. The schizophrenics' brain volume was, however, lower. Cognitive function did not correlate with VBR or ventricular CSF in either patients or controls. However, correlations emerged in both groups between cognitive function and total brain volume. Divided into deficit (DF) and nondeficit (NDF) groups, only DF patients had lower brain volume than controls, and only DF patients revealed correlations between brain volume and function. Neuropsychological function in DF patients was also more impaired than in NDF patients. Reduced brain volume may be a feature of DF patients, and may underlie some of the cognitive dysfunction.

J.J. VASTERLING, L. ROOT, K. BRAILEY, M. UDDO, & P.B. SUTKER. Attention and Memory Performances in Post-Traumatic Stress Disorder.
Post-traumatic stress disorder (PTSD) is often associated with complaints of concentration and memory problems. Attention and memory performances were examined in 16 PTSD-diagnosed military personnel and 15 military personnel without PTSD. Relative to the comparison sample, PTSD-diagnosed individuals displayed greater impairment on tasks of attention and mental control, especially on those tasks with visual components. In addition, the PTSD group displayed relatively greater sensitivity to proactive interference on a verbal learning task and less proficiency in visual organization on a constructional task. Results are consistent with neurobiological models of PTSD that emphasize the role of hyperarousal and implicate dysfunction of frontal-subcortical systems.

S. AMANULLAH, O. SPREEN, & A. JONES. Errors of Omission and Commission in Distinguishing Alzheimer-Type and Depressed Patients.
Cholinergic system dysfunction is implicated in the cognitive deficits of DAT; noradrenergic dysfunction is implicated in depression. Different perseverative errors have been associated with each system. Recurrent perseverations, the inappropriate repetition of a previous stimulus into the current response, have been associated with cholinergic dysfunction. Continuous perseverations, the inappropriate repetition of aspects of a current response, have been associated with noradrenergic dysfunction. Data were collected from 49 patients with a clinical diagnosis of Alzheimer's disease and 39 patients with the dementia syndrome of depression. Error scores from the stories and designs of the WMS were used in a discriminant function analysis with 86% correct classification. The DAT group produced a higher proportion of recurrent perseverations; the DEP group produced a higher proportion of continuous perseverations.

M.L. GOUROVITCH, T.E. GOLDBERG, J.M. GOLD, E.F. TORREY, C. RANDOLPH, & D.R. WEINBERGER. Neuropsychological Assessment of Monozygotic Twins Discordant for Bipolar Disorder.
A comparison of monozygotic twins discordant for a neuropsychiatric disorder controls for genetic variance, thus, highlighting differences related to manifestations of the disease process. We used such a paradigm to evaluate seven twin pairs discordant for bipolar illness and seven normal twin pairs on neuropsychological tests. Statistical measures revealed that the affected twins were significantly impaired as compared to the unaffected and normal twins on measures of visuo-spatial functioning and verbal memory, including stories and list learning. Surprisingly, unaffected twins performed similarly to affected twins and significantly worse than normal controls on a Brown-Petersen memory task and overall Wechsler MQ. These data suggest that while visuo-spatial and verbal memory deficits are likely a feature of bipolar disorder related to disease variables, mild deficits in overall memory functions may be a genetic manifestation of the illness.

M.L. SILVERSTEIN, G.J. BRYSON, A. NATHAN, & L. DANIELS. Neuropsychological Dysfunction and Stages of Illness in Psychiatric Disorders.
This report examines neuropsychological performance as a prognostic indicator of clinical recovery up to two years following discharge from psychiatric hospitalization for an acute episode of either schizophrenia or mood disorder. The Halstead-Reitan Battery and WAIS were administered twice: at the acute episode and two years following discharge. The findings indicate that neuropsychological improvement does occur, however this remains outcome-dependent. Unfavorable clinical outcome

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is associated with only marginal changes in neuropsychological performance, whereas good outcome status is associated with cognitive improvement. Since both good and poor outcome subgroups had comparable levels of neuropsychological performance at the point of index hospitalization, the neuropsychological differences at follow-up do not appear to be attributable to either initial group differences or ceiling effects.

Poster Session 2

NEUROLOGICAL, MEDICAL, AND PSYCHIATRIC CONDITIONS

G.D. RAINS. Abolition of Bias for Phonemically-Similar Distractors in the Visual Recognition of Patients with Left Temporal Lobectomy.
The hypothesis that an impairment in the relationship between phonemic encoding and mnemonic processes underlies the verbal memory impairment known to follow left temporal-lobe lesions was tested by assessing verbal recognition as a function of physical, phonemic or semantic encoding in 19 patients with left temporal lobectomy, 20 patients with right temporal lobectomy and 20 normal control subjects. A recognition test, which followed the encoding phase after a delay of five minutes, employed distractors which were either phonemically or semantically similar to target items. Patients with left temporal lobectomy: (1) were impaired in overall verbal recognition and for recognition within each encoding category, (2) followed the pattern of the other two groups in recognizing more semantically-encoded words than physically or phonemically encoded words and (3) evidenced fewer phonemically-based recognition errors. These results indicate that patients with left temporal-lobe lesions exhibit the same relationship between semantic encoding and subsequent recognition as is seen in normal subjects but that a disruption in the relationship between phonemic encoding and mnemonic processes contributes to the verbal memory impairment seen in these patients.

M.L. PREVEY, R.C. DELANEY, R.H. MATTSON, L. CATTANACH, S.S. SPENCER, J.H. KIM, & D.D. SPENCER. Verbal Short Term Encoding in Temporal Lobe Epilepsy: Comparison of Patients with Left Temporal Lobe Lesions vs Hippocampal Sclerosis.
Lateralized temporal lobe epilepsy (TLE) patients show deficits in auditory/verbal short term memory due to increased susceptibility to proactive interference (PI). This study compares performance by left TLE patients with lateral neocortical lesions (LN), left TLE patients with hippocampal sclerosis (HS), and normal controls equated for age, education, and FSIQ on the Wickens Release from PI paradigm. HS patients performed significantly more poorly than controls on successive trials, a finding consistent with decreased capacity to cope with PI. Performance by LN patients fell midway between controls and HS patients. All groups showed normal release from PI on "shift" trials. The results are discussed in comparison to other patient populations, and in relation to theories re: the role of the hippocampus in coping with PI.

G.P. LEE, D.W. LORING, J.R. SMITH, H.E. FOUTY, H.F. FLANIGIN, & K.J. MEADOR. Memory Testing During Intraoperative Hippocampal Cooling: Correspondence With Wada Memory Results.
Memory assessment during intraoperative thermal hippocampal inactivation and during the Wada procedure evaluate the capacity of the contralateral hippocampus to form new memories in temporal lobectomy patients. Correspondence between the two methods was examined in 25 temporal lobectomy patients in an attempt to help determine their clinical value. Wada testing suggested poor contralateral memory support in 15 cases and adequate support in 10 cases. Hippocampal cooling results were consistent with Wada memory testing in 13 cases (4 = risk, 9 = no risk) and inconsistent in 12 patients (Wada/no risk, cooling/risk = 1, Wada/risk, cooling/no risk = 11). Because post-cooling memory was deficient in only 5 cases, results suggest that it may be a more specific method than Wada memory assessment.

G.P. LEE, D.W. LORING, J.R. NEWELL, & S.L. HAVERSTOCK. Self-Evaluative Response Bias in Temporal Lobe Epilepsy: Do Left and Right Temporal Lobe Epileptics Differ?
Differences between self-report and rater evaluations have suggested a tendency for left temporal lobe epileptics (LTs) to provide overly harsh self-descriptions ("tarnishers") and for right temporal lobe epileptics (RTs) to present themselves in an overly favorable light ("polishers"). These self-evaluation response biases were investigated in 40 patients with unilateral temporal lobe seizure onsets (20 LTs, 20 RTs) by examining the weight factor from their Millon Clinical Multiaxial Inventories (MCMI). The weight factor was designed to detect excessive self-depreciation or self-enhancement among individuals completing the MCMI. There were no statistical differences between left and right TL's weight factor scores. Results do not support the hypothesis that LTs have a self-depreciating ("tarnish"), and RTs a self-enhancing ("polish"), self-evaluation response bias.

J. ROBIDOUX, I. ROULEAU, R. LABRECQUE, & C. DENAULT. Analysis of Reading Errors After Left (L) and Right (R) Injections During the Intracarotid Sodium Amytal (ISA) Test.
It was reported that in most patients undergoing the ISA test the L hemisphere is dominant for language and the R hemisphere is dominant for the control of attention to the extrapersonnal space. Since performance on reading task during the ISA test can be confounded by both language and visuospatial deficits we examined 114 reading errors of words and phrases produced after R and L injections in 25 right-handed patients with unilateral temporal lobe focus and with a L cerebral dominance for language. The errors were rated by 3 judges unaware of the side of injection. After the R injection, errors were found mostly in the L portion of the stimuli read, while after the L injection the errors were more equally distributed to the L, R and both portions of the stimuli. Furthermore, the expected dissociation between neglect errors (R inj.) and phonemic paraphasia (L inj.) was found. However, morphological errors were observed after both injections. The present findings demonstrated in 2 ways that the nature of reading errors during the ISA test was different after L and R injections, supporting the notion of differential hemispheric abilities.

J. BORTZ & G.P. PRIGATANO. Response Characteristics of Pseudoseizure and Seizure Disorder Patients on a Verbal Learning and Memory Test.
Extensive diagnostic procedures are often required to differentiate psychogenic seizures from true epileptic seizures. To date, the neuropsychological profile of pseudoseizure patients has not been well-characterized. This study compared the response characteristics of 12 patients with psychogenic seizures (PS) to those of patients with documented right (RT) and left temporal lobe seizure foci (LT) on the recognition memory subtest of the CVLT. Only PS patients evidenced a negative response bias, whereas both SD groups demonstrated a positive response tendency. Hermann and colleagues (1992) also reported a positive response bias in SD patients pre- and postanterior temporal lobectomy. If a negative response bias in PS patients is a reliable finding, it may prove useful in the clinical evaluation of these patients.

Z. CARAMANOS, A. SVENSEN, M. KATSARKAS, A. PALKHIVALA, L.B. TAYLOR, & M. PETRIDES. Copy and Recall of the Rey-Osterrieth Complex Figure Before and After Unilateral Frontal- or Temporal-Lobe Excision: No Effect of Side or Lobe of Lesion.
Copy and recall drawings of the Rey by patients with well-localized epileptic foci were scored blind as to lesion site using standard protocol (18 elements scored 0 to 2 based on whether they are drawn and placed correctly). Drawings were also scored for which and how many elements were missing, distorted, displaced, and/or repeated. No main effects of

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side or lobe or side-by-lobe interactions were found on copy or recall scores, either before or after unilateral left or right, -frontal or -temporal lobe removals. Moreover, all groups' recall improved equally from pre- to post-operative testing. Furthermore, between-group overlap was complete on each of the other measures and lesion site could not be predicted using discriminant functions derived from either pre- or post-operative performance.

W.B. BARR, K. PERRINE, O. DEVINSKY, & N. SCHAUL. Spatial Learning Abilities in Epilepsy Surgery Candidates.

Verbal learning impairments are quite common in patients with left temporal lobe seizures (LTL). Analogous impairments in spatial learning have been more difficult to identify in patients with right temporal lobe foci (RTL). This study examined spatial learning with the $\frac{7}{24}$ Spatial Recall Test. The test was administered to patients with unilateral temporal lobe seizures from two epilepsy surgery centers. The LTL and RTL groups exhibited comparable patterns of performance during the five learning trials and after a short delay. The RTL group showed significantly lower recall of an interfering set of stimuli and lower retention of the original stimuli after a $\frac{1}{2}$-hour delay. The results suggest that RTL patients have a greater susceptibility to interference effects and greater difficulties in retaining spatial information over time.

K. PERRINE, O. DEVINSKY, N. DONOFRIO, & D.J. LUCIANO. Relationship of the California Verbal Learning Test to Other Measures of Memory, Language and Frontal Lobe Functions.

This preliminary study examines the relationship of the California Verbal Learning Test (CVLT) to other memory measures and to tests of language and frontal lobe functions in 51 patients with epilepsy undergoing presurgical evaluations. Significant but modest intercorrelations were found between the CVLT and SRT. Logical Memory correlated significantly only with SRT. Naming ability related more strongly with the CVLT and Logical Memory than with the SRT. The CVLT related more to frontal functions mediating inhibition over competing response sets. Different task demands in the CVLT, SRT and Logical Memory may account for some of the variance not shared by these tests. Patients with left versus right temporal foci did not differ significantly on any of the memory tests.

K. PERRINE, O. DEVINSKY, K.J. MEADOR, B. HERMANN, J.A. CRAMER, R.D. HAYS & B.G. VICKREY. The Relationship of Neuropsychological Functioning to Quality of Life in Epilepsy.

Epilepsy impacts significantly on patients' lives. Although psychosocial and cognitive factors have been examined in epilepsy, there has been little research pertaining to quality of life issues. The current study examines the relationship of formal tests of cognition and mood to a new Quality of Life in Epilepsy inventory (QOLIE-89) in 304 subjects. The QOLIE-89 scales of self-reported cognitive function (memory, language, attention) correlated significantly with overall quality of life. Objective tests of mood and cognition also correlated with quality of life scales, but to a lesser degree than the QOLIE-89 scales assessing self-perceived neuropsychological dysfunction. Quality of life assessment adds a new dimension to understanding patients with epilepsy, and should be included with formal tests of cognition and mood.

A.K. BOLTON, S. WEINTRAUB, & R.A. NOVELLY. Qualitative Analysis of Verbal Learning Changes Following Left Temporal Lobectomy.

Component processes (e.g., encoding, consolidation, retrieval) of verbal list learning and memory were studied pre and postoperatively in patients undergoing left (LTL) or right (RTL) temporal lobectomy for control of intractable epilepsy. There were no differences in performance between LTL and RTL groups presurgically. However, there was a postsurgical increase in susceptibility to proactive interference for the LTL group relative to the RTL group. Findings suggest that LTL can lead to specific deficits within the learning process. Encoding of new information appears to be particularly affected by LTL, perhaps on the basis of increased sensitivity to proactive interference. Results highlight the need to utilize tests that allow for dissociations among specific learning and memory processes when evaluating epilepsy surgery patients.

A.K. BOLTON & L.B. KRUPP. Learning and Memory Processes in Lyme Disease and Multiple Sclerosis.

Cognitive deficits have been reported in patients with Lyme borreliosis, but there is very little information about the effect of the disease on specific memory functions. Component processes of verbal list learning were examined in patients with Lyme disease and MS. The Lyme group showed deficits in immediate verbal processing capacity but performed normally on measures of retrieval. In contrast, MS patients demonstrated impairment in aspects of retrieval (e.g., increased sensitivity to retroactive interference) but showed relatively intact initial encoding. No deficits in recognition memory were observed for either group relative to controls. Our findings support previous studies which have documented verbal memory impairment in Lyme disease and indicate that Lyme encephalopathy may have its greatest impact on initial encoding processes.

A.M. SANDER, S.A. BROWN, P.M. PLENGER, T.D. RIDLEY, J.W. WHELESS, & L.J. WILLMORE. The Relationship of the Nonverbal Selective Reminding Test to Other Tests of Visual Memory and to Hemispheric Dysfunction in Epilepsy Patients.

The construct and concurrent validity of the Nonverbal Selective Reminding Test (NVSR) was investigated by determining its correlation with some widely used tests of visual memory as well as by investigating any differences in performance in epilepsy patients with left vs. right hemispheric dysfunction, as assessed by EEG and CT/MRI data. Suggestions regarding the possible contribution of the NVSR to the existing data on lateralization of functions in epilepsy patients will be discussed.

J.A. SHELTON, C.M. RYAN, & R.M. DASHEIFF. Neuropsychological and Psychosocial Indicators of Potential Selection Bias in Epilepsy Treatment Trials.

Clinical trial volunteers from outside the usual treatment population may differ from "regular" clinical patients. The University of Pittsburgh Epilepsy Center compared 23 clinical trial candidates with 23 clinic patients being evaluated for epilepsy surgery, on demographic, neuropsychological, and psychosocial variables. Clinical trial volunteers were significantly older, but differed on no other demographic variable, and differed on none of a wide range of neuropsychological variables. However, the groups differed on several scales of the Millon Clinical Multiaxial Inventory and the Washington Psychosocial Seizure Inventory, with clinical trial participants more impaired. The similarity between groups on neuropsychological variables bodes well for generalizability of results for research questions in this realm, but differences on psychopathological and psychosocial variables may confound results on outcome measures related to quality of life.

R. HENDRICKSON, C.M. RYAN, J.A. SHELTON, & R.M. DASHEIFF. Memory and Intelligence Tests Do Not Discriminate Unifocal From Multifocal Temporal Lobe Epilepsy.

Previous studies with temporal lobe epilepsy (TLE) patients have provided mixed support for using neuropsychological data to lateralize seizure focus. If subjects with multifocal TLE have more diffusely distributed damage than those with unifocal disease, then those inconsistent findings may be due to the tendency of previous studies to group unifocal and multifocal subjects together. We studied 66 patients using depth electrodes to identify locus (left; right) and focus onset (unifocal; multifocal). The 4 subgroups were comparable on age, gender, handedness and age at diagnosis, but no differences were found on measures of Verbal IQ, Performance IQ, verbal memory, or nonverbal memory. These results suggest that clinical neuropsychological measures do not appear to differentiate unifocal from multifocal TLE.

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B.P. HERMANN, G. SOMES, A.R. WYLER, J. PETERSON, & L. CLEMENT. Dysnomia Following Left Anterior Temporal Lobectomy Without Language Mapping: Frequency and Correlates.
The purpose of this investigation was to determine the frequency and correlates of dysnomia following left anterior temporal lobectomy (ATL) without language mapping. The sample consisted of 162 nonretarded (FSIQ > 69) left speech dominant patients without MRI lesions (excluding mesial temporal sclerosis) (85 left ATL, 77 right ATL). The distribution of pre- to postoperative change scores on the Visual Naming subtest from the Multilingual Aphasia Examination was derived for right handed, right ATL patients. Seven percent of the left ATL patients exceeded the worst right ATL change score, even though there was no significant mean difference between the left and right ATL groups. Further analysis of the left ATL group revealed a later age at onset of epilepsy and lower Full Scale IQ to be associated with post-operative dysnomia.

M. LAFRAMBOISE, P.J. SNYDER, A. AUGUST, P. FEDIO, & H. COHEN. Cerebral Control of Speech During the Intracarotid Sodium Amytal Procedure.
Many epilepsy patients develop seizure disorders early in life often resulting in anomalous patterns of cortical functional organization. Acoustical study of speech productions during the intracarotid sodium amytal procedure (IAP) may clarify how specific individual variables (e.g., age of onset) impact on the pattern and extent of amodal cerebral organization of speech. Two case studies are presented: both are right-handed, male, left speech dominant, with focal left temporal lesions; they differ in ages of onset of seizure disorders (1.5 vs. 16 yr). Recorded pre- and postinjection speech samples were digitized at 22 KHz and analyses of Formants 1 and 2 (F_1 and F_2) of vowel sounds were performed. Greater vocal control was observed in the patient with early acquired RAB left mesial temporal dysfunction. An explanatory model will be presented.

G. AHERN, A. HERRING, D. LABINER, M. WEINAND, & K.J. OOMMEN. Affective Self-Report During the Intracarotid Sodium Amobarbital Test.
Changes in internal affective state were investigated in patients undergoing the intracarotid sodium amobarbital test. It was found that when the left hemisphere was inactivated, patients rated their mood as significantly more negative than during baseline conditions. No significant change in affective state was observed during the inactivation of the right hemisphere. The findings are interpreted in terms of a differential lateralization model of emotion, in which the right hemisphere is more involved in the more powerful and salient negative affects.

E. SHAPIRO, L. LOCKMAN, D. KNOPMAN, & W. KRIVIT. Frontal Dementia in Metachromatic Leukodystrophy.
Patients with the late juvenile and adult form of metachromatic leukodystrophy (MLD), a rare genetic neurodegenerative disease, demonstrate a pattern of frontal dementia from both behavioral description and neuropsychological testing. This pattern distinguishes it from psychiatric disorders with which it is often confused and from the forms seen in childhood in which neurological motor symptoms predominate. Nine cases had neuropsychological testing from a protocol performed to determine eligibility for bone marrow transplantation. Behaviorally, disinhibition and inattention were found. Poorer nonverbal than verbal skills, difficulty with spatial perception and visual memory, relative preservation of language functions, and poorer mathematics than reading was characteristic. Poor encoding but good short term verbal memory was found. Results on the Test of Variables of Attention, a continuous performance measure of attention, showed severe deficits in vigilance, excessive distractibility, and difficulty sustaining attention. Together with poor performance on the tests of executive functioning, results were consistent with a picture of severe frontal lobe dysfunction superimposed on abnormalities associated with white matter disease. Corroborative MRI findings indicate widespread demyelination with frontal areas most severely impaired.

D.L. NYENHUIS, S.M. RAO, T.L. LUCHETTA, L. BERNARDIN, & L. RAYMAN. A Comparison of Patient and Spouse Report of Multiple Sclerosis Symptoms.
We compared the report of physical, cognitive and behavioral MS-related symptoms in 52 MS-spouse dyads. We found that when patients and their spouses were asked to report on the patients' MS symptoms: 1) patients endorsed more symptoms than their spouses, 2) the report of patients and spouses correlated at roughly the same level with independent measures of neurological and neuropsychological impairment and 3) MS patients who endorsed fewer symptoms than their spouses were not found to be more physically or cognitively impaired than those who endorsed more symptoms than their spouses. These results are not consistent with the idea that MS patients, as a group, under-report their symptoms and are supportive of the validity self-report data from MS patient groups.

M. SCHMIDT, F.L. COOLIDGE, & P.A. MIDDLETON. Qualitative Aspects of Word-List Learning in Multiple Sclerosis.
Word-list learning for a Multiple Sclerosis group (MS; $n = 30$) was compared to age and education matched normal controls ($n = 30$). MS was similar to controls on delayed recognition memory but worse on free recall during learning. A regression equation that predicts free recall from 11 qualitative indices (e.g., semantic clustering) was equally accurate for Controls, MS with memory impairment (MS-MI; $n = 14$), and MS without memory impairment (MS-MU; $n = 16$). Five indices were significantly worse for the MS-MI group; less consistent recall across learning trials, less semantic clustering, stronger recency effect, more intrusions, and lower IQ (likely due to mild general cognitive decline in the MS-MI group). The results support the theory that memory problems in MS are related to inefficiencies in accessing information in long-term storage.

J.J. MANLY, T.L. PATTERSON, S.J. SEMPLE, R.K. HEATON, R.A. VELIN, J.L. CHANDLER, W.L. KOCH, I. GRANT, & THE HNRC GROUP. The Relationship of Psychosocial Variables to Neuropsychological Functioning in HIV+ Men.
The relationship between psychosocial functioning and neuropsychological status was examined in 198 symptomatic and asymptomatic HIV+ men. A direct discriminant function analysis was performed to distinguish between globally neuropsychologically impaired and unimpaired subjects. Depressed mood, perceived emotional support, social network size, use of approach and avoidant coping, an objective rating of major life adversity, self-perceived ability to turn down unreasonable demands (negative assertion), and CD4+ cell count were examined as possible predictors of group membership. A significant discriminant function ($\chi^2(8) = 21.45$, $p = .006$) revealed that globally impaired subjects use more approach and avoidant coping, have smaller support networks, and report more competence in negative assertion than unimpaired subjects. These findings suggest that cognitively impaired HIV+ persons are more isolated and exert more coping effort to deal with life adversity, yet are not more depressed.

J.C. STOUT, S.L. ARCHIBALD, T.L. JERNIGAN, I. ABRAMSON, J. CHANDLER, J.H. ATKINSON, I. GRANT, & THE HNRC GROUP. Longitudinal Effects of HIV on Brain Morphology.
Quantitative MR image analysis was used to estimate regional brain volumes, and their changes over 12–36 mo in 40 CDC IV, 25 CDC II/III HIV+ and 17 HIV− men. For each of three cerebral gray matter measures examined (caudate nucleus, mesial temporal lobes, and cortical gray excluding mesial temporal lobes), HIV+ subjects had significant volume decreases relative to HIV− controls. Importantly, the asymptomatic subgroup (CDC II/III) also showed significant losses. In a subset of 27 HIV+ subjects, gray and white matter measures over time were related to serum beta-2 microglobulin (β_2M), whose rise relates to HIV

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progression. Increasing β_2M correlated significantly with declining caudate, posterior diencephalon, and cerebral cortex volumes, and increasing white matter volume. We conclude that progressive loss of gray matter occurs in HIV disease and can be detected in asymptomatic HIV+ persons.

C. HINKIN, W. VAN GORP, T. MARCOTTE, J. FOSTER, L. CAMPBELL, M. BALUDA, & P. SATZ. The Relationship Between Metacognition and Episodic and Procedural Memory Among HIV-Infected Individuals.

The relationship between self-reported cognitive dysfunction and performance on measures of procedural memory among HIV-infected individuals has yet to be studied. It was hypothesized that HIV-infected individuals would demonstrate a dissociation between their performance on measures of procedural vs. declarative memory and measures of metacognition. Subjects consisted of forty-four HIV-infected males, 12 who were medically asymptomatic and 32 who met diagnostic criteria for AIDS. Following rigid exclusion/inclusion criteria subjects were administered a battery of neuropsychological measures assessing procedural memory, episodic memory, metacognition, and depression. Results of ANCOVA revealed an inverse relationship between subjects self-complaints of neuropsychological impairment and their performance on measures of episodic, but not procedural, memory. Results are discussed in terms of underlying brain-behavior relationships as well as their clinical significance.

A.U. MONSCH, M.W. BONDI, J.S. PAULSEN, N. BUTTERS, P. BRUGGER, D.P. SALMON, R.K. HEATON, I. GRANT, M.R. WALLACE, M.R. SWENSON, & THE HNRC GROUP. Verbal Fluency Performance of HIV+ Men: A Comparison to Patients With Alzheimer's and Huntington's Diseases.

Eighty-six cognitively impaired men who tested positive for the Human Immunodeficiency Virus (HIV+) were compared to 60 demographically matched HIV seronegative control subjects (HIV−) on letter and category fluency tasks. Subject performances were also compared to 44 patients with dementia of the Alzheimer type (DAT), 44 elderly normal control (ENC) subjects demographically matched to the DAT patients, 42 patients with Huntington's disease (HD), and 42 middle-aged normal control (MNC) subjects demographically matched to the HD patients. DAT, HD, and HIV+ patients were significantly impaired on both tasks relative to ENC, MNC, and HIV− subjects, respectively. Analyses of standard scores and verbal fluency indices revealed that HIV+ subjects exhibited a pattern of impairment that was similar to that of HD patients. These findings suggest that cognitively impaired HIV+ patients demonstrate a pattern of deficit consistent with subcortical brain dysfunction.

A.M. PODRAZA & R.A. BORNSTEIN. Neuropsychological Performance and CD4 Levels in HIV-1 Asymptomatic Infection.

The performance of 42 HIV-1 seropositive asymptomatic subjects with CD4 levels greater than or equal to 500 cells/mm^3 (CD4 $\geq$ 500) was compared with 26 HIV-1 seropositive asymptomatic subjects with CD4 levels less than 500 cells/mm^3 (CD4 $<$ 500) and 82 HIV-1 seronegative subjects on a battery of neuropsychological, mood state, and perceived health status measures. None of the seropositive patients were taking antiviral agents. The groups did not differ for age, mood state, or WAIS-R Verbal and Performance IQ scores. Due to group differences for education and weekly ethanol consumption, both variables were used as covariates in multivariate analyses of variance. Poorer performance on measures of psychomotor speed and higher rates of impairment was observed in the CD4 $\geq$ 500 group compared to seronegative group. With the exception of the Grooved Pegboard measure, there were no differences between the two seropositive groups on any of the measures. Although CD4 $<$ 500 group tended to report more subjective complaints of impairment in daily function than the CD4 $\geq$ 500 group, these differences did not survive statistical adjustment for education and weekly ethanol consumption. These data suggest that factors other than absolute levels of immunosuppression, as expressed by CD4 levels alone, appear to be responsible for the deficits observed in HIV-1 seropositive asymptomatic patients.

D. HOLLAND, K. CLAYPOOLE, C. MARRA, A. COLLIER, & B. TOWNES. Longitudinal Neuropsychological Functioning in Early HIV Infection.

There have been few longitudinal neuropsychological studies conducted with early HIV-seropositive individuals prior to full-blown AIDS. This study examined differences in neuropsychological performance over time in 58 seropositive and 26 seronegative control subjects. Subjects were a subset of the 159 seropositive and 76 seronegative homosexual or bisexual men recruited from an ongoing natural history study of HIV infection begun in 1982. Subjects included in the analysis underwent three or more neuropsychological assessments over a two or more year period. Subjects were evaluated with an extended 3–4 hour neuropsychological battery and global neuropsychological functioning was compared between groups. Although seropositive subjects performed less well than the seronegative subjects at each visit, there was no divergence in neuropsychological performance over time. A second mean neuropsychological rank with tests specifically targeting attention, concentration, memory and psychomotor speed was calculated for each subject, since neurocognitive dysfunction in HIV-seropositive individuals may be most evident in these areas. Neuropsychological functioning was again lower at each visit in the seropositive subjects compared to the seronegative subjects, but did not worsen or diverge across repeated evaluations.

M.C. DIEHR, R.A. VELIN, R.K. HEATON, J.A. MCCUTCHAN, M.R. WALLACE, I. GRANT, & THE HNRC GROUP. Low CD4 Count Related To Risk of Neuropsychological Decline in Asymptomatic HIV+ Men.

Rapid decline in CD4 after seroconversion predicts worse medical outcome; we predicted that those with low CD4 would experience more NP decline. *Subjects:* 60 HIV+ men in CDC II/III with estimated seropositivity of 3 yr. The group was split at median CD4 (489 cells/mm^3) into high-CD4 and low-CD4 subgroups. *Method:* Expanded Halstead-Reitan Battery was administered at baseline and one-year follow-up. Clinical ratings of NP status and NP change were rendered blindly by RKH. *Results:* At both visits, the groups differed on Full-Scale and Verbal IQs, but not on age, education, CDC Class, illness duration, or Performance IQ. At follow-up, the low-CD4 group was worse ($p = .01$) on global NP functioning. 28% of low-CD4 vs. 10% of high-CD4 were clinically worse on NP status at follow-up ($p = .09$). Regression analysis confirmed that lower CD4 uniquely predicted follow-up NP after baseline NP was entered. *Conclusion:* Low CD4 is a risk factor for NP decline in asymptomatic HIV+ men.

A.M. TIMPEIRO, A.M. PODRAZA, & R.A. BORNSTEIN. Subtypes of Neuropsychological Performance in HIV+ Asymptomatic Subjects.

Previous studies have identified a subgroup of HIV+ asymptomatic subjects with lower neuropsychological performance relative to HIV− controls. Cluster analysis was used in this study to identify performance subtypes in a group of 135 HIV+ asymptomatic subjects. A four cluster solution was obtained. Over 47% of the sample was identified as neuropsychologically normal. However, 19% were clustered by low mood ratings, 22% were grouped into the low verbal memory and slowed psychomotor speed cluster, and 12% were categorized by slowed decision time. The clusters were found to differ statistically on domain scores computed by principle components analysis. The observed differences do not appear to be accounted for by education, IQ, or mood effects.

A. BENNETT, C.A. MEYERS, R. KOMAKI, & J.D. COX. Neuropsychological Function in Patients With Small Cell and Non-Small Cell Lung Cancer Treated With Multi-Agent Chemotherapy.

A prospective study was undertaken to evaluate the cognitive status of patients with SCLC relative to normal functioning and to the functioning of a comparison group of non-small cell lung cancer (NSCLC)

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patients. Eighteen patients with SCLC and 11 patients with NSCLC, with limited stage disease and a good response multi-agent chemotherapy were studied with a battery of neuropsychological tests. Both groups showed impaired acquisition and retention of verbal material within the context of average functioning in other tested cognitive domains. Consideration of possible etiological factors does not support a significant contribution by depression, smoking, or microscopic cerebral metastases. Paraneoplastic and multi-agent chemotherapy effects are more likely to have primary etiological significance for the particular pattern of results observed in this study.

N.H. PLISKIN, H. YURK, L.T. HO, S.B. SHOCHET, & J.G. UMANS. Neuropsychological Function in Chronic Stable Hemodialysis Patients.

Neuropsychological dysfunction has commonly been reported in patients with endstage renal disease (ESRD). However, neuropsychologic assessments of ESRD patients often fail to quantitate the delivery of dialysis treatment which, along with poor control of other demographic factors, may contribute to the inconsistent pattern of cognitive impairment found across studies. Indeed, medical standards of dialysis adequacy have changed dramatically, suggesting that many patients studied previously were relatively under-dialyzed. We studied fifteen well-dialyzed and medically stable ESRD patients who demonstrated relatively subtle deficits in mental processing speed, concentration capacity, and higher-level problem-solving. Commonly reported findings of lower Performance vs. Verbal IQ and intellectual deterioration were not observed, and no area of neuropsychological function was dramatically affected. We hypothesize that severe neuropsychological deficits reported previously may be due to inadequate dialysis, rather than to ESRD.

H.C. GRANT, P.L. CRAIG, & J.M. WILLIAMS. Hypothermically-Mediated Neuroprotection from Anoxia: A Neuropsychological Case Study.

A 31-year-old woman demonstrated amazingly intact neuropsychological functioning after being submerged for at least 30 min in icy cold water. Following submersion, the patient received CPR for approximately 45 min. Even seven hours after submersion, the patient's temperature was 31°C (87°F). She remained in coma for two days post accident. Extensive neuropsychological testing was completed three months post accident with no objective or subjective deficits evidenced. Such remarkable hypothermically-mediated neuroprotection from anoxia should spur research on the putative neurophysiological mechanisms invoked (e.g., inhibiting the release of neurotoxic levels of glutamate) and the potential for application of clinically-induced hypothermia in the acute management of other types of cerebral insults.

R.F. KAPLAN, L.C. JONES, M.E. MEADOWS, E. LOGIGAN, & A.C. STEERE. CNS Infection and Memory Disturbance in Lyme Disease.

Lyme encephalopathy, which causes disturbances in memory, mood and sleep, is a common neurologic manifestation of Lyme Disease. However, the etiology of Lyme-related memory loss has been questioned. To demonstrate a relationship between CNS infection and memory disturbance, Lyme patients with increased CSF protein, intratheeal antibody production or both ($n = 16$) were compared to Lyme patients with normal CSF ($n = 21$) and normals ($n = 11$) on the Selective Reminding Test and the Beck Depression Inventory. The patients with abnormal CSF scored significantly lower on the Selective Reminding Test indicating greater memory problems. Both Lyme groups had higher depression scores than normals. The data support the hypothesis that memory loss in Lyme disease is caused by a CNS infection.

S.R. WALDSTEIN, P.F. MALLOY, R. STOUT, & R. LONGABAUGH. Predictors of Neuropsychological Performance Among Antisocial and Non-Antisocial Alcoholics.

The ability of demographic, developmental, and acquired subject characteristics to predict neuropsychological performance (Brain Age Quotient; BAQ) was examined in 22 alcoholics with Antisocial Personality Disorder (ASP) and 84 non-ASP alcoholics. Results of stepwise multiple regression analyses revealed that, in ASP subjects, poor BAQ performance was predicted by less education, childhood symptoms of Conduct Disorder, average numbers of drinks consumed per drinking day, and history of head injury, accounting for 80% of the explained variance ($p < .0001$). In non-ASP subjects, compromised BAQ performance was predicted by history of diagnosed Attention Deficit Disorder, Verbal Learning Disability, and Nonverbal Learning Disability, accounting for 24% of the explained variance ($p < .0001$). These results suggest the presence of different paths to neuropsychological impairment among ASP and non-ASP alcoholics.

J. CORWIN, A.N. GILBERT, & M. LOURY. Age, Sex, And Workplace As Mediators Of Olfactory Function In The National Geographic Smell Survey.

Many environmental pollutants are known to adversely affect chemosensation. We report data from 712,000 respondents aged 20–79 to the National Geographic Smell Survey suggesting that exposure to environmental chemicals adversely affects the sense of smell especially in men. Men and women reporting employment in factories reported and demonstrated detection and identification evidence of impaired olfactory abilities that increased with age in a more pronounced manner relative to office, home and outdoor workers. These effects were greater for men, especially for mercaptans and rose. 7.3% of respondents over age 70 could not detect mercaptans, the odorant added to natural gas. Men also reported proportionally more problems than women secondary to chemical exposure. Thus, olfaction may behave as other senses: age, sex and exposure to noxious agents interact in producing sensory deficits.

S.B. ROURKE & I. GRANT. Clinical Ratings of Neuropsychological Abilities in Two Groups of Alcoholics With Different Levels of Abstinence: Prevalence of Ability Deficits.

Alcoholics are known to have neuropsychological (NP) deficits, but less is understood about patterns of impairment and their recovery. We performed clinical ratings of 6 NP abilities (attention/concentration, learning, memory/recall, abstraction, perceptual-motor, simple motor) in 124 recently detoxified male alcoholics (RDA: abstinent mean 30 d), 52 long-term abstinent male alcoholics (LTA: abstinent mean 3.3 yr), and 65 non-alcoholic (NAC) male controls (sample mean age = 47.0; mean education = 13.6). Group comparisons showed RDA to be impaired on all ability domains; LTA and NAC were indistinguishable, except on simple motor ability. On clinical ratings RDA had significantly ($p < 0.05$) more subjects in the impaired range (versus NAC) in the areas of learning, abstraction, complex perceptual motor skills, and simple motor ability, but not in recall or attention. More LTA ($p < 0.05$) had motor defects than NAC. It appears that recent alcoholics have selective NP impairments, most of which improve with long-term abstinence; however, motor deficits may be permanent.

E.A. GAUDINO, D.M. MASUR, M. SLIWINSKI, L.D. KAUFMAN, & L.B. KRUPP. The Effect of Depressive Symptoms on Cognitive Performance in Patients with the Eosinophilia Myalgia Syndrome.

Eosinophilia Myalgia Syndrome (EMS) is a multi-system disorder caused by the toxic effects of contaminated L-Tryptophan. Studies on EMS reveal several areas of cognitive impairments. EMS patients, however have significantly more depressive symptoms than controls which makes the interpretation of cognitive impairments in EMS more difficult. In the present study, 48 EMS patients with complaints of cognitive difficulties and 15 controls with mild depressive symptoms (DC) were administered a battery of neuropsychological tests. The results demonstrate that EMS patients perform significantly more poorly than depressed controls on tests of verbal list learning and concentration. EMS patients were also rated by a clinical neuropsychologist as having more overall cognitive impairment than DC controls, regardless of level of depressive symptoms. Thus, depression alone cannot account for the extent of cognitive impairment in EMS.

P.W. KODITUWAKKU, J.K. NELSON, R.A. YEO, & W.R. MILLER. **Specific Impairments of Planning Under Acute Alcohol Intoxication.**
Previous studies have found acute alcohol-induced impairments on a wide range of motor and cognitive abilities. However, very little research has been done on the effects of acute alcohol intoxication on planning. Male college students, with no history of alcohol abuse, were given one ml of 190 proof alcohol/kg of body weight. They were then administered a battery of tests including the Progressive Planning Test (a new look ahead puzzle), the Category Test and the Shipley Institute of Living Scale. Their performance on these measures was compared to a group which had received no alcohol. The intoxicated group performed significantly more poorly than controls on the planning tests. No group differences were found on the Category Test or the Shipley.

K.M. ADAMS, S. GILMAN, R. KOEPPE, K. KLUIN, D. DEDE, S. BERENT, & L. JUNCK. **The Relationship Between Frontal Lobe Cerebral Metabolism Measured With [^{18}F] FDG PET and Neuropsychological Test Measures of Concept Formation in Older Alcoholic Patients.**
We examined 37 chronic alcoholic patients (Age: $X = 50 \pm 9$ yr; Ed: $X = 12 \pm 2$ yr; Years Heavy Drinking: $X = 22 \pm 8$ yr) screened to rule out complicating disorders and detoxified an average of 31 d. All were scanned using [^{18}F] FDG PET with quantitative analysis of local cerebral metabolic rates for glucose (LCMRG). Three stereotaxically-determined anatomic regions of the frontal lobe (cingulate, dorsolateral, orbitomedial) were identified. To test the hypothesis that reduced concept formation capability is related selectively to hypometabolism in the frontal lobe, we administered the Halstead Category Test (HCT) to all patients, and later the Wisconsin Card Sorting Test (WCST) to 19 of the patients. A significant negative correlation was found between errors on the seventh summary subtest of the HCT and LCMR for all three regions of the frontal lobe. The WCST showed a significant positive correlation between the incidence of perseverative errors and reduced metabolism, but only for the cingulate region. The data suggest that these tests capture differing kinds of concept formation. The WCST reveals disturbances relevant to focal regions of the frontal lobe, whereas the HCT reflects behavioral disturbances throughout the frontal lobe. Supported by NIAAA Grant P50 AA07378 and NIA Grant P50 AG08671

T.J. FERMAN, M. PRIMEAU, & V.C. JAMPALA. **Directed Attention and Visuospatial Processing in Schizophrenia.**
A model of atypical hemispheric asymmetry in schizophrenia was investigated using the Global/Local selective attention paradigm described by Delis et al., 1993. Subjects included 17 male right handed patients with schizophrenia and 20 normal controls matched as a group for age, education and National Adult Reading Test (NART) scores. Schizophrenics but not controls responded significantly faster when their attention was directed to the local rather than global components of a hierarchical figure. Results are consistent with hypotheses of right hemisphere underactivation/left hemisphere overactivation in schizophrenia.

D. LAPIERRE & C.M.J. BRAUN. **Orbitofrontal Deficit in Psychopathy.**
Various neuropsychological tasks were used to test the hypothesis that psychopathy is associated with a specific dysfunction of the orbitofrontal region. Prison inmates were first selected, and then divided into groups of 30 very high and 30 very low ratings of psychopathy according to Hare's Psychopathy Checklist. Subjects had no neurological history and the two groups were matched for age, education and substance abuse. Results indicate a selective and significant impairment for the psychopathic group on orbitofrontal measures (anosmia, errors of commission on a go/no-go task and qualitative error score on the Porteus Maze Test) whereas the groups performed identically on fronto-dorsolateral measures (perseveration on WCST and quantitative score on the Porteus Maze Test) or non-frontal measures (spatial rotation and similarities on a WAIS analog). The initial hypothesis is thus supported.

A.J. LAZOSKY, A.K. MALLA, & R.M.G. NORMAN. **A Role for Neuropsychological Assessment in the Psychosocial Rehabilitation of Patients with Schizophrenia.**
The aim of this preliminary study was to determine whether information obtained in detailed neuropsychological assessments of patients suffering from severe and chronic psychotic disorders may be used to assist clinical case managers working in a comprehensive assertive community management program in making specific recommendations to patients regarding their rehabilitation goals. Case managers identified neuropsychological assessment results as helpful in providing objective information on which to base decisions in forming realistic rehabilitation goals, understanding the patients' level and pattern of cognitive functioning, confirming impressions of patients' cognitive functioning (particularly when inconsistent with the patients' reports), documenting the presence or absence of learning disability, and providing suggestions for compensatory strategies. The results should be viewed as preliminary, but certainly provocative. Future directions are discussed.

R.E. LAUER, B. GIORDANI, S. BERENT, A.M. WALTERS, C.A. KING, M. NAYLOR, B. BOLYARD, E. BRAND, C. PERSAD, G. ANTROBIUS, W. MARSH, & L.L. LEININGER. **Neuropsychological Performance Differences Between Conduct Disordered and Depressed Adolescents.**
Conduct disorder (CD) is common among adolescents with depression (D). Comorbidity of the two diagnoses (D + CD) is associated with poor academic progress and treatment outcome, though no study has directly compared the two groups on neuropsychological performance. We compared 28 adolescent inpatients with D to 26 with both D and CD. Although the two groups did not differ in age, education, personality, motor ability, conceptual learning, and Performance IQ, the D + CD group performed significantly lower on academic achievement, verbal intelligence and memory, and receptive/expressive language. There were no gender differences. The results of this study confirm that patients with both CD and D perform more poorly than patients with D alone, and that their poorer performance appears to be limited to verbal and language areas.

J. GOLD, T. BLAXTON, B. HERMANN, C. RANDOLPH, P. FEDIO, T. GOLDBERG, W. THEODORE, & D. WEINBERGER. **Memory and Intelligence in Temporal Lobe Epilepsy and Schizophrenia.**
We compared the intelligence, attention, and memory performance of 72 patients with lateralized temporal lobe epilepsy (30 Left TLE, 42 Right TLE) and 70 schizophrenic patients using the WAIS-R and WMS-R. Groups were matched for age, education, and FSIQ. The RTLE group had better memory performance than the LTLE or schizophrenic groups. Unlike the schizophrenics, the LTLE group had specific verbal memory impairments, most evident on delayed testing. Both epilepsy groups had better visual memory than the schizophrenics. The schizophrenic group had a degree of attentional impairment not seen in either TLE group. The overall pattern of results suggests that lateralized temporal lobe pathology does not provide a model of schizophrenic cognitive impairment. Extratemporal pathology likely contributes to the attentional impairment of schizophrenia.

L. WOLF, M. OBUCHOWSKI, K.G. OSGOOD, & B.A. CORNBLATT. **Specificity of Neuropsychological Deficits in Schizophrenic Adolescents.**
A comprehensive neuropsychological battery was administered to neuroleptic stabilized adolescents in their first year of psychotic illness to determine if schizophrenic, psychotic affective and nonpsychotic affective adolescents could be differentiated by testing. Groups were matched on age, premorbid IQ and clinical severity. Tests were grouped into factors: set-shifting, fluency, motor speed, spatial ability and attention. Schizophrenics were severely impaired on set-shifting, fluency and spatial ability, independent of deficits in motor speed and IQ. Psychotic

affective's performance was intermediate between the other groups. More schizophrenics were severely impaired than psychotic affectives, suggesting that stable cognitive deficits persist despite clinical recovery. Longitudinal follow-up, evaluation of medication effects and comparison with normal controls is underway.

M. OBUCHOWSKI, L. WOLF, K.G. OSGOOD, & B. CORNBLATT. Neuropsychological and Attentional Impairments in First Episode Adolescent and Chronic Schizophrenic Patients.
First episode adolescent schizophrenics were compared to chronic schizophrenic patients. All subjects received consensus DSM-III-R diagnosis by structured interview and were matched by symptom severity as measured by BPRS. Preliminary data from neuropsychological and attentional comparisons are presented in order to determine if adolescent schizophrenics demonstrate deficits comparable to those found in chronic patients. Overall, the findings indicate that adolescent schizophrenics are not atypical, in that they are neuropsychologically and attentionally similar to older, chronic patients and show a comparable pattern of deficits. The severity of deficits in this early onset group suggests that cognitive impairment in some schizophrenics does not result from deterioration, but rather may be a stable trait.

K. BOONE, I. LESSER, B. MILLER, M. WOHL, N. BERMAN, A. LEE, & B. PALMER. Cognitive Functioning in a Geriatric Depressed Population: Relationship to Chronological Age.
Whether advancing age potentiates the effect of depression on cognition was examined by comparing the neuropsychological performance of three age cohorts of depressed patients (46–59, 60–69, and 70–85) against that of age-matched controls. Depression and increasing age did not interact to produce more pronounced cognitive deterioration in our unmedicated, medically healthy, well-educated outpatients diagnosed with major depression of mild to moderate severity. The test findings suggest that the presence of mild/moderate depression may result in a premature "aging" of specific cognitive abilities (e.g., nonverbal memory, word generation, and categorization), but once the seventh decade is reached, cognition in depressed and nondepressed individuals is comparable.

K. BOONE, I. LESSER, B. MILLER, M. WOHL, N. BERMAN, A. LEE, & B. PALMER. Cognitive Functioning in a Geriatric Depressed Population: Relationship of Presence and Severity of Depression to Neuropsychological Scores.
Neuropsychological evaluation of older depressed patients revealed subtle but significant declines relative to controls on measures of right hemisphere functioning (nonverbal memory, Performance IQ) and on a frontal lobe task (verbal fluency); no deficits were observed in attention, verbal memory, verbal intellectual skills, or naming. Patients with more severe depression scored more poorly than mildly depressed patients primarily on tasks of information processing speed. Thus, the presence of major depression in older, medically healthy outpatients is associated with the same pattern of neuropsychological deficits, primarily in right hemisphere/frontal lobe abilities, as has been identified in younger depressed individuals. Increasing severity of depression is associated with declines in information processing speed.

K.O. YEATES & R.A. BORNSTEIN. Neuropsychological Correlates of Learning Disability Subtypes in Children with Tourette's Syndrome.
Neuropsychological deficits in Tourette's syndrome (TS) may reflect the presence of learning disabilities. We compared the neuropsychological performance of 69 TS children between the ages of 6 and 18 who were classified into five groups based on their pattern of performance on the Wide Range Achievement Test. The groups included four learning disability subtypes similar to those described by Rourke, and a non-learning disabled comparison group. The groups did not differ in age, onset or duration of symptoms, or the severity of tics or obsessive-compulsive behaviors. The groups differed significantly on several measures in a comprehensive neuropsychological test battery. The profile of differences, however, was not entirely consistent with previous research, suggesting that the neuropsychological correlates of learning disabilities are idiosyncratic in children with TS. Thus, previous research on the neuropsychology of learning disability subtypes might not be generalizable to children with discrete neuropsychiatric or neuropathological disorders.

A. TIGNER, J. JAEGER, S. BERNS, & R. RASTOGI. Neuropsychological Tests Fail to Distinguish Between Schizophrenia and Functionally Disabled Affective Disorder Patients Seeking Rehabilitation.
Functionally disabled affective disorder patients (FD-AD) are a subset of major depression and bipolar disorder patients who are unable to engage in work, educational and/or social activity. Such disability is common in schizophrenia but not in major affective disorder. This study compares FD-AD ($N = 23$) and schizophrenia ($N = 32$) patients from an outpatient rehabilitation program on neuropsychological measures of intellectual, memory, attention, motor and executive functions. MANOVA revealed no significant differences between diagnostic groups. Our data show that FD-AD and schizophrenics have a similar pattern of neuropsychological deficits. Thus, FD-ADs requiring comprehensive rehabilitation services may be more similar to schizophrenics than other affective disorder patients who are typically less functionally disabled. Implications for inclusion of FD-ADs in neuropsychological remediation are discussed.

J.P. BOLGER & L.M. DOUGHERTY. Inhibition and Aggressive Behavior in Psychogeriatric Inpatients.
Aggressive behavior of 84 psychogeriatric inpatients was compared to their global level of cognitive functioning, psychiatric diagnosis, and ability to inhibit behavior as assessed by neuropsychological, personality, and behavioral approaches. Cognition and diagnosis did not discriminate aggressive and nonaggressive patients, but poor inhibition was related to aggressive behavior. Behavioral and personality measures of inhibition better differentiated aggressive from nonaggressive patients than the neuropsychological approach. In addition, performance on the neuropsychological measure co-varied with cognitive functioning and diagnosis, but the behavioral and personality measures were unrelated to cognition or diagnosis. Findings suggest that use of brief measures of executive functioning or cognition to predict complex behaviors in psychogeriatric inpatients may be inappropriate. Difficulties measuring psychological constructs in severely impaired psychogeriatric inpatients are also discussed.

L.A. FLASHMAN. Neuropsychological Evaluation of Patients With Schizophrenia and Temporal Lobe Epilepsy (TLE): Evidence of Subcortical Impairment.
Cognitive similarities in patients with schizophrenia and TLE were explored by examining the relationship between reaction time crossover and performance on different neuropsychological tasks. Right-handed male schizophrenics ($N = 14$), temporal lobe epileptics ($N = 9$), and normal controls ($N = 12$) were administered a neuropsychological battery including the crossover task. Results indicate that crossover is not specific to schizophrenia. Fifty percent of the schizophrenic patients, 89% of the temporal lobe epileptics, and 70% of the psychiatric controls ($N = 10$) demonstrated crossover. Further, while there was some evidence of higher cognitive impairment in patients with schizophrenia and epilepsy, the more prominent findings were difficulties in reaction time, initiation, planning and problem solving. This points to involvement of subcortical mechanisms and supports the notion of dysfunction of hierarchically low information processing mechanisms. When crossover rather than diagnosis was used to segregate the subjects, speed of motor processing, difficulty regulating inhibitory processing, and initiation deficits, which related to crossover performance, were evident as well.

Paper Session 3

VISUAL PROCESSING

P.J. ESLINGER & D. TREMENTOZZI. Lower Visual Field Advantage in Visual Spatial Processing.
A tachistoscopic study in normals was performed to investigate functional asymmetries in perceptual processing between the upper and lower visual fields. We employed experimental paradigms to probe form and pattern analysis (faces & words) and spatial analysis (judging line orientation) in both upper and lower visual fields. In ten normal subjects, we found statistically significant differences in analysis of facial and spatial stimuli between the upper and lower visual fields. Line orientation was recognized either more quickly or more accurately in the lower visual field, while a trend indicated facial stimuli was more quickly processed in the upper visual field. Reading of simple words was not statistically different. Findings indicate functional asymmetries in the upper and lower visual fields, consistent with specialization, respectively, for form and spatial perception.

M.D. HORNER & D. FREIDES. Effects of Spatial Frequency on the Lateralized Processing of Metric and Categorical Spatial Relations.
Two models of hemispheric asymmetry in visual information processing were compared, using hemifield reaction-time tasks. The metric/categorical distinction (Kosslyn, 1987), which proposes that performance asymmetries depend on the specific type of spatial relationship that is computed, was supported only under viewing conditions similar to those under which it has previously been investigated. The spatial frequency hypothesis (Sergent, 1982), which proposes that performance asymmetries are determined largely by physical properties of the stimuli, was supported under conditions in which high frequency stimulus information was either more attenuated or more available. Correlational analyses supported the existence of separate neural subsystems for processing metric and categorical spatial relations.

M.R. BASSO, B.K. SCHEFFT, M.D. RIS, & W.N. DEMBER. Positive and Negative Mood Effects on Global/Local Visual Processing.
This study tested hypotheses derived from neuropsychological models of affect and cognition (Pribram, 1981; Schefft et al., 1985; Tucker, 1988). Research has shown that the right and left frontal lobes are differentially active during positive and negative moods. Given the inhibitory role of the frontal lobes over temporo-parietal (TP) areas, it was predicted that these latter regions would also be differentially influenced during positive and negative states, yielding distinct effects on cognition. In particular, since visual processing of configural information seems associated with the right TP region and processing of detail elements with the left TP, a global bias was anticipated with positive affect and a local bias was expected with negative affect. Correlations between mood measures and perceptual judgement task performance consistently supported these hypotheses.

J.H. RICKER & S.R. MILLIS. Visuospatial Impairment in Patients with Striatal, Frontal White Matter, or Posterior Thalamic Infarction.
Visuospatial functioning was studied in inpatients with recent nondominant striatal ($n = 12$), frontal white matter ($n = 10$), or posterior thalamic ($n = 7$) infarction with equivalent levels of dementia. Discrimination, detection, and perception were equivalent across groups and within normal limits. Spatial task performance was impaired across groups. In striatal and FWM groups, spatial task impairment was associated with Wisconsin Card Sorting Test perseverative errors. This was not observed in the thalamic group. Results suggest that frontal-executive dysfunction underlies impaired spatial performance in patients with striatal or FWM lesions, but not with the thalamic lesions. Findings are explained in terms of differening subcortical pathways and support the idea that multiple processes may mediate the cognitive sequelae of subcortical lesions.

M.B. CASEY, R. NUTTALL, ELIZABETH PEZARIS, M.L. HARWOOD, & C. BENBOW. The Impact of Mental Rotation Ability on Math Aptitude: A Comparison of Males and Females Across Diverse Samples.
Recent meta-analyses have demonstrated conclusively that mental rotation is one type of spatial ability which demonstrates large and consistent sex differences. Nevertheless, it's been argued that this type of spatial sex difference has little practical relevance. The present paper compares males and females in terms of the impact of mental rotation ability on math scholastic aptitude. Three samples of subjects were administered the Vandenberg Test of Mental Rotation Ability: mathematically-talented preadolescents, college students, and high school seniors. A regression analysis was performed, using SAT math scores as the dependent measure. To control for general intelligence factors, SAT verbal scores were entered first in the equation, with the mental rotation scores entered second. Across all three samples, mental rotation ability significantly predicted for math ability for females beyond the predictive effects of verbal SAT's. In contrast, for males in more selective samples, mental rotation ability did not significantly contribute to the prediction equation above verbal ability. However, for males in the less selective high school sample, for the males as well as the females, mental rotation ability predicted for math ability.

Symposium 2

NORMAL AGING VS. MILD DEMENTIA: DEFINING THE BOUNDARIES FOR OLDER PERSONS

Early clinical detection of dementia is of theoretic and practical importance. Distinguishing mild dementia and normal age effects can be very challenging, especially with advancing age of the patient. Memory assessment and neuroimaging may be the most sensitive methods for the early detection of dementia. However, there is controversy as to which aspects of memory function and neuroimaging are most sensitive to dementia. Moreover, the specificities of these methods are limited by changes associated with normal aging. This symposium includes research from neuropsychologists and behavioral neurologists from National Institute on Aging sponsored Alzheimer's Disease Centers. The validity of the concept of very mild dementia and aspects of memory and imaging which are effective in the early detection of dementia are described.

R.J. IVNIK & J.F. MALEC. (In)stability of Normal Older Persons' Psychometric Test Performances Over a 3-5 Year Interval: Implications for Use of Longitudinal Data in the Detection of Dementia.
Three to five year stability coefficients for 220+ normal persons above age 55 demonstrate that IQ is "robust" over time but that "memory" tests have reduced long-term stability. Analyses show that for IQ scores both group and individual stability can be assumed; however, for memory individual stability cannot despite acceptable overall group stability. The clinical practice of using cognitive test variability to decide if a person who reports subjective cognitive decline is in fact "impaired" is challenged by these demonstrations of excessive "normal variability" (i.e., *in*stability) among independently functioning and cognitively "normal" older persons.

K.A. WELSH, J.M. HOFFMAN, & C. BEAM. Positron Emission Tomography and Neuropsychological Assessment in the Early Detection of Alzheimer's Disease.
In the present study we explored the relative utility of neuropsychological assessment and regional brain metabolism using fluorodeoxyglucose positron emission tomography (FDG-PET) in the early detection and discrimination of Alzheimer's disease (AD) from other brain disorders. A sample of 88 patients with diverse memory disorders were studied with the CERAD neuropsychological test battery, the Clinical Dementia Rat-

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ing scale of functional abilities, and with regional ratings of resting state FDG-PET metabolism. Two canonical discriminant functions were generated (one with the clinical measures alone; one with PET measures added) to provide the maximum possible correlation between these variables and disease status (AD or not). Receiver operator characteristic curves (ROC) were generated to compare the utility of the two statistical solutions across all possible cutpoints. Although the curve with the PET variables added dominated the curve with the clinical variables alone (86% vs. 83% proportional area under the curves, respectively), the difference was not statistically significant. The results suggest that PET variables may contribute important information to the clinical evaluation of dementia but should be considered confirmatory and not diagnostic of AD.

J.C. MORRIS, M. STORANDT, E.H. RUBIN, D.W. MCKEEL JR., & E.A. GRAND. Clinical, Psychometric, and Pathological Distinctions Between Very Mild Alzheimer's Disease and Normal Aging.
Distinguishing the earliest stages of dementia of the Alzheimer type for normal aging presents a clinical dilemma. In 14 elderly subjects entered as controls in longitudinal studies of healthy aging and senile dementia, none clearly progressed to even very mild dementia at time of autopsy. However, 7 of the 14 at last assessment were rated as "questionably" demented by one of the two clinicians; in the remaining 7 controls, both raters agreed there was no cognitive impairment at last assessment. Cognitive performances of the two groups were similar. All 7 "questionable" controls had unequivocal Alzheimer's disease (AD) at autopsy whereas the 7 pure controls had no AD (normal brains). At present, clinical detection of the earliest stages of AD appears accurate; development of sensitive psychometric measures is needed.

R.C. PETERSEN, G.E. SMITH, C. JACK. Utility of Facilitated Acquisition and MRI Volumetric Measures in Distinguishing Very Early Dementing Illness From Static Mild Cognitive Impairment.
We have examined continua of memory performance for normals, those with mild cognitive impairment (MCI) and those with dementia. Memory components differ in accuracy at characterizing these patients and predicting their ultimate outcome. Unfacilitated acquisition declines gradually across normal aging, delayed recall and facilitated acquisition do not. MCIs display impairment in one area of cognition but are without functional decline. Initial categorization as MCI is usually based on delayed recall impairments; the best predictor of 36-month outcome (demented or static) for MCIs was initial acquisition performance. Stepwise logistic regression with 32 patients with early probable Alzheimer's disease and 29 normal controls matched on Mini-Mental State Exams scores, revealed acquisition to be the most sensitive FCSRT function for separating the groups. The continua of FCSRT acquisition scores parallels hippocampal volume assessed with MRI volumetric techniques.

Paper Session 4

APRAXIA AND GESTURAL COMMUNICATION

P.J. MASSMAN, K.T. KREITER, J. JANKOVIC, & R.S. DOODY. Neuropsychological Differentiation of Corticobasal Degeneration From Alzheimer's Disease.
Patients with corticobasal degeneration (CBD) display prominent rigidity and apraxia, exhibit an asymmetric onset, and may show other symptoms including the "alien limb" sign, limb dystonia, and cortical sensory loss. Past neuropathological and PET studies indicate both cortical (e.g., inferior parietal and medial frontal) and subcortical (e.g., substantia nigra) involvement. In this study, the neuropsychological test performances of 19 CBD patients were compared with those of 23 Alzheimer's disease (AD) patients, matched on age, years of education, and severity of dementia. The CBD patients performed significantly better than AD patients on immediate and delayed recall of the WMS-R Logical Memory stories and on WMS-R Paired Associates; whereas the AD group obtained better scores on the Boston Apraxia Exam, Finger Tapping speed, and motor programming. The groups did not differ on WAIS-R Verbal IQ, but the CBD patients scored significantly higher on Similarities than on Digit Span, while AD patients showed the opposite pattern. The groups did not differ on the Boston Naming Test, the Aphasia Screening Test, or tests of sustained attention. The CBD patients endorsed more symptoms on the Geriatric Depression Scale.

L.M. MAHER, A.M. RAYMER, A. FOUNDAS, K.M. HEILMAN, & L.J.G. ROTHI. Patterns of Recovery in Ideomotor Apraxia.
The purpose of this study was to evaluate extent of recovery from ideomotor apraxia (IA) in left hemisphere damaged Ss, to identify particular spatial/temporal movement components that may or may not recover, and to see if recovery differences exist between transitive vs intransitive gestures. 12 Ss with IA from left CVAs were tested on the Pantomime-to-Auditory-Command subtest of the Florida Apraxia Battery (FAB) (Rothi et al., 1992) consisting of 20 transitive and 10 intransitive gestures. All Ss were tested on 2 occasions; prior to 6 wk post onset and again at 3-6 mo post onset. Ss performances were videotaped for scoring at a later date by 2 scorers. At onset, subjects made more apraxic errors with transitive than intransitive gestures. Both of these gesture types improved to some extent though. Whereas, for the intransitive gestures there was primarily a reduction in the number of content errors, for transitive gestures there was not. Instead, a reduction in the number of unidentifiable responses was noted. It should be noted, however, that recovery of praxis was incomplete in each case of apraxia and correlated poorly with recovery from aphasia.

M. MIMURA, P.M. FITZPATRICK, & M.L. ALBERT. Predictors of Long Term Recovery of Ideomotor Apraxia in Aphasia.
Goal: To discover predictors of long-term recovery of ideomotor apraxia in aphasia. *Methods:* An extensive battery of apraxia and aphasia tests was administered twice to 14 subjects with aphasia and apraxia: T1 mean 2.9 (range 1-9) mo post onset; T2 mean 94.6 (range 44-147) mo post onset. *Results:* For each praxis subtest and each form of apraxia, T1 significantly predicted T2, although more than 50% of subjects remained apraxic at T2. Initial patterns of aphasia were not correlated with recovery from apraxia, although recovery of auditory comprehension was highly correlated with recovery of limb praxis. *Conclusions:* Long-term recovery in apraxia can be predicted by initial apraxia profiles in aphasia. When recovery from apraxia occurs, most forms of apraxia recover in parallel. Auditory comprehension and limb, but not facial, praxis recover in parallel.

A. FOUNDAS, B.L. MACAULEY, A.M. RAYMER, L.M. MAHER, L.J.G. ROTHI, & K.M. HEILMAN. Lateralized Hand Use in Gestural Communication.
In right handers speech and praxis are mediated by the left hemisphere. In patients with left hemisphere brain damage, the right hemisphere may be used to compensate for the left. Gesture laterality may be a reflection of hemispheric functional laterality. We investigated lateralized hand use during spontaneous gesture production in a group of left hemispheric apraxic stroke patients, who were not hemiparetic, and matched controls. Whereas the controls used the right-hand for most gestures (50%), the stroke patients did not have a hand preference. Lateralized gesture production also differed within gesture type (Content, Emphasis, Fillers). Whereas controls preferred the right hand for content and emphasis gestures, the stroke group preferred the left hand for fillers. These data suggest that lateralized gesture production may be related to language and praxis systems.

S.Z. RAPCSAK, P.M. BEESON, C. OCHIPA, & A.B. RUBENS. Gesture Production and Comprehension by the Right Hemisphere.
The praxic skills of the right hemisphere were investigated in two right-handed patients with massive left hemisphere lesions. Both patients were

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severely impaired in pantomiming transitive gestures with the left hand and in reproducing novel, non-symbolic hand and arm movement sequences. However, actual object use and intransitive gestures were relatively spared. Gesture comprehension and discrimination were also preserved. We propose that the praxis system of the right hemisphere is biased toward "concrete" or context-dependent execution of familiar, well-established action routines. The right hemisphere is critically dependent upon transcallosal contribution from the left hemisphere for control of the left hand in "abstract" or context-independent execution of transitive gestures and in learning novel movement sequences. The right hemisphere has some independent capacity to comprehend and discriminate gestures.

THURSDAY AFTERNOON, FEBRUARY 3, 1994

Paper Session 5

CHILD NEUROPSYCHOLOGY I: BRAIN INJURY AND DISEASES

C.G. OWENS, C. BARRY, & H.G. TAYLOR. Attention in Children with Early Brain Disease.
The construct validity of neuropsychological measures of attention was investigated by subjecting children's scores on a comprehensive test battery to factor analysis. The sample consisted of a group of approximately 200 school-age children with and without early brain injury secondary to meningitis. Hypotheses were that the attentional measures would: (1) load on multiple attentional factors that were distinct from other ability constructs; and (2) prove useful in assessing the effects of early brain injury and in predicting learning and behavior. Findings confirmed both hypotheses and provided evidence for the "focus/execute" and "sustain" components included in Mirsky's model of attention.

H. BAWDEN, J. DOOLEY, M. RIDING, G. LLEWELLYN, D. BUCKLEY, K. GORDON, & P. CAMFIELD. Neuropsychological Abilities and MRI Findings in Children With Neurofibromatosis-1.
Neuropsychological assessments, neurological examinations and MRI brain scans were carried out on 17 children (8 females, 9 males, mean age = 11.3 ± 1.9 yr) with neurofibromatosis type 1. Most patients had average intelligence (Mean WISC-R Full Scale IQ = 92.8 ± 13.3). Although their Verbal and Performance IQs were similar, many had nonverbal learning problems including difficulty judging the orientation of lines, matching complex visual stimulus configurations, recognizing pictures of faces, as well as copying and recalling the Rey Osterrieth figure. Ten (58.8%) children had high intensity signal abnormalities on their MRI scans. These abnormalities were most frequently located in the basal ganglia or cerebral peduncles. There were no differences in the neuropsychological abilities of children with and without high intensity signal abnormalities. These findings suggest that these high intensity signal abnormalities do not have functional significance.

R.W. BUTLER & J.M. HILL. The Neuropsychological Effects of Cranial Irradiation, Intrathecal Methotrexate and Systemic Methotrexate in Childhood Cancer.
The current study addressed the effects of irradiation, intrathecal chemotherapy and systemic chemotherapy on neuropsychological functioning in children treated for cancer ($n = 109$). A battery of neuropsychological tests was administered that comprehensively evaluated most cortical and higher cortical functions. Even after age, SES, age at diagnosis, length of remission, school missed and presence/type of brain tumor were statistically controlled, cranial irradiation still manifested a significant relationship with decreased cognitive efficiency in several domains. These domains appear to follow a reasonably consistent pattern and are generally reflective of nondominant hemisphere dysfunction. Brain irradiation dosage significantly predicted decreased functioning in nonverbal intelligence, new learning, perceptual localization, nondominant hand motor skills and susceptibility to perceptual interference. Systemic and intrathecal chemotherapy were associated with isolated neuropsychological deficits.

L. EWING-COBBS, J.M. FLETCHER, H.S. LEVIN, K. COPELAND, D. FRANCIS, & M. MINER. Closed Head Injury in Infants and Preschoolers: A Three Year Longitudinal Neuropsychological Follow-up.
Infants and preschool-aged children sustaining severe closed head injury ($n = 15$) were significantly more impaired on measures from 4 ability areas; intelligence, motor function, expressive language, and receptive language than comparably aged children with mild-moderate injuries ($n = 16$) throughout the three year follow-up period. At 3 yr following the injury, children with mild-moderate injuries scored in the Average range in all 4 of the ability areas; in severely injured children, IQ and expressive language scores improved to the Low Average range, while difficulties persisted on the receptive language and motor scores. Although receptive language scores did not change significantly over time, a trend was obtained for motor and expressive language scores to improve. IQ score increased significantly in the severely injured children over time. Our findings do not support the hypothesis that early brain injury is associated with sparing of function.

T. MCKITTRICK, J.S. HAUT, S. SCHAUSS, A.S. BRADLYN, & M.D. FRANZEN. Predicting WRAML Performance Based on Intellectual Functioning: Evidence for Construct Validity of the WRAML.
The WRAML is a recently developed tool for assessing memory performance in children and adolescents. It has no clear precursor; hence, information regarding its validity and usage is needed. The present study investigated the relationship between general intellectual functioning and WRAML performance in a clinical sample. Results indicate that intellectual functioning accounted for 42% of the variance in the WRAML General Memory Index, and Stroop word score accounted for another 15%. This suggests that while a significant amount of the variance was accounted for, a portion of unique variance remained, which was interpreted as reflecting memory factors. This provides evidence that overall intellectual functioning may define a range of expected memory performance, but does not predict specific aspects of memory functioning.

Paper Session 6

NEGLECT

A. CHATTERJEE. Crossover, Completion, and Confabulation in Unilateral Spatial Neglect.
Patients with left sided neglect frequently crossover and bisect short lines to the *left* of midline, an observation difficult to explain. In order to distinguish whether these patients 1) have ipsilateral neglect, or 2) experience perceptual distortions, or 3) complete lines past the objective left end, four patients with left-sided neglect were tested on bisection and reading with lines and single words of varying lengths. Patients' performances were systematically influenced by line and word lengths in similar ways suggesting that these tasks are comparable. Large leftward crossover errors on short line bisections were associated with reading short words as being longer. Confabulation of letters to the left of short words suggests that these patients extend short lines past the objective leftward end.

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M. VERFAELLIE, R. McGLINCHEY-BERROTH, W. MILBERG, L. GRANDE, & M. D'ESPOSITO. Cross-Field Matching of Visual Stimuli in Hemispatial Neglect.
Nine patients with hemispatial neglect were asked to judge whether two pictures, one presented in the LVF and one in the RVF, were same or different. A forced choice discrimination task in which they had to select one of two pictures presented to the LVF or RVF was also administered. Patients who performed at chance on the LVF discrimination task performed significantly better on the matching task, suggesting that they were able to process some "neglected" information implicitly. In contrast, patients whose LVF discrimination was above chance showed no dissociation between matching and discrimination performance. Qualitatively different processes may mediate matching performance depending on the amount of LVF information available to awareness.

R. McGLINCHEY-BERROTH, M. VERFAELLIE, W. MILBERG, M.L. GRANDE, E. BOLTON, & M. D'ESPOSITO. Semantic Processing From Lexical Information in Hemispatial Neglect.
Visual processing was investigated in 7 hemispatial neglect patients. In a semantic priming task, subjects made lexical decisions to target words preceded by lateralized word primes. In a discrimination task, the same subjects indicated which of two alternatives had been presented to the LVF or RVF. Results indicated intact semantic priming from the neglected visual field in the absence of conscious awareness. This supports previous findings of implicit visual processing and suggests that the information extracted may be rich enough to support complex processes involved in orthographic and phonological encoding. Additional data suggests that the word priming effect is not mediated by topdown feedback.

M. MENNEMEIER, E. VEZEY, & K.M. HEILMAN. The Effects of Hemispatial Placement and Cueing on Line Bisection in Neglect.
Heilman and Valenstein found that placing lines in right or left hemispace affected line bisection performance of patients with neglect more than did cueing subjects to the right or left end of lines. Riddoch and Humphreys found that cueing was a more important determinant of neglect than was hemispatial placement. Whereas the former findings suggest primary defects of the systems that govern movement in or toward neglected space, the latter suggest primary deficits in orienting attention. To determine whether these disparate findings reflect subtypes of neglect, 19 patients with right hemisphere lesions and neglect performed line bisections under varying conditions of hemispatial placement and cueing. Significant main effects of both hemispatial placement and cueing were observed for the total group. Individual case analyses revealed three subtypes including those patients primarily effected by 1) hemispatial placement, 2) cueing, and 3) both hemispatial placement and cueing.

J. WEBSTER, C. JIRON, B. MORRILL, & C. GODLEWSKI. Topographical Representation of Allocentric Space After Focal Brain Injury.
We compared focal lesion groups (R-parietal, R-anterior, L-CVA, and normal controls) on their performance on a cognitive mapping task, as well as on a wheelchair obstacle course designed to represent real-life obstacles in the environment. The mapping task involved blindfolding the subjects, then assisting them in manually tracing line maps, and subsequently asking them to independently trace the original line, and extrapolate a new line on the map. R-parietal subjects showed significantly greater angle error both rightward and leftward, with leftward drawings of the extrapolated line being the most difficult. They also showed significantly more incidents of continuing their lines off the page, and significantly greater distance error. Three of the four angle error measures, as well as the offpage score were correlated significantly with the most severe left-sided obstacle course collisions. These results confirm that the R-parietal patients had the greatest difficulty with cognitive mapping, and predictably were most impaired for maneuvering their extrapersonal environment. We suggest that intervention strategies for them need to consider topographical distortions as well as attention & motor strategies

Poster Session 3

ASSESSMENT, NEW TESTS, AND REHABILITATION

F.W. UNVERZAGT, H.C. HENDRIE, K.S. HALL, A.M. TORKE, & J.D. REDIGER. The CERAD Neuropsychological Test Battery: Preliminary Norms From an African-American Sample.
Interpretation of neuropsychological test performance in African-American subjects is difficult due to the lack of normative data in this population. We report normative data on the CERAD Neuropsychological Test Battery (CERAD-NB) in an elderly African-American sample. The CERAD-NB is a cognitive screening battery composed of five tests (Mini-Mental Status Exam, Animal Naming, 15-item Boston Naming, Word List Learning Task, and Constructional Praxis) which has been useful in the evaluation of elderly patients with suspected dementia. Fifty normal, healthy African-American men and women age 65 and older completed the battery of tests. Results indicate significant education influences on all tests in the battery. There were no significant sex differences. Means and standard deviations are presented for low and high education groups for each of the tests in the CERAD-NB.

G. IVERSON, E. BARTON, A. IVERSON, & J. FARMER. Normative Data for the Children's Orientation and Amnesia Test.
The Children's Orientation and Amnesia Test (COAT) was developed to assess cognitive functioning in children and adolescents who are in the early stages of recovery from traumatic brain injury. The COAT is composed of 16 items designed to assess general orientation, temporal orientation, and memory. The original norms are based on 146 subjects between the ages of 3 and 15. The norms for subjects over the age of eight are meager (i.e., not exceeding a sample size of 14 for each age group). In this study, normative data were collected for children between the ages of 8 and 13 ($N = 227$). These results provide important reference data for interpreting COAT scores of children who have sustained traumatic brain injuries.

D. CAMPBELL, D. BERRY, J. ADAMS, B. THARPE, & D. WEKSTEIN. Comparison of Three Methods of Estimating WAIS-R IQs in Older Persons.
Three major approaches to the problem of premorbid intellectual estimation have emerged in the last decade. The present study assessed the utility of combining these approaches in the estimation of premorbid WAIS-R IQs in an elderly sample. Therefore, regression formulas including demographic variables, reading ability level, and personal interests, hobbies and attitudes were computed to improve the accuracy of using each category of variables independently. Results suggested that the most accurate predictor method was a combination of the NART-R reading test (Blair and Spreen, 1989) and the Barona and Chastain (1986) demographically based estimated IQs. The Intellectual Correlates Scale (Schlottmann & Johnsen, 1991), which utilizes personal interests etc. in the estimation of IQ, was found to only moderately correlate with WAIS-R FSIQs.

M. ZACHAREWICZ, N. PLISKIN, C. NEUMANN, S. BERENT, & H. BUCHTEL. The Utility of Premorbid IQ Estimation Across Mild and Moderate Dementia Populations.
Various premorbid IQ estimates in mild and moderate dementia populations were compared. These comparisons included the original NART, NART standardized on the WAIS-R, the NART with demographic adjustment, Barona's regression formula, and the 'best performance' method. Subjects were 49 patients with suspected dementia referred to several University-based neuropsychology clinics. Except for the 'best performance' method, the various methods of estimating premorbid IQ

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appear to be insensitive to stage of dementia when demographic variables are held constant. In addition, the NART standardized on the WAIS-R appears to provide the most clinical utility as an estimate of premorbid IQ in dementia samples of this kind.

B.S. CLOUD, R. SWENSON, B.L. MALAMUT, E. KAPLAN, L.P. SANDS, H.L. GITLIN, & D.J. LIBON. The Boston Revision of the Wechsler Memory Scale Mental Control Subtest.

The tasks of the WMS Mental Control subtest (WMS-MC) require one to mentally manipulate information without any external aid and can provide a measure of executive control. A problem with the standard WMS-MC subtest is that some of the tasks may be too easy and thus may not detect mild or subtle cognitive impairment. To address this problem, additional tasks were included in the creation of the Boston Revision of the WMS-MC subtest (BRWMS-MC). A principle component analysis of the BRWMS-MC generated three factors. One factor was comprised of less familiar, non-automatized tasks; two other factors were comprised of relatively familiar, automatized tasks. Accuracy scores based on this factor structure were able to distinguish Alzheimer's from cerebrovascular dementia patients.

F.A.J. ZELKO, L.D. STANFORD, S.G. MURPHY, N.D. PLISKIN, M.J. KIM, A.B. SIVAN, & D.X. CAPRUSO. Error Analysis of the Benton Judgement of Line Orientation Test.

A technique for analyzing errors on the Benton Judgement of Line Orientation (JLO) test was devised and used with 49 adults with unilateral vascular lesions. Specific JLO errors were found to occur with differential frequency. Errors involving minor deviations from the JLO stimuli ("Near Misses") were more common than severe deviations. Oblique angle errors were also more common than errors involving vertical/horizontal line segments. Significant lateral field effects (left vs. right) were not found. Adjusted for overall performance level, the error analysis scheme did not enhance discrimination between right and left lesion groups over that based on a simple index of JLO performance. The possible use of the error analysis technique with other populations is discussed.

F.A.J. ZELKO, D. STRITE, & T. LAZARUS. A Transitional Measure of Reproduction Strategies for the Rey-Osterreith Complex Figure.

A new measure of reproduction strategies on the ROCF was devised, based on how often the examinee shifts (i.e., Transitions) between elements at different levels of gestalt organization while drawing the figure. Ninety-six child protocols were scored using the technique, which was compared to parameters for accuracy and strategy defined by Kirk and Kelly (1986). Moderate agreement was found between the Kirk and Kelly *Starting Strategy* index and the new *Transition* score. Transition scores also correlated modestly with recall accuracy indices. However, Transition scores yielded lower correlations with indices of reproduction accuracy than did Starting Strategy codes, and were unrelated to Beery VMI performance and chronological age. The potential use of such a scoring index is discussed.

J.L. WOODARD, B.N. AXELROD, & J.L. FISK. Parsimonious Prediction of WMS-R Memory Indices.

The Wechsler Memory Scale-Revised (WMS-R) represents a substantial improvement over the original WMS by providing better normative data and standardized scoring instructions for Logical Memory and Visual Reproduction. However, its utility is diminished by the increased time requirements needed to administer the full WMS-R. Using a sample of 306 patients referred for neuropsychological testing, the General Memory and Delayed Recall indices were predicted using the WMS-R analogues for five of the seven subtests from the original WMS. Logical Memory I, Visual Reproduction I, and Verbal Paired Associates I predicted General Memory with a multiple R^2 of 0.97; Logical Memory II and Visual Reproduction II predicted Delayed Recall with a multiple R^2 of 0.95. The unstandardized regression equations and cautions regarding their use are presented.

J.L. WOODARD, R.C. GREEN, & J. GREEN. Screening for Cognitive Impairment in the Elderly With the Mattis Dementia Rating Scale.

We studied the ability of the Mattis Dementia Rating Scale (DRS) to detect neuropsychological impairment in elderly individuals. Sensitivity and specificity were computed for 22 mildly-impaired patients and 48 age and education-matched controls, rigorously screened to exclude controls with occult neuropathology. Using a cut-off total DRS score of 133, the optimum sensitivity and specificity were 0.95 and 1.00, respectively. Assuming a 10% dementia prevalence, predictive values positive and negative were 1.0 and 0.995, respectively. Our optimum cut-off score does not reflect impairment according to established DRS norms but may be related to our use of highly screened controls. In addition to being useful for tracking degree of dementia, our results suggest that the DRS may validly screen for mild impairment in the elderly.

J.L. WOODARD & R.C. GREEN. Cognitive Predictors of Token Test Performance in a Demented Population.

The Token Test (TT) is commonly used in dementia assessment for measurement of auditory comprehension. However, a variety of other cognitive operations are required for successful performance of the task that may also be deficient in patients with dementia. This study used the Mattis Dementia Rating Scale subscales as indices of possible cognitive operations that may underlie performance on the TT for 62 patients meeting DSM-III-R criteria for dementia. Results of multiple regression and principal components analysis suggest that although TT performance is predicted by the DRS Attention and Memory subscales, a substantial portion of variance appears to be attributable to overall severity of cognitive impairment. The assumption of TT specificity should be carefully examined in patients with dementia or in any patient with cognitive deficits in multiple domains.

M.D. FRANZEN, M.W. HAUT, E. RANKIN, & R. KEEFOVER. Empirical Comparison of Alternate Forms of the Boston Naming Test.

Various short forms of the Boston Naming Test have been proposed including an empirically derived 30 item form, odd and even items split-half forms, and five 15 item forms. There has been only one investigation of the equivalency of these forms, and that study was conducted in a limited sample. The present analysis was conducted using a sample of 320 individuals with diagnoses including dementia, thought disorder, depression, general neuropsychiatric disorders, and cerebral tumors. Scores for each of the various forms were correlated, and classification rates using the various forms were compared. Coefficient alpha was calculated for each form. The results indicate that all forms possess adequate internal consistency, although the CERAD 15 Item form possessed the lowest. Correlations between forms were reasonable. However, classification rates were different by forms, indicating limitations on the extent to which the forms may be used interchangeably.

S.L. SCHAUSS, M.L. BOONE, M.D. FRANZEN, T. DUNCAN, & L. EPPERLY. Digit Symbol/Symbol Copy Performance in a Mixed Neuropsychiatric Sample.

Ratio values derived from the time required for completion of the WAIS-R Digit Symbol Substitution Test and a symbol copy task can help discern the role of peripheral motor speed from cognitive processes required to perform symbol substitution. This may be useful in identifying neuropsychological impairments particular to certain disorders and facilitate accurate diagnosis. In an attempt to verify the need for normative values, test data from patients representing a range of neuropsychiatric disorders were analyzed. Results were consistent with previous research suggesting a relation between age and digit symbol performance that is attributable to other cognitive processes in addition to writing speed. Significant differences between groups on the ratio measure were not obtained perhaps secondary to limitations in statistical power.

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M.L. BOONE, S.L. SCHAUSS, M.D. FRANZEN, G.L. IVERSON, L. EPPERLY, & T. DUNCAN. Accuracy of Objective Tests Designed to Detect Malingering.
Recently, several objective methods for assessing malingered memory deficits have been suggested, and cutting scores have been provided to distinguish neurologic populations from persons instructed to simulate memory deficits. However, it cannot be assumed that cutting scores generalize beyond populations in particular studies. The present study evaluated cutting scores of the 21 Item Word List and a modified version of Rey's Dot Counting Test by applying suggested cutting scores to a sample of persons with documented neurologic injuries. Both instruments demonstrated a low rate of false positives. This study provides further evidence that these instruments have clinical utility, and may help alert clinicians to non-optimal performance on neuropsychological testing. Further study utilizing neurologic samples and persons instructed to simulate deficits is suggested.

J. BOEKAMP, M.E. STRAUSS, & N. ADAMS. Estimating Premorbid Intelligence in Elderly Veterans Using the American Version of the Nelson Adult Reading Test.
The valid measurement of premorbid intellectual functioning is essential in the early diagnosis of many neurological disorders. Grober and Sliwinski (1991) developed the American version of the Nelson Adult Reading Test (AMNART) based on Nelson and O'Connell's (1978) observation that reading irregularly spelled words is preserved in mild dementia. The present study compared performance on the AMNART and WAIS-R, a measure of present ability, in African American and white mildly demented and control veterans. The discrepancy between AMNART and WAIS-R estimated VIQ was significantly larger and similar in both African American and white demented veterans, suggesting the AMNART provides a valid measure of prior functioning for minority veterans.

J.E. MENDOZA, G.T. APOSTOLOS, & R.K. HENDRICKSON. Coin Rotation Task: A Bedside Measure of Motor Dexterity.
An easily administered, bedside measure of motor dexterity—a coin rotation task—was compared with several traditional measures of motor skills (finger tapping, grooved pegboard and grip strength). Sixty control subjects and 23 neurological patients with a history of unilateral CVA and subtle residual motor deficits were compared on all tasks. All subjects were right-handed males. Based on the control group data, correction factors (CF) were developed for both dominant and non-dominant hand performances for each task. These CF were found to be unaffected by age. Using these CF, impairment ratios were calculated for each neurologic patient on each task. These ratios were designed to estimate the effects of brain lesions on motor performance. They were based on differences between the observed and the expected scores, with the latter being derived from the performance of the unaffected hand. The results indicate that both the coin rotation task and grooved pegboard are more sensitive to subtle residual motor deficits than either the tests of finger tapping or grip strength.

D. WILLIAMSON, J. SCOTT, K. KRULL, & R.L. ADAMS. The Oklahoma Premorbid Intelligence Estimate (OPIE): Validation on Clinical Samples.
When assessing patients with evidence of recent brain impairment, accurate interpretation of neuropsychological test data is dependent upon an accurate estimate of the subject's premorbid level of intellectual function. Available methods of premorbid IQ estimation most commonly address this issue by interpolating premorbid ability on the basis of test performances which are among the least impacted by brain impairment or by using regression-based estimates which incorporate demographic information. A common weakness of these methods is the restriction of range of predicted scores. The OPIE was designed to combine both current performance on the Vocabulary and Picture Completion subtests of the WAIS-R with demographic information to estimate premorbid IQ. Previous work has established its validity with normal populations. The results of this study suggest that the algorithm may be applied to four populations commonly seen by clinical neuropsychologists (i.e., TBI, dementia, cardiovascular disease, neoplastic processes) with much less restriction in range of predicted IQ's than is seen with other methods.

J.A. KNIGHT, E. KAPLAN, & L.D. IRELAND. Survey Findings of Rey-Osterrieth Complex Figure Use Among the INS Membership.
The present study surveyed the membership of INS on variables related to training experiences and use of the Rey-Osterrieth Complex Figure (ROCF). An analyzable return rate of 33% was obtained. The findings are summarized by the following categories: professional specialization, years post-training, sources of ROCF training, usefulness of the ROCF, range of applications, methods of administration and scoring, and reasons for not using the ROCF. The findings illustrate: 1) ROCF applications to a wide range of clinical problems and populations, 2) high perceived utility among ROCF users and a salient need for norms and standardized administration procedures among non-users, and 3) patterns of use based more on exposure and professional setting than years of experience. Additional findings will be discussed.

J. SCOTT, M. SHERER, & R. ADAMS. Clinical Utility of WAIS-R Factor Derived Standard Scores in Assessing Brain Injury.
The present study explores the clinical utility of WAIS-R factor derived standard scores in differentiating brain-damaged from nonbrain-damaged subjects. Sixty brain-damaged and forty nonbrain-damaged subjects were compared on Verbal/Comprehension, Perceptual/Organization, and Freedom From Distractibility standard scores generated from age corrected WAIS-R subscale scores. The results indicated that the groups differed significantly on each factor. The factor derived standard scores were equally as effective in discriminating brain-damaged from nonbrain-damaged groups as Full Scale IQ, Verbal IQ, and Performance IQ. When considered with data from the Halstead-Reitan Neuropsychological Battery, both the Freedom From Distractibility and Verbal/Comprehension factors added significantly to the ability to discriminate among the groups. The advantages of using factor derived standard scores in clinical practice are discussed.

D. KAREKEN & R.C. GUR. Concurrent Validity of Word Reading on the Wide Range Achievement Test-Revised and Parental Education in Estimating IQ.
It is necessary in research and clinical evaluations to obtain estimates of premorbid intelligence prior to measuring IQ. There is evidence that word reading may be a useful way to establish premorbid IQ. The present study examined the relationship between reading ability on the Wide Range Achievement Test-Revised (WRAT-R) and IQ in order to determine the utility of WRAT-R reading (READ) in estimating premorbid IQ. Consistent with previous findings, READ was found to account for a significant amount of variance in Verbal, Performance, and Full Scale IQs. Parental education, a variable not previously examined in this literature, was also found to add predictive power to READ. The predictive ability of these variables compares favorably with estimates made by Barona, Reynolds, and Chastain's (1984) IQ estimation formula, which uses only demographic information.

P.L. CHRISTIANSEN & S.A. WINGENFELD. Comparison of Regular and Interactive Assessment Conditions for the Booklet and Computer Category Tests.
The purpose of this study was to examine the effects of interactive test administration on Category Test performance. One-hundred college students completed the Booklet Category Test and the Computer Category Test under either regular standardized or interactive administration procedures. In the interactive condition, subjects were given cognitive strategy instruction. Subjects in the interactive condition made significantly fewer errors than subjects in the standard administration condition on both the Booklet and Computer Category Tests, suggesting strong learning effects among non-neurologically impaired subjects. Mean error scores and standard deviations also reflected a tendency to respond dif-

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ferently to Category Test items when provided cognitive strategy instructions.

W. WHELIHAN, G. BUONGIORNO, R. SWIFT, & O. KUZNETSOV. Assessing Acute Effects of Alcohol With Computerized Neuropsychological Techniques.

The effects of acute alcohol use on neuropsychological (NP), and particularly frontal-lobe, functioning have been documented using conventional NP assessment approaches for high dose but not lower dose levels of ethanol (1.0 mg/kg or higher). However, little attention has been given to the use of computer-administered techniques as a potentially more sensitive way of evaluating ethanol effects at lower dose levels. This study evaluated 19 nonalcohol abusing subjects (mean age 25.6; mean education 16.2) on selected measures of the Neurobehavioral Evaluation System (NES2) test battery at baseline and at peak blood alcohol levels after a standard 'medium' dose of ethanol (0.65 mg/kg). The NES2 battery has been used extensively in studies of solvent-exposed subjects to provide measures of subcortical-frontal brain dysfunction. Nine measures evaluating vigilance, divided attention, learning, and response speed were selected. Repeated measures ANOVA was utilized and two measures (vigilance and response speed on a learning task) showed significant differences over time. Implications of these findings and the usefulness and perhaps higher sensitivity of computerized NP techniques will be discussed.

C.L. HEXUM, J.S. HAUT, & M.W. HAUT. Modification of the WISC-III Coding B Subtest for Neuropsychological Assessment.

The Coding subtest of the WISC-III is a measure of visual-motor processing used in neuropsychological evaluation of children and adolescents. In the standard form, as with the adult version of the task, deficient performance is difficult to interpret. The purpose of the present study was to examine the usefulness of modifying this subtest to include measures of incidental learning and motor writing speed. Moderate correlations were found between incidental recall and motor speed on coding and standard measures of memory and motor response. This study indicates that these modifications of the WISC-III Coding B subtest provide unique and useful information and would be beneficial additions to clinical practice.

G.P. LEE, D.W. LORING, J.R. NEWELL, & L. McCLOSKEY. Figural Fluency on the Five-Point Test: Preliminary Normative and Validity Data.

The Five-Point Test is a measure of nonverbal fluency created by Regard, Strauss, & Knapp (1982). The test was administered to 52 patients (34 pseudoneurologic controls and 18 with neurologic disease) to provide preliminary normative and validity information. Pseudoneurologic controls produced significantly more unique designs than patients with documented brain-damage. There were, however, no group differences in the number of design perseverations. Eight of 18 (44%) neurologic patients produced fewer unique designs than the lowest scoring control patient. Examination of the type and location of disease among neurologic patients revealed all 8 who performed at or below the lowest score in the normative distribution had either diffuse or frontal lobe disease. These results provide preliminary indications of the test's sensitivity to frontal lobe pathology.

M.A. LACY, T.J. FERMAN, D.P. HAMER, & N.H. PLISKIN. Letter and Category Fluency Across Various Clinical Populations.

Verbal fluency is often examined within a neuropsychological evaluation. Despite widespread use, the utility of such tasks in various clinical populations is unclear. Randolph et al. (1993) suggested that to gain a better understanding of verbal fluency, various patient groups need to be examined. The present study investigated fluency performance in eight patient groups compared to a medical control group, covarying age and education. Results revealed that SDAT, focal left hemisphere pathology, and psychiatric patients performed significantly worse than controls for letter and category fluency. Comparisons within each patient group indicated fewer words were generated for individual letters compared to categories across all investigated clinical populations except psychiatric and medical control groups. The neuropsychological utility of verbal fluency across groups is discussed.

P.S. FASTENAU & N.L. DENBURG. Reliability and Validity of the Extended Complex Figure Test (ECFT).

Following pilot work by Fastenau & Manning (INS 1992), the Rey-Osterrieth Complex Figure Test (ROCFT) was extended. For 90 healthy adults (age-/sex-stratified, ages 30–80+), we followed the ROCFT with 30 multiple-choice recognition items and 10 matching items. WMS-R Visual Reproductions (VR) and Hanger's VR recognition/matching trials (INS, 1991) were also administered. Alpha reliabilities indicated homogeneity of content (.61–.91, $p < .001$). Modest relationships with analogous VR subtests showed convergence in a common domain ($r_{Recog} = .59$, $r_{Match} = .43$, $p < .0005$). Point-biserial correlations showed most items to be very discriminative (.272–.804, $p < .0005$). Older subjects scored lower on both trials, and the less-educated older adults scored lower yet ($p < .0001$). Appropriate norms are provided.

A. SAYKIN, R.C. GUR, R.E. GUR, B. KESTER, P. STAFINIAK, L. MOZLEY, L. ROBINSON, B. MALAMUT, B. WATSON, D. SHTASEL, & D. MOZLEY. Normative Neuropsychological Test Performance: Effects of Age, Education, Gender and Ethnicity in a Young Adult Urban Sample.

Normative data is presented for a sample of 130 adults (ages 18–49). Subjects were native English speakers screened for medical, neurological and psychiatric disorders, including substance abuse. Effects of age (mean = 27.7 yr), education (mean = 14.6 yr), gender (58% male, 42% female), and ethnicity (62% white, 38% black) were observed. Younger subjects with higher education performed better on some measures. Females were superior to males on verbal learning and memory, and males were better on motor speed and reaction time tasks. Ethnicity was associated with performance on many tests and should be considered to avoid diagnostic bias. We report means, standard deviations and percentile rankings for all tests, the expected frequency of abnormal scores, and regression coefficients for adjustment of tests influenced by demographic variables.

S.S. OSATO, A. LA RUE, & J. YANG. Validity of the Neurobehavioral Cognitive Status Examination (NCSE) Subtests in Older Psychiatric Patients.

Eighty-nine elderly psychiatric patients were evaluated in this study. Fifty-six patients had a diagnosis of dementia, while 33 patients had a diagnosis of affective disorder. All subjects were administered the NCSE and a brief battery of neuropsychological measures. Analyses suggested the majority of NCSE subtests evaluated were significantly associated with full neuropsychological measures. These results are important in establishing the validity of the individual subtests on the NCSE. The NCSE is often used as a screening measure and its utility lies in allowing neuropsychologists to generate hypotheses regarding specific cognitive domains; generation of these hypotheses can then lead to evaluation with full neuropsychological instruments. The present study presents preliminary support for interpretation of individual NCSE subtests.

L. BINDER, & D. JOHNSON-GREENE. Observer Effects of Neuropsychological Performance: A Case Report.

A woman with well documented medically intractable epileptic seizures, developmental cognitive deficits associated with her epilepsy, medial temporal sclerosis, and dependent personality traits received the Portland Digit Recognition Test (PDRT) as part of a comprehensive neuropsychological battery. Portions of the PDRT were administered with her mother alternately present and absent in an A-B-A-B design. The patient performed significantly worse with her mother present than with her mother absent. The results suggest that situational variables sometimes

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have a potent effect on neuropsychological performance. The practice of excluding significant others from the examining room during the testing should be continued. The medicolegal implication of these data is that attorneys also should be excluded from the examination.

R.A. STERN, E.A. SINGER, L.M. DUKE, N.G. SINGER, C.E. MOREY, E.W. DAUGHTREY, & E. KAPLAN. The Boston Qualitative Scoring System for the Rey-Osterrieth Complex Figure: Description and Inter-Rater Reliability.

This report describes a qualitative scoring system for the Rey-Osterrieth Complex Figure (ROCF) that provides scores for fragmentation, planning, presence and accuracy of various features, size distortions, perseveration, confabulation, rotation, and neatness. Inter-rater reliability is reported for a sample of 60 children and adults. Subjects received copy, immediate, and 20-min delayed recall trials. Each production received 16 initial 1–5 ratings, based on specific criteria. Eleven summary scores were then calculated, including total presence and accuracy, retention, and overall organization. Kappa statistics and intraclass correlations indicated excellent inter-rater reliability for almost all initial scores and summary ratings. In summary, the Boston Qualitative Scoring System for the ROCF appears to be a highly reliable and informative method for scoring this widely used instrument.

J.J. RYAN & A.M. PAOLO. Comparative Test-Retest Stability of the "Kaufman," "Reynolds," and "Silverstein" Four-Subtest Short Forms of the WAIS-R in Persons 75 to 87 Years.

Compared the retest stability of popular four subtest short forms. Subjects were 61 normals with means for age and education of 78.93 yr ($SD = 3.46$) and 9.74 yr ($SD = 1.91$). The mean retest interval was 65 days. Stability coefficients were .87, .94, and .89 for the Kaufman, Reynolds, and Silverstein abbreviations. These values compare favorably to the coefficient of .93 for the standard FSIQ. Retest means changed by 3.02 points on Kaufman, −.36 on Reynolds, and .61 on Silverstein. Mean change on the FSIQ was 2.82. The percentages of subjects with the same intelligence classification at both assessments were 59, 72, and 68 for the Kaufman, Reynolds, and Silverstein abbreviations. On the FSIQ, 75% maintained the same ability classification. These short forms possess adequate test-retest stability.

C.E. PANIAK, H.B. MILLER, & D. MURPHY. Wisconsin Card Sorting Test Normative Data for Ages 9 to 12.

The purpose of this study was to present a large Wisconsin Card Sorting Test (WCST) normative database for 9 to 12 year-old children. Subjects were 365 elementary school students who were screened for biasing conditions. The mean estimated IQ, based on WISC-III Vocabulary scaled scores, for each age group was very close to the WISC-III standardization sample mean. There were no consistent sex differences across the age levels. Within each year of age, number of months of age did not correlate with WCST scores. There were small but consistent mean improvements on six of eight variables from ages 9 to 11. The present sample is the largest currently available for WCST normative purposes.

M.L. GOUROVITCH, T.E. GOLDBERG, & D.R. WEINBERGER. Differential Verbal Fluency Deficits In Schizophrenic Patients as Compared to Normal Controls.

Schizophrenics demonstrate deficits in phonemic fluency which have been associated with frontal lobe dysfunction. The ability to produce category members has been linked to both frontal lobe and semantic dysfunction. This study evaluated phonemic and category (semantic) fluency in 24 schizophrenics and 20 normal controls who were matched on putative measures of premorbid intellectual function. Additionally, we evaluated the ability to switch between letters and categories during 15 s intervals. The results from all conditions showed that schizophrenics produced significantly fewer phonemic and category members than normal controls and that there was an interaction such that normals produced a greater number of category than phonemic words, while schizophrenics produced a greater number of phonemic over category words. More profound deficits in category fluency may be related to a subtle disorganization of semantic information.

C. RANDOLPH. The Repeatable Battery for the Assessment of Dementia (RBAD): Preliminary Clinical Validity.

Neuropsychological assessment of older individuals with dementing illnesses has suffered from a lack of appropriately designed test instruments. The Repeatable Battery for the Assessment of Dementia (RBAD) was developed specifically for the purpose of identifying and characterizing abnormal cognitive decline in the older adult. The entire battery takes approximately 30 min to administer, and yields scaled scores for five cognitive domains. The current study reports preliminary clinical validity results with the RBAD, comparing mildly demented patients with a diagnosis of probable Alzheimer's disease ($N = 20$) to patients with Huntington's disease ($N = 20$) and normal controls ($N = 40$). A repeated measures ANOVA on the five scaled scores yielded highly significant effects of group and group by subtest interaction. The patient groups had essentially opposite profiles. The AD patients performed most poorly on immediate memory, language, and delayed recall, while the HD patients received their lowest scaled scores on attention and visuospatial/constructional functions. These data suggest that the RBAD is effective at both identifying and characterizing dementia of different etiologies.

B. PALMER, K. BOONE, & L. ALLMAN. Exaggerated Cognitive Deficits With CNS Lesions and Premorbid Malingering.

Findings are presented from a patient with a premorbid history of malingering, who subsequently developed infarcts in the left parietal/occipital and right internal capsule regions. Neuropsychological results suggested a pattern of exaggeration on cognitive tests, even in light of the documented CNS lesions. This case demonstrates that feigning of symptoms can occur within the context of actual brain lesions, and that faking and brain damage are not mutually exclusive. These findings are discussed in regard to the need to routinely evaluate patient motivation, and the ability of available tools to detect motivationally based deficits.

G.P. AYLWARD, G.A. GIOIA, S.J. VERHULST, & S. BELL. Factor Structure of the WRAML in a Clinical Population.

Investigation of the WRAML factor structure has direct clinical implications. The WRAML was administered to a clinical sample of 236 subjects, referred because of school problems. Pairwise principal factor analyses were examined for 2, 3, and 4 factor solutions. Results supported a 3 factor solution, accounting for 40% of the total variance: Factor I included 4 "visual" subtests, Factor II contained 3 "verbal" subtests, and Factor III, 2 "verbal STM" subtests. No "learning" factor was evident. The 3 factor structure differs from the scale structure proposed by the authors. These findings argue for interpretation of individual subtests on the first order, and the three factors on the second order in clinical populations. The influence of attention on the verbal STM subtests must be considered.

P. WILLIAMS-RUSSO & S. MATTIS. A Neuropsychology Battery for Assessment of Perioperative Cognitive Function In Elderly Adults.

We sought to develop a battery of neuropsychologic tests that could be employed serially in longitudinal studies of perioperative cognitive function in elderly patients. The rationale for selection of neuropsychologic tests for inclusion is presented. The battery includes the Controlled Word Association, Boston Naming, Trail Making A & B, Digit Symbol, Digit Span, Benton Visual Retention and Recognition Memory, and the Mattis-Kovner Verbal Recall and Recognition Memory. Results of testing in 400 elderly perioperative patients are presented. Variables affecting preoperative performance include education, age, gender, comorbid medical conditions, and depression. At 1 wk postoperatively, the magnitude and profile of deterioration in cognitive performance differs by type of surgery. By 6 mo, the vast majority of patients are again performing at their preoperative level. We conclude that the battery is feasible for longitudinal serial testing in the elderly population and appears to be sensitive to perioperative changes in cognitive function.

S.H. PUTNAM, S.R. MILLIS, & K.M. ADAMS. Predicting Digit Symbol Time to Full Grid Completion With Conventional Psychomotor Measures.
Trailmaking parts A and B and dominant hand Grooved Pegboard removal contributed significantly to prediction of total time required to complete the entire WAIS-R Digit Symbol grid. TPT total time, finger oscillation, age, and Grooved Pegboard insertion failed to achieve significance in the multiple regression model employed. The results are consistent with other studies finding the Trailmaking test and Digit Symbol subtest to load on a visuo-motor scanning factor involving sustained attention and set maintenance. This easily administered modification of the Digit Symbol subtest appears to be contributing important information to the neuropsychological test battery and can be useful in identifying specific contributions to overall performance on this multifactorial task.

B.N. AXELROD & J.H. RICKER. Utility of an Oral Version of the Trail Making Test.
Performance on the Trail Making Test is dependent upon multiple factors (e.g., motor speed, visual tracking, symbolic set shifting) that are deficient in certain clinical populations (e.g., visually or motorically impaired). The present study investigated the use of an oral presentation of the Trail Making Test in three age groups of adults. Comparable oral-to-written ratios were observed across all three age groups, despite age-consistent decrements in performance on raw performance times. These results suggest that the oral version of the Trail Making Test may yield results consistent with one's written performance, regardless of age. With appropriate normative research, the oral presentation may prove to be a useful alternate measure for specialized populations.

A. FOUNDAS, B.L. MACAULEY, A.M. RAYMER, L.M. MAHER, L.J.G. ROTHI, & K.M. HEILMAN. Apraxia and Action Deficits in the Environment: Environmental Apraxia.
Apraxia has been thought to be of only theoretical interest and not to interfere with activities of daily living. We examined ten apraxic stroke patients and compared their performance while eating a meal to a group of age matched controls. The apraxic patients were less efficient in executing actions required to complete the meal. The apraxics made more errors while using tools, than when completing nontool actions. Action deficits included misuse and mis-selection of tools, timing and sequencing errors. Error type seemed to dissociate by lesion site, with production errors occurring more commonly with anterior lesions, and conceptual errors occurring more commonly with posterior lesions.

S.P. CERCY & R.C. RADTKE. Integrating Memory Theory in the Detection of Malingered Amnesia: The Application of Proactive Interference.
A study applying interference theory for use in detecting malingered amnesia was conducted. Twenty-one subjects with intact memory, 20 subjects simulating memory dysfunction, and 20 closed head-injured (CHI) patients were given a list-learning task designed to produce proactive interference (PI). Group differences in the development of PI, release from PI, and serial position of recall were assessed. No statistically significant differences were found between the CHI and simulating groups on any of the measures. Simulators and CHI groups showed lower overall recall relative to controls, but were not different from each other. Results suggest simulators were able to feign memory dysfunction with surprising accuracy despite being theory-naive. Further study to refine theory-driven approaches of malingering detection is recommended.

F.E. ROSE, S. HALL, & A.D. SZALDA-PETREE. The Computerized Portland Digit Recognition Test: Malingering Detection is Improved by Measuring Response Latency.
This study compared the performance of subjects instructed to malinger with a group of severely impaired head injury patients on a computer-administered version of the Portland Digit Recognition Test (PDRT-C). The PDRT-C was designed to measure response latencies. In addition, half of the malingering subjects were provided with information regarding how to avoid detection in order to investigate the effects of advanced preparation (coaching) on the PDRT-C's ability to identify would-be malingerers. The addition of the response latency measure resulted in superior classification of both malingerers and brain injured patients. Coached malingerers were more likely to escape detection than uncoached malingerers, although the addition of the response latency measure substantially reduced the number of misses and false positives. Potential explanations and implications for these findings are discussed.

C.K. HISCOCK, L.B. LAYMAN, & M. HISCOCK. Using Symptom Validity Testing to Detect Feigned Lack of Criminal Responsibility: A Cross-Validation Study.
Two symptom validity tests–a test of general knowledge and a test of moral reasoning–were administered to male prison inmates who were assigned randomly to one of three treatments: control, naive faking, and coached faking. The majority of inmates in the naive and coached faking groups scored significantly below chance on at least one of the tests. No control subjects scored below chance on either test. When subjects were classified using a cut-off score suggested by previous research instead of below-chance performance, sensitivity increased modestly but there was a corresponding decrease in specificity. No significant difference was found between first offenders and second offenders. The data cross-validate the two tests as means of identifying individuals who are feigning a lack of criminal responsibility.

S.S. WILKINS, K.S. TANZY, & D. SCHRETLEN. Detecting Feigned Insanity: A Comparison of the Rey Osterreith Complex Figure and the Rey 15 Item Memory Test.
The Rey Osterreith Complex Figure was evaluated as a measure to detect malingering. In addition, the utility of the Rey Osterreith as a malingering test was compared with that of the Rey 15 Item Memory Test. The fakers ($N = 22$) were psychiatric inpatients on a substance abuse ward who were instructed to fake insanity, and were provided a monetary incentive. Their performance was compared with inpatients from a schizophrenia treatment unit ($N = 21$) who received standard instructions. Findings suggest that the Rey Osterreith is sensitive in detecting malingered insanity, and that it is a more sensitive tool than the Rey 15 Item Memory Test. A cut off score of $\frac{24}{36}$ identified 68% of the fakers with no false positives.

W.N. TENHULA & J.J. SWEET. Identifying Malingering Through Analyses of Multiple Components of the Category Test.
The purpose of this study was to determine whether the Category Test can be used to differentiate between traumatically brain-injured patients, malingerers, and normal controls. The Category Test was administered to 34 normal controls instructed to perform optimally, 31 normals instructed to malinger and provided basic information regarding genuine patient performance, and 33 brain-injured patients. Results indicate that these groups can at least partially be distinguished on the basis of their scores on subtests I and II. With only one exception in the brain-injured group, only the malingerers made errors on subtest I and more than one error on subtest II. Analyses of individual items that are infrequently missed will be presented, as will subtest and total scores between groups. Additional findings utilizing multivariate analyses will also be presented.

D.M. SCHNYER, J.J. ALLEN, & K. FORSTER. Event-Related Brain Potentials as Indicators of Memory Strength for Words Encoded With Awareness and Those Encoded Without Awareness.
While ERP repetition priming effects for stimuli encoded with awareness have been well-documented, the effect for stimuli encoded without awareness has not been examined. Seventeen subjects had ERPs recorded to repeated and nonrepeated words. ERPs to repeated words revealed an augmentation in the range of P300 compared to nonrepeated

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words. This effect was present for the repeated words that were encoded with as well as without awareness, although the effect was greater in amplitude and duration for words encoded with awareness. Topographical mapping suggests the possibility of distinct brain systems for each type of effect. These data also lend further support that a P300-like component can show augmentation to stimuli that a subject fails to explicitly identify as significant.

H. RIORDAN, B. TURETSKY, A. SAYKIN, & R. GUR. ERP and Neuropsychological Evidence for Temporal Lobe Dysfunction in Schizophrenia.
Seventeen schizophrenics and 16 normal controls completed a full neuropsychological test battery, an event-related potential task and magnetic resonance imaging. Significant differences between the two groups emerged on an auditory odd-ball task, with schizophrenics exhibiting lower P3 amplitudes and longer P3 latencies, to target but not non-target stimuli at midline and left temporal electrodes only. Results from neuropsychological testing revealed that schizophrenics performed worse than controls on functions mediated by the left temporal lobe (Language, Verbal Memory). MRI results revealed increased left VBR and reversed hemispheric asymmetry in schizophrenics. Numerous predicted relationships emerged between dependent measures for controls, but not for schizophrenics, suggesting a possible breakdown in normal structure-function relationships in schizophrenia.

F.W. BYLSMA & J. BRANDT. EEG Correlates of Cognitive Impairment in Huntington's Disease.
Raw and proportional EEG power measures and dominant EEG frequencies in the Delta (2.0–4.0 Hz), Theta (4.1–8.0 Hz), Alpha (8.1–12.0 Hz) and Beta (12.1–20 Hz) frequency bands were determined by power spectral analysis in 16 Huntington's disease (HD) patients and 8 age- and education-equated control subjects (NC). HD patients showed *more* Delta and Beta but *less* Theta and Alpha activity than NC subjects. Frontal Theta frequency was significantly lower in HD (5.30 Hz) than NC (6.45 Hz) subjects. In HD patients, poor cognitive performance correlated most strongly, and in the expected direction, with the degree of abnormality in frontal and temporal EEG measures, suggesting that cognitive impairment reflects abnormal neuronal activity in those areas. The extent to which the abnormal EEG measures reflect cortical denervation due to basal ganglia atrophy is unknown.

M. SHERER & C. BOAKE. Prediction of Return to Productivity Following Traumatic Brain Injury.
Prediction of outcome following traumatic brain injury is a frequent responsibility of neuropsychologists. Our study examined the relative contributions of four types of variables to the prediction of return to productivity following traumatic brain injury. Variables studied were severity of injury, four indices of premorbid functioning, age at injury, and four postmorbid neuropsychological scores. Subjects were 50 traumatic brain injury survivors. Of these, 41 suffered severe closed head injuries or gunshot wounds. Average time to followup from neuropsychological assessment was almost two years. Findings indicated that premorbid history of alcohol or substance abuse and number of perseverative responses on the Wisconsin Card Sorting Test were the two variables most predictive of productivity status at followup. Together, these two variables accounted for about 29% of the variance.

J.S. WEBSTER, B. MORRILL, L.J. RAPPORT, S. OKAMOTO, & P. ABADEE. Utility of Computer Assisted Wheelchair Simulation Treatment of Hemi-Inattention of R-CVA Patients.
Right-CVA patients with evidence of left hemi-inattention participated in an experimental treatment of computer assisted visual scanning retraining. Programs included wheelchair obstacle course simulations directed at improving real-life wheelchair safety. Treated subjects significantly improved from pre to post-treatment on standard measures of neglect (Letter Cancellation and Rey-Osterreith Figure), on experimental simulated wheelchair obstacle courses, and on independent occupational therapist rating of accident risk. In addition, treated subjects made significantly fewer errors on an in vivo wheelchair obstacle course as compared to an untreated group of R-CVA subjects.

J. ROSENBAUM, R.S. FISCHER, & C.A. LEAVELL. Motor Impersistence and Relationship to Rehabilitation Outcome.
Predicting functional recovery in rehabilitation is becoming increasingly important in today's changing health care environment. Ben-Yishay et al. (1968) found motor impersistence (MI) relates positively to rehabilitation length and inversely to functional gains but the rating scales were less robust and the 4.7 mo mean post onset suggests a severe neurological sample unrepresentative of today's rehabilitation population. We examined 20 unilateral right CVA patients in the acute epoch of recovery to determine whether MI interferes with rehabilitation outcome. Outcome variables included: discharge setting, length of stay, total FIM score, and various FIM subscales. Results were generally consistent with our hypothesis that MI patients with unilateral right lesions have worse outcomes than matched right CVA controls without MI. Theoretical mechanisms underlying the results are discussed.

Paper Session 7

DEMENTIA

L.E. WATT, J.G. BUCKWALTER, C.G. LOGAN, & V.W. HENDERSON. Estrogen Replacement Therapy and Cognitive Performance of Women With Alzheimer's Disease.
Several lines of evidence imply that estrogen deficiency is relevant to Alzheimer's disease (AD) in women. We hypothesized that women with AD receiving estrogen replacement therapy (ERT) would perform better on cognitive tasks than those not receiving ERT. Eligible subjects were women consecutively enrolled in a longitudinal study of dementia who met strict criteria for "probable" AD and had full datasets. Nine cases were receiving ERT at the time of their enrollment, and these were matched by age, age at onset of dementia symptoms, and education to 52 other eligible women. AD cases receiving ERT performed significantly better than demented controls on most components of a comprehensive neuropsychological battery. Largest group differences were on tasks of semantic memory (Boston Naming Test, $R = .59$, $p < 0.0001$; animal fluency, $R = .46$, $p < 0.0005$). On separate analyses in which we partialled out effects of disease severity, semantic memory differences remained significant. Analyses were retrospective and conclusions must be considered tentative, but findings support the view that ERT may improve cognitive performance in women with AD, particularly on tasks of semantic memory.

S. RAJARAM, H.B. COSLETT, & E.M. SAFFRAN. Restriction in the "Spotlight" of Visual Attention in Alzheimer's Disease: A Case Study.
A 56-year-old DAT patient with normal verbal intelligence and memory functions was studied for selective visual attentional deficits. Contrary to normal findings, the patient exhibited array-size effects in both preattentive and attention-requiring tasks (Treisman & Souther, 1985). On the Navon task (1977), the patient took longer and made more errors to identify global targets compared to local targets. Similarly, words presented in large prints were read more slowly and erroneously compared to small prints. In contrast, he performed well on a task assessing the integrity of his egocentric map for location. Results are interpreted within the framework of a model of visual function proposed by Coslett and Saffran (1991) and indicate a restriction in the "Spotlight" of visual attention.

D.X. RASMUSSON, A. BARR, & J. BRANDT. Predictors of Illness Progression in Alzheimer's Disease.
Predictors of rates of cognitive and functional decline were sought in autopsy confirmed Alzheimer's disease patients. Scores from Mini-

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Mental State Exam and the Physical Capacity subscale of the Psychogeriatric Dependency Rating Scales (PGDRS) were regressed against visit number for a minimum of five assessments at six month intervals. The slopes of these functions were our rate of decline metrics. Linear regression analyses determined that, of the clinical variables, shorter duration of illness, presence of other neuropathology, and earlier age of onset, predicted rapid cognitive decline. Lower scores on the Physical Capacity and Orientation subscales of the PGDRS predicted rapid functional decline. Cognitive variables were less valuable for predicting rates of decline.

D. JACOBS, M. SANO, K. MARDER, K. BELL, L. MILLER, F. BYLSMA, J. BRANDT, G. LAFLECHE, M. ALBERT, & Y. STERN. Differential Pattern and Rate of Cognitive Decline in Early and Late Onset Alzheimer's Disease.

Rate of cognitive decline in early and late onset probable Alzheimer's disease was examined in 127 subjects (44 early and 83 late onset) on a modified version of the Mini Mental State Exam. Early (onset before age 65) and late onset groups were matched at baseline for overall dementia severity (mild). Repeated measures analysis of variance revealed significantly more rapid decline in early onset subjects after two years of follow-up. Early onset subjects performed significantly worse than late onset subjects on attentional items at baseline and follow-up. Conversely, late onset subjects performed significantly worse than early onset subjects on memory and naming items at baseline, and the two groups were comparable on these tasks at follow-up. Results provide longitudinal evidence of more rapid cognitive decline in subjects with early onset Alzheimer's disease, and suggest that early onset AD may be characterized by disproportional impairment of attentional skills.

L. FREEDMAN. The Spectrum of Neurocognitive Function in Frontotemporal Degeneration.

Cortical degenerations affecting the frontotemporal cortices have received much clinical attention over recent years. The term frontotemporal degeneration (FTD) encompasses a number of distinct pathologic entities including frontal lobe degeneration of the non-Alzheimer's type (FLD), ALS-dementia, Pick's disease, and focal neuronal achromasia. The neurocognitive features of FTD may vary, and tend to correlate with the predominate lesion topography. Severe fluent anomia with loss of semantic knowledge occurs prominently in FTD with disproportionate temporal lobe involvement whereas nonfluent aphasia, usually of the transcortical motor aphasia type, is associated with greater damage to the frontal lobe. Aphasia, however, is not, an invariant feature of FTD. The neurocognitive and SPECT features of several FTD's are virtually indistinguishable. This presentation will survey the clinical spectrum of FTD and highlight its similarities and differences from a neurocognitive perspective.

Symposium 3

SICKLE CELL DISEASE: NEUROIMAGING, NEUROPSYCHOLOGICAL, AND BEHAVIORAL SEQUELAE

This symposium provides an overview of the impact of sickle cell disease (SCD) on the central nervous system using neuroimaging, neuropsychological, and sociometric (peer nominations) data from the University of Cincinnati Sickle Cell Study as examples of the problems children with this illness encounter. This project is a multi-disciplinary collaboration (pediatric hematology and radiology, neuropsychology, developmental psychology) studying school aged children with SCD and matched (same race/gender/neighborhood) healthy comparison children. Special emphasis will be placed on the relationships between results of imaging studies (MRI, MRS, and MR perfusion), neuropsychologic findings, and peer relationships for children with SCD and comparison African American children without a chronic condition.

K.A. KALINYAK. Sickle Cell Anemia: An Overview With an Emphasis on CNS Problems.

Sickle cell anemia is a disease with a well characterized molecular defect in which a single amino acid substitution results in abnormal hemoglobin. Intra-cellular polymerization of hemoglobin is a necessary determinant of clinical features which are modulated by biochemical, vascular, and genetic factors. The medical course is unpredictable with morbidity beginning in infancy with episodes of vaso-occlusion and musculoskeletal pain. About 10% of children suffer cerebral infarction (stroke) during the first decade of life. The risk of reinfarction approaches 70% in untransfused patients. Moreover, silent cerebral ischemia demonstrated by abnormalities on magnetic resonance imaging may result in impaired motor and cognitive function in other patients. Mortality in childhood has been substantially reduced by early diagnosis, improved access to comprehensive care, and prevention of serious infection. However, the risk of morbidity and mortality from stroke, vaso-occlusive episodes, and progressive organ failure persists.

M.D. RIS, R. GRUENEICH, & K. KALINYAK. Neuropsychological Risk in Children With Sickle Cell Disease.

The neurocognitive functioning of 33 children with sickle cell disease (SCD) having no history of neurological problems was compared to that of 33 matched classroom peers. Subjects were between 9 and 15 years of age and in regular classrooms. The neuropsychological evaluation consisted of measures of intellect, achievement, memory, visuoconstructional ability, impulsivity, and fine motor dexterity. Preliminary analyses indicate that children with SCD have lower IQs and are impaired relative to controls in Verbal and Attention/Memory domains. Evidence was also found for greater impulsivity relative to IQ in children with SCD. Analyses are ongoing comparing patients with different genotypes. Also being explored are correlational models of neuropsychological development as a function of biologic and psychosocial predictors.

W.S. BALL. Sickle Cell Anemia: Recent Applications of Neuroimaging.

Children with sickle cell anemia (SCA) are at risk for cerebral vascular accidents (CVA) with involvement predominately of the large vessels, and small vessel disease playing a less contributory role. Recent studies using Doppler ultrasound and MR angiography identify large vessel disease in neurologically symptomatic and asymptomatic patients with SCA. While these may correlate with CVA, they fail to predict patients at risk for CVA or correlate with neurocognitive deficits. Tissue perfusion abnormalities have been demonstrated in SCA using PET. Using perfusion MR imaging, and brain metabolism (proton spectroscopy) may proceed large vessel disease and thus identify children at risk for CVA. Similar functional imaging abnormalities may also correlate with neurocognitive dysfunction in this population of children.

R.B. NOLL, K. VANNATTA, M.D. RIS, & K. KALINYAK. The Relationships between Neuropsychological Functioning and Peer Relationships for Children With Sickle Cell and Matched Comparison Peers.

Previous work examining the peer relationships of school aged children has consistently demonstrated a modest relationship between estimates of overall intellectual abilities (based upon 2 or 3 WISC-R sub-tests) and peer relationships. Neuropsychological data were obtained using individual testing and data on peer relationships were collected in classrooms using the Revised Class Play and socio-metric nominations from all classmates ($N \approx 718$) and teachers. The purpose of this presentation is to examine the relationships between cognitive abilities and various patterns of neuropsychological abnormalities, with the peer relationships of children with sickle cell disease and matched (same race/gender/closest date of birth) healthy comparison classmates (total $N \approx 60$).

R. GRUENEICH, W.S. BALL, & M.D. RIS. The Relationship Between Neuroimaging Studies and Neuropsychological Performance in Children with Sickle Cell Disease.

The relationship between neuroimaging studies and neuropsychological performance in children with sickle cell disease (SCD) was investi-

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gated. Subjects were 29 SCD patients and 25 matched classroom comparison peers ranging in age from 9 to 16 years. Neuroimaging data consisted of conventional and perfusion MRI imaging studies. Neuropsychological data included measure of IQ, achievement, attention/memory, and motor skills. Neuroimaging studies were normal for all of the comparison peers except one who showed minor abnormalities. Minor abnormalities were found in five patients, and major abnormalities involving frontal hypoperfusion and numerous lesions were found in four additional patients. Three of the four patients with major neuroimaging abnormalities, but none of the other patients, subsequently developed clinical strokes. Preliminary analyses suggest that neuropsychological scores are not correlated with the presence of major neuroimaging abnormalities.

Paper Session 8

LANGUAGE

N.F. DRONKERS & B. REDFERN. Cerebral Localization of Naming Deficits in Aphasia.
An enhanced version of the Boston Naming Test was administered to a group of chronic aphasic patients with word-finding deficits. After the standard administration, the items not named by the patient were presented again, this time providing the patient with three possible names for the drawn object. Two groups of patients emerged: one that responded correctly to 97% of the recognition cues and one that responded less frequently to the correct cue. The dissociation in the naming behavior was also supported by the fact that each group showed a different area of lesion overlap. Patients in the former group all had lesions in the fiber tracts neighboring the anterior horn of the lateral ventricle, while the latter group all had lesions in fiber tracts clustering around the posterior horn. This is the first report of a neuroanatomical correlate to the behavioral distinctions in anomic patients.

A. MARTIN, C.L. WIGGS, C. MACK, & F.M. LALONDE. Modeling Word Generation Deficits: Double Dissociation Between Letter and Semantic Fluency in Normal Subjects Using Interference Tasks.
Retrieval of words beginning with the same letter may place greater demands on frontal lobe-mediated strategic search processes than on semantic knowledge. Conversely, generation of words from the same semantic category may place greater demands on posterior temporal lobe-mediated semantic knowledge than on strategic search. We tested this hypothesis by requiring subjects to generate lists of words to letter and semantic cues with and without an interference task. A motor sequencing task was used to activate frontal regions and an object decision task was used to activate posterior temporal cortex. In support of this hypothesis, letter fluency was reduced to a greater extent by concurrent performance of the motor sequencing task than by the object decision task. The opposite interference pattern was found for semantic category fluency.

L.J. BUXBAUM & H.B. COSLETT. Letter by Letter Deep Dyslexia.
We report a patient who exhibited letter by letter reading subsequent to a left occipital infarct. Seven months after the stroke, the patient continued to read in a serial manner, as evidenced by a linear increase in latency to read as a function of word length. In addition, characteristics of the patient's reading (semantic paralexias; word class, imageability, and part of speech effects) were consistent with the presence of deep dyslexia. Investigations demonstrated that the reading deficit was specific to the visual modality, and that it was not attributable to prelexical visual or attentional impairment. We suggest that the patient's deficient performance can be attributed to the failure of early visual input to access intact left hemisphere lexical/semantic systems, with subsequent reliance on right hemisphere systems. The co-occurrence of letter by letter reading and deep dyslexia suggests that a common right-hemisphere mechanism mediates residual reading in both disorders.

L.X. BLONDER, J.E. PICKERING, R.L. HEATH, C.D. SMITH, & S.M. BUTLER. Prosodic Characteristics of Speech Before and After Right Hemisphere Stroke.
Case-control studies have shown right hemisphere specialization in the production of intonation in speech. We examined prosody in audiotapes of interviews with a 79-year-old right-handed woman recorded six months before and two months after she suffered a right fronto-temporo-parietal stroke. Post-stroke, the patient had a Mini-mental Status Examination Score of 29, hemispatial neglect, and impairments in the comprehension of facial and prosodic emotion. We compared beginning, peak, and ending fundamental frequencies (*fo*) in breath groups, the timing of these *fo* changes, pause duration, and rate of speech. We found that post-stroke, the patient had a more restricted *fo* contour, no changes in timing of *fo* changes, an increased rate of speech, and less variability in pause duration.

J. KEGL, R. GILMORE, E. FENNELL, D. BOWERS, H. POIZNER, & K. HEILMAN. WADA Testing of a Deaf, Left-Handed, ASL Signer Reveals Right Dominance for Language.
This paper focuses upon the results of a WADA test performed on JR, a 36-year-old, left-handed, deaf male with intractable epilepsy. Particular attention is paid to linguistic analysis. WADA testing of this subject revealed right hemisphere dominance for both signed and spoken language, with both sign and speech arrest occurring after right-sided, but not left-sided, injection. This constitutes the first reported case of a right hemisphere dominant signer with familial left-handedness and is just one piece of a comprehensive study that also included neuropsychological assessment, a battery of tests to determine sign language capacity, EEG monitoring, five days of cortical stimulation and functional mapping, neuroimaging with PET and MRI, and a detailed transcription and analysis of language production in both speech and sign.

FRIDAY MORNING, FEBRUARY 4, 1994

Paper Session 9

EPILEPSY

C. KUBU, L. MILLER, J. GIRVIN, & A. PARRENT. Intra-Operative Assessment of Language Functions in Surgical Epilepsy Patients.
Cortical mapping with electrical stimulation is an established method of helping surgeons define areas critical for language. We describe a brief language protocol developed to help verify language regions during intra-operative cortical stimulation and assess language functions during the post-operative course. Subjects included 10 surgical epilepsy patients whose resection included the dominant temporal lobe. The data indicate that the language protocol is more sensitive than traditional serial speech tasks. Furthermore, the results indicate that language can be disrupted with cortical stimulation at sites throughout much of the perisylvian region. Finally, preliminary data suggest that the occurrence of even a few errors in response to stimulation within the resection site or nearby regions are associated with increased post-operative language difficulties.

P. FEDIO, A. AUGUST, S. SATO, C. KUFTA, & J. VAN BUREN. Naming, Working and Experiential Memory During Stimulation of Temporoparietal and Basotemporal Cortex and Pulvinar.
Functional mapping of cortical and subcortical sites in patients with epilepsy (23) or Parkinsonism (12) established Wernicke's area as the primary mediator of language, working memory, and related experiential

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memories. With pulvinar stimulation, naming and working memory were less compromised and patients often remembered their difficulty. While basotemporal stimulation evoked anomia, patients accurately recalled both the experience and specific item they had missed, suggesting a greater role in language than in memory. Overall, if patients failed to name items during stimulation, they were less likely to recall the experiences; however, if they misnamed, their memory for the events and items improved, indicating that initial activation of semantic systems is an important factor in working and experiential memory.

R.M. BAUER, J. BREIER, B. CROSSON, R. GILMORE, E.B. FENNELL, & S. ROPER. Neuropsychological Functioning Before and After Unilateral Temporal Lobectomy for Intractable Epilepsy.
This study evaluated aspects of neuropsychological functioning before and after unilateral left (LTL) or right (RTL) anterior temporal lobectomy for intractable epilepsy, with the goal of identifying significant predictors of seizure focus laterality and cognitive outcome after surgery. Presurgically, a few measures discriminated LTL's and RTL's along what appeared to be material-specific lines, though the majority of tests did not. Postsurgical evaluation clearly revealed that LTL was associated with more deleterious neuropsychological consequences, particularly in verbal memory and executive skill, than was RTL. Higher presurgical test scores were associated with larger surgical effects, consistent with previous research. Further analyses explore the relationship between neuropsychological functioning and results of structural (MRI) and functional (HMPAO SPECT; PET) imaging studies in this population.

K.J. MEADOR, D.W. LORING, G.P. LEE, M.E. NICHOLS, D.W. KING, B.B. GALLAGHER, A.M. MURRO, & J.R. SMITH. Temporal Lobe Dysfunction as Evidenced by Wada Test Predicts Surgical Outcome.
The Wada memory test was originally developed to assess risk of developing amnesia post temporal lobectomy. More recently, it has been used to compliment EEG localization by lateralizing temporal lobe dysfunction. In this study, we examined the relationship of pre-operative asymmetries in Wada memory to seizure outcomes at one year post surgery in 80 patients with no structural lesion other than gliosis, who underwent a standard anterior temporal lobectomy including hippocampus. Eight common objects were presented after each Wada injection for subsequent recognition versus foils post recovery. Left/right Wada memory asymmetries predicted side of seizure focus ($\chi^2 = 35.714$, $p \leq .0001$), and ipsilateral-contralateral asymmetries ≥ 6 were associated with better seizure control ($\chi^2 = 4.609$, $p \leq .03$). The results support the utility of pre-operative Wada memory testing for epilepsy surgery.

J.T. LANGFITT & R. RAUSCH. On-Line Sentence Processing is Selectively Compromised With Left Temporal Lobe Damage.
Use of lexical semantic information during on-line sentence processing by left (LTL) and right (RTL) temporal lobectomy patients is reported. 20 LTL, 20 RTL and 16 normal controls (NC) read sentences where early semantic information guided later syntactic parsing decisions. Compared to NCs, both patient groups processed more slowly as sentences became syntactically complex. Compared to RTLs, LTLs were slower to use semantic information to guide syntactic analysis. Otherwise, LTL and RTL performances were similar. LTLs thus have a specific sentence processing deficit independent of semantic or episodic retrieval problems. Implications for understanding information-processing deficits associated with left temporal lobe damage are discussed. This project sponsored in part by the Epilepsy Foundation of America's Wilder Penfield Behavioral Sciences Post-Doctoral Fellowship, supported by CIBA-GEIGY Pharmaceuticals.

M.R. TRENERRY, C.R. JACK JR., F.W. SHARBROUGH, G.D. CASCINO, & R.J. IVNIK. Sex Differences in Relationships Between Visual Memory Outcome and MRI Hippocampal Volumes in Right Temporal Lobectomy Patients.
Sex differences in relationships between visual memory and hippocampal volumes (HV) were investigated in nonlesional left hemisphere language dominant right temporal lobectomy patients. Pre- and postoperative WMS-R Visual Reproduction percent retention (VRPER), right and left HV divided by total intracranial volume (RAHV, LAHV), and HV difference (DHV = R − L volume) were obtained from 17 women and 19 men. Repeated measures ANOVAs of VRPER by sex and each volume variable produced triple interactions including each of RAHV and DHV ($p < .05$). Postoperative VRPER was correlated with DHV ($r = -.53$) and RAHV ($r = -.52$), and preoperative VRPER was correlated with RAHV ($r = .54$) in women only (all $p < .03$). Pre- and postoperative visual memory in left hemisphere language dominant right temporal lobectomy patients appear to differ with right hippocampal atrophy in women, but not men.

Symposium 4

NEUROPSYCHOLOGICAL ASPECTS OF THE CANADIAN STUDY OF HEALTH AND AGING

As part of the Canadian Study of Health and Aging (CSHA), a nationwide dementia epidemiology study, 1879 participants 65 years of age and older from across Canada were seen for neuropsychological evaluation. Few large dementia epidemiology studies of this type have included a neuropsychological component as comprehensive as the one employed in the CSHA. In the present symposium, several studies using data derived from the CSHA will be presented. The neuropsychology component of the CSHA is a rich source of information on a variety of topics related to health and aging. The papers presented in this symposium illustrate some of the areas in which data from the CSHA will be able to shed new light.

M. CROSSLEY, C. D'ARCY, & N. RAWSON. Language Functioning in Community-dwelling Normal and Dementing Subjects in the Canadian Study of Health and Aging (CSHA).
As part of the neuropsychological component of the CSHA, measures of letter generation (FAS) and semantic (Animal Naming) word fluency, confrontational naming (Buschke Object Naming), and verbal comprehension (modified Token Test) were administered to a community-dwelling sample of normal elderly (637), and to individuals diagnosed with Alzheimer Disease (156) or Vascular or other dementias (76). A Behavioral Rating Scale contained five descriptors of language. Dementia groups were subdivided into mild and moderate impairment categories based on the Modified Mini Mental State Examination (3MS). Semantic word fluency was sensitive to mild dementia, regardless of type, whereas letter generation word fluency differentiated AD from other dementias, especially at the more severe stage. Both performance on the FAS test and ratings of expressive language on the Behavioral Check List were more impaired for vascular and other dementias than for AD subjects.

J.A. MILLER. The Use of Screening Measures in Predicting Diagnosis in the Vancouver Center of the Canadian Study of Health and Aging.
British Columbia was one of the five geographically defined regions in the Canadian Study of Health and Aging (CSHA). Vancouver was one of two centers in this region. This paper focuses on a subsample of community-dwelling seniors who completed both the screening and clinical components of the study. The results indicated that two measures of cognitive functioning administered at the time of the screening interview were related for all age groups. One of these cognitive measures was repeated in the clinical component and was found to be related to diagnosis for two of three age groups. An examination of the relations among the screening and clinical variables revealed that both of the measures of cognitive functioning administered at the screening interview were related to diagnostic category.

W.G. SNOW & M.C. TIERNEY. Rey Auditory Verbal Learning Test Results in the Canadian Study of Health and Aging.
We examined the Rey Auditory Verbal Learning Test (RAVLT) performance of those subjects in the Canadian Study of Health and Aging

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(CSHA) who had completed the entire RAVLT. There were seven diagnostic groups: Normals ($n = 646$), cognitively impaired nondemented ($n = 531$), probable Alzheimer's ($n = 84$), possible Alzheimer's ($n = 64$), vascular dementia ($n = 51$), other dementias ($n = 25$), and unclassifiable dementias ($n = 37$). Using analysis of covariance (with age and education as the covariates), we found that the normal subjects performed better on almost every RAVLT score than did any of the other groups. The cognitively impaired nondemented group also performed better on most measures than did the other groups. There were essentially no differences between the demented groups.

R.E. STEENHUIS & T. OSTBYE. Neuropsychological Data From the Canadian Study of Health and Aging (CSHA).
This paper gives an overview of the neuropsychological data from the CSHA. Neuropsychological performance ($n = 1879$) contributed to diagnostic decision-making. Consistent with this, persons given a diagnosis of dementia or cognitive loss but no dementia scored lower than persons with no cognitive loss on most tests of memory, abstraction, judgement and higher cortical function. One exception was a color naming test on which the three groups did equally well. Generally, persons with dementia also scored below those with cognitive loss. For some measures (e.g., digit span and object naming), differences between mean scores were very small suggesting that use in clinical decision-making may be problematic. Learning and retention, fluency and visuoconstruction measures distinguished the groups well.

H. TUOKKO, B. KRISTJANSSON, & J.A. MILLER. An Overview of the Neuropsychological Component of the Canadian Study of Health and Aging (CSHA).
This paper provides a descriptive summary of the methodological basis of the neuropsychological component of the CSHA. The findings indicated that differences existed between participants administered the battery in English or French in terms of refusal rates and diagnoses of dementia. Examination of the utility of the battery indicated that the battery was tolerated well by both the participants and the psychologists involved with the study and that measures of memory functioning were central to diagnostic decision-making. The relations between neuropsychological, preliminary medical and consensus diagnoses were examined and indicated that neuropsychological information influenced diagnostic decision-making. The neuropsychology component of the CSHA is a rich source of information on persons aged 65 yr and older in Canada.

Paper Session 10

EXECUTIVE FUNCTIONS

P.J. ESLINGER & L.M. GRATTAN. Impaired Sequential Organization and Serial Order Effects After Frontal Lobe Lesions.
Subjects with frontal and nonfrontal lobe lesions were compared on measures of serial order effects and sequential organization during verbal learning. The expected serial order effects were found after nonfrontal lobe lesions, but frontal lobe lesions caused a significant disturbance of serial order effects that became more disorganized over learning trials. A standard index of subject-generated sequential organization was significantly lower in the frontal than nonfrontal lesion group. Sequential disorganization was most evident after dorsolateral frontal lesions and least evident after orbital frontal lesions. Impairment in temporal ordering and temporal organization may account for at least part of the memory disturbance after frontal lobe lesion.

R.S. FISCHER, M. D'ESPOSITO, M.P. ALEXANDER, & R. OTTO. Neuropsychological and Neuroanatomical Correlates of Confabulation.
In the present investigation we report nine confabulatory patients of comparable age, education, and general level of intelligence in the acute epoch of recovery who had undergone rupture and clipping of ACoA aneurysms. Five patients had spontaneous confabulation, severe anterograde amnesia, markedly poor attentional and executive functions, and denial of illness. These patients all had multiple lesions that involved basal forebrain, ventral frontal lobe, and striatum. The other four patients manifested only momentary or provoked confabulations, relatively normal language and sustained attentional skills, inefficient performance on tasks of new learning and concept formation and shallow insight. These patients had lesions restricted to the basal forebrain except for one who had additional restricted orbital frontal damage. Analysis of these two groups of confabulatory patients suggests that they have a common profile of deficits and anatomic foundation which represents a continuum of the same disorder: "spontaneous" confabulators appear to require extensive, simultaneous disruption of medial forebrain and frontal cognitive systems resulting in extensive executive and memory deficits, whereas transient or provoked confabulators had more limited lesions to the basal forebrain or orbital frontal systems resulting in more restricted cognitive deficits.

L.M. GRATTAN & P.J. ESLINGER. Characteristics of Favorable Outcome After Frontal Lobe Lesion.
Although the debilitating cognitive and psychosocial difficulties of patients with frontal lobe lesion are well documented, the characteristics associated with their favorable recovery remain unknown. Based upon the outcome study of 35 consecutive patients with frontal lobe lesions, we report that 11% demonstrated favorable recovery. When cognitive, social and neuroanatomic characteristics of positive and negative outcome patients were compared, results indicated favorable recovery was unrelated to measured intellect, language, memory or perceptual abilities. Favorable outcome was related to: (1) lesions sparing the anterior insula, frontal operculum and paraventricular white matter, (2) creative problem solving abilities, (3) flexible and "easy going" premorbid personality style and (4) average levels of social sensitivity. Positive outcome from frontal lobe lesion may be a result of interrelated cognitive, neuroanatomic, premorbid and social factors.

J. GREEN, B.E. SIROCKMAN, G.O. ZAKERS, C. MAIER, & R.L. WATTS. Stability of Neuropsychological Performance in Younger and Older Mildly-Affected Non-Medicated Patients With Parkinson's Disease (PD).
We compared neuropsychological measures of 10 younger PD patients (age < 50 yr), 10 older PD patients (age > 60 yr), and age and education-matched controls. Patient groups were matched in disease severity and had discontinued medications five days before evaluation. Measures included the WAIS-R, Trails, Stroop, Boston Naming, Controlled Oral Word Association, Test of Visual-Perception Skills, California Verbal Learning Test, WMS-R Logical Memory, and Profile of Mood States (POMS). Analysis of variance revealed expected age differences on measures related to memory and attention, and increased fatigue and tension in patients. Thus, although age differences were present, these were not greater in PD patients, nor were there deficits in patients compared to controls. The impact of medication, premorbid intelligence, and disease severity on neuropsychological deficits is discussed.

H. WISHART, W.B. BARR, R.M. BILDER, & N. SCHAUL. Examination of Executive Control in Epilepsy Surgery Candidates.
A set of experimental tests, previously derived from Luria's investigations of executive control of hand movement, were psychometrically evaluated. Although the experimental tests require integrity of both primary motor and executive ability, they are intended primarily to address the latter, and to be sensitive to anterior frontal dysfunction. Subjects were adults with partial epilepsy ($N = 64$). Site of seizure origin was determined on the basis of 24-h video/EEG monitoring. The construct validity of the experimental executive tests was supported by the results of a Principle Components Analysis, in which the experimental measures loaded with other established executive tests rather than motor measures. In addition, the experimental measures nearly discriminated subjects with frontal onset from those with temporal onset (Discrimi-

nant Analysis: $\chi^2(3) = 7.55$, $p = .056$). Clinical and empirical implications are addressed.

M. D'ESPOSITO, R. McGLINCHEY-BERROTH, M.P. ALEXANDER, R.S. FISCHER, M. O'CONNOR, & M. WALBRIDGE. Cognitive Recovery Following Anterior Communicating Artery Aneurysm Rupture.

We studied the recovery of cognitive impairment in 7 patients following anterior communicating artery aneurysm rupture and repair. Patients were tested at two consecutive points in time (mean 55 d and 93 d). During the earlier stage, patients' performance on testing fell into two disparate groups based on severity of frontal systems dysfunction. However, both groups had severe anterograde amnesia. Patients with severe frontal impairment showed a temporal gradient pattern of retrograde amnesia. During later testing, frontal dysfunction significantly improved yet anterograde amnesia remained severe. In those patients in which frontal impairment improved, the pattern of retrograde amnesia also changed with time resulting in an attenuation of the temporal gradient. These results suggest that the cognitive profile following ACoA rupture changes dramatically with time. Accounting for recovery is crucial in attempting to define neuropsychological syndromes as well as understanding underlying cognitive mechanisms in neurological disorders.

Poster Session 4

FOCAL BRAIN DISORDERS AND HEMISPHERIC SPECIALIZATION

M.R. POLSTER & S.Z. RAPCSAK. The Influence of Encoding Instructions on Face Learning in Prosopagnosia.

We present the performance of a prosopagnosic patient, RJ, on a series of face learning tasks. RJ performs very poorly when presented with no encoding instructions or when told to focus on individual facial features. However, he performs relatively well when presented with encoding instructions to focus on trait or character information about the face. Thus, he shows significant benefit from so-called "deep" encoding instructions and no cost from "shallow" encoding instructions relative to no instruction conditions. Our findings suggest that RJ's face learning impairment is attributable to excessive reliance on a "shallow," feature-based encoding strategy. The potential utility of "deep" encoding strategies in rehabilitation may be limited, however, since such instructions were of no benefit when the view of the face was changed between study and test.

M. PURDY. The Relationship Between Symbol Usage and Executive Function Ability in Aphasia.

Numerous attempts have been made to train verbal or nonverbal symbols to aphasic patients to help compensate for their impaired communication skills. However, it has often been demonstrated that patients can acquire trained symbols but they do not use these symbols propositionally. The purpose of this study was to test the hypothesis that this reduced ability to spontaneously use trained symbols may be related to an impairment in executive function ability. Fifteen nonfluent aphasic subjects were trained to acquire 20 symbols in three modalities (communication board, gesture, verbal). Symbol usage was assessed via a referential communication task then correlated with performance on the Wisconsin Card Sorting Test as a measure of executive function ability. Results demonstrated significant correlations between symbol usage and executive function ability.

R.D. JONES & A.L. BENTON. Use of the Multilingual Aphasia Examination in the Detection of Language Disorders.

The sensitivity of the Multilingual Aphasia Examination (MAE) was assessed in 48 subjects with documented focal left hemisphere lesions that had resulted in clear disorders of communication (aphasia) and 115 normal controls. As expected, the aphasic group performed poorly on all of the subtests of the MAE relative to controls. All aphasics and 15% of controls performed poorly on at least one MAE subtest. Using a cutoff of two defective performances, 96% of aphasics performed poorly, whereas 3% of controls performed poorly. The results indicate the great sensitivity of the MAE to the presence of aphasic disorder. Specific MAE performance profiles are being explored in relation to traditional classifications of aphasic disorder and lesional localization.

T.E. MARKEE, L.H. MOORE, W.S. BROWN, & D.C. THEBERGE. Bilateral Field Advantage and Evoked Potential Interhemispheric Transfer Time in Dyslexic Adults.

Recent research has implicated inefficient interhemispheric communication as a neurological substrate of some forms of dyslexia. Callosal function was assessed in 21 dyslexic subjects and 21 controls through measurement of interhemispheric transfer time (IHTT) with visual evoked potentials recorded during tachistoscopic presentation of a letter-matching task. Interhemispheric collaboration in dyslexia was also explored through measurement of a processing advantage for bilateral versus unilateral visual field presentations. Results revealed significantly slower IHTT in the dyslexic group for P1 latency, and a similar trend for the N1 component. Letter-matching performance data yielded no significant group differences in bilateral field advantage, however, dyslexics made significantly more errors and were slightly slower than controls. These data suggest that callosal dysfunction is a significant contributor to at least some forms of reading disability.

A. FOUNDAS, B.L. MACAULEY, A.M. RAYMER, L.M. MAHER, L.J.G. ROTHI, & K.M. HEILMAN. Fluency of Gesture in Spontaneous Speech.

It has been posited that speech and gesture are mediated in part by different systems. In order to study the relationship of verbal and gestural fluency, we developed a method of quantifying fluency of gesture based on the fluency subtest of the BDAE (Goodglass & Kaplan, 1983). We studied a group of left hemispheric stroke patients with ideomotor apraxia and matched controls. The stroke patients differed significantly from the controls in verbal and gestural fluency. Within the stroke group there was a double dissociation of verbal and gestural fluency with a subgroup who were verbally fluent and gesturally nonfluent, and another group who were verbally nonfluent and gesturally fluent. Although this dissociation suggests that, at some level, different systems mediate verbal and gestural expression, lesion site did not predict these behaviors.

B.L. MACAULEY, A.L. FOUNDAS, A.M. RAYMER, L.M. MAHER, L.J. GONZALEZ-ROTHI, & K.M. HEILMAN. Ideomotor Apraxia and Conversational Gesture.

To examine the effects of ideomotor apraxia on gestures used during conversation, 12 left hemisphere stroke patients and 12 matched control subjects were videotaped while engaged in spontaneous conversation with an examiner. The videotapes were quantitatively and qualitatively analyzed using an adaptation of the scoring system defined by LeMay et al. (1988). Significant differences were found between the two groups in number of emphasis gestures (Controls > Apraxics), length of consecutive gestures (Controls > Apraxics), and number of pictographs (Controls > Apraxics). Other gesture types did not differ. Dissociations in gesture use between severity of apraxia and type of aphasia were also observed. The results indicate that there is an interaction between apraxia and aphasia that determines gesture use during conversation.

B.L. MACAULEY, A.L. FOUNDAS, L.M. MAHER, & L.J. GONZALEZ-ROTHI. Right Hemisphere Contributions to Conversational Gesture.

To examine the contributions of the right hemisphere to conversational gesture, a subject (BR) with unusual bilateral parietal lesions was evaluated. Six stroke patients with unilateral parietal lesions (5L, 1R) and twelve control subjects were also studied. All subjects were videotaped

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while engaged in spontaneous conversation with an examiner. The videotapes were quantitatively and qualitatively analyzed using an adaptation of the scoring system defined by LeMay et al. (1988), and a measure of gesture fluency adapted from the BDAE (Goodglass & Kaplan, 1983). Results indicated that the quantity, quality, fluency, and handedness of BR's gestures were severely impaired and suggest that the right hemisphere makes significant contributions to conversational gesture.

L.J. BUXBAUM, M.F. SCHWARTZ, H.B. COSLETT, & T.G. GIOVANNETTI. Dissociations of Everyday Action and Praxis in Callosal Apraxia: Evidence for Lateralized Contributions to Action.
We report a subject who, subsequent to a closed head injury, demonstrated severe left handed apraxia and apraxic agraphia consistent with the presence of callosal apraxia. Performance of the right hand was unimpaired on tests of transitive and intransitive praxis but was significantly deficient relative to the left hand on a series of functional tasks. Errors could not be attributed to motor slowing or imprecision, and were frequently spatial in nature. Performance of the left hand may be attributed to a disconnection of left hemisphere spatiotemporal codes for skilled movement from right hemisphere/left hand motor effector programming. In contrast, the deficient performance of the right hand may be attributed to the failure of right hemisphere modules essential to constructional praxis and manipulospatial skills to inform left hemisphere/right hand motor systems. Evaluation of both praxis and everyday action may be essential in the development of appropriate treatment strategies.

J. SHUREN, L.M. MAHER, & K.M. HEILMAN. The Role of the Pulvinar in Ideomotor Praxis.
The production of learned skilled movements (praxis) is mediated by a modular network of cortical (parietal and frontal) and subcortical structures that may include the thalamus. We report a woman with a left medial occipital, inferior temporal, and pulvinar infarct who demonstrated a bilateral ideomotor limb apraxia to command that improved with tool use. She had impaired gesture imitation and motor skill learning. We attribute her apraxia to the pulvinar infarct. The thalamus may function together with the cortex in the selection of the motor representation and the translation of the representation into spatiotemporal coordinates.

L. BURTON. Awareness of Performance for a Memory and Face Recognition Task: Relationship to Specific Task Accuracy and Frontal Lobe Functioning.
Twenty head injured subjects were administered a memory task and a face recognition task. Confidence ratings for each trial were correlated with trial accuracy, yielding a "performance awareness" score. The relationship of performance awareness to 1) overall task accuracy and 2) frontal lobe functioning inferred from a neuropsychological task, were evaluated. Performance awareness was related to overall accuracy for each task, supporting the idea that specific awareness is tied to a specific functional system. No relationship between frontal functioning and specific performance awareness for the face task was found. A relationship between frontal functioning and memory appeared, such that good frontal functioning was associated with both better memory accuracy and with impaired performance awareness; this is discussed.

M. ZIMMERMAN, B. POPPEN, K. PODELL, & E. GOLDBERG. Lateralized Frontal Lobe Dysfunction in Males: The Wisconsin Card Sorting Test Versus The Graphical Sequence Test.
Studies that have examined the effects of lateralized frontal lesions on Wisconsin Card Sorting Test (WCST) performance have produced inconsistent results. The Graphical Sequence Test (GST) was designed to quantitatively assess graphomotor perseverations associated with frontal lobe dysfunction and is as accurate as the WCST in classifying healthy controls (HC), patients with focal frontal lesions, and schizophrenics (SZ). The present study shows that patients with left and right frontal lesions were significantly impaired on WCST compared to HC and SZ, but that the test was not sensitive to side of lesion. Conversely, the GST was particularly sensitive to the performance of schizophrenics and patients with left frontal lesions. These results suggest that the GST may be particularly sensitive to lateralized dysfunction of the left prefrontal cortex. The interaction of GST with lesion side was not related to performance on language tests, or to lesion size.

A. DÉCARY & F. RICHER. Response Selection Deficits in Frontal Lobectomy.
Our previous work suggested that frontal lobectomy patients show a deficit in multiple-target search and in detecting rare stimuli in sequences. To investigate the nature of this problem, we examined the performance of 6 frontal patients, 4 temporals and 6 controls on speeded choice-response tasks (Go/No-Go, 2-choice and 4-choice) in which event probability, stimulus degradation, stimulus and response set-size, the complexity of the S-R association rule and S-R spatial compatibility were manipulated. Response times were sensitive to conditions but did not differentiate the 3 groups. Complexity of the S-R association rule and spatial compatibility strongly affected error rates in frontals while stimulus set-size and response set size affected their performance moderately. Both temporals and frontals were affected by stimulus degradation. These effects point to a deficit in the control of conditional S-R associations which probably contributes to several reported response regulation problems in frontals.

J. BARRASH, D. TRANEL, & S. ANDERSON. Assessment of Dramatic Personality Changes After Ventromedial Frontal (VF) Lesions.
Damage to the VF region may produce profound personality changes including grossly maladaptive social behavior. Standard psychometric evaluations of such patients have not yielded systematic, coherent findings. We report results with an extensive battery of widely used personality measures and measures specifically developed to assess psychopathic features in 6 subjects with VF damage, premorbidly unremarkable personality, and profound personality changes. Measures included MMPI, Eysenck Personality Questionnaire, Hare Psychopathy Checklist, Beck Depression Inventory, and by structured interviews of the subject and a collateral. Individuals with VF lesions were generally unable to accurately describe personality changes, and scores were inconsistent across different measures of the same features. One noteworthy exception was the accurate report of diminished anxiety. Although similarities exist, important distinctions between individuals with acquired sociopathy and developmental antisocial personality disorders are suggested. Even combined in an elaborate battery, standard psychometric measures of personality characteristics and psychopathic features developed for psychopathological populations are not adequate for assessing personality changes in patients with frontal lobe dysfunction.

D.W. DESMOND, Y. STERN, M. SANO, T.K. TATEMICHI, M. FIGUEROA, T.I. GROPEN, & E. BAGIELLA. Clinically Significant Cognitive Decline in the First Year After Stroke.
To determine whether clinically significant cognitive decline occurs during the first year after stroke, we administered neuropsychological tests to 124 patients 3 and 12 mo after stroke and 198 stroke-free subjects on 2 occasions 12 mo apart. Two neuropsychologists classified each subject's test performance as having declined, improved, or remained stable based solely on clinical impression. Reliability of the rating of decline versus improvement/stability was excellent ($\kappa = .79$) and MANOVA found that the two groups differed significantly and in the appropriate directions in test score change. In a logistic model, correlates of a rating of cognitive decline included stroke status (Odds Ratio = 2.0), the interaction between stroke status and education (OR = 2.0), older age (OR = 2.3), and black race (OR = 3.4) and Hispanic ethnicity (OR = 2.1) relative to white race. Clinically significant cognitive decline occurs during the first year after stroke, with low education further increasing the risk of decline among stroke patients.

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K. McNULTY, R. AU, R.F. WHITE, M. KELLY-HAYES, C.S. KASE, P.A. WOLF, J. COBB, & R.B. D'AGOSTINO. Cognitive Profiles Following Stroke in the Framingham Study.
There has been a decrease in stroke severity and mortality in recent years. To assess the severity of recent versus remote strokes, we examined 67 stroke subjects and 2016 non-stroke subjects with a comprehensive neuropsychological battery. The residual cognitive deficits in the overall stroke group included word list generation, working and visual memory, and attention. To determine if neuropsychological sequelae of stroke had decreased in recent years, we divided the overall stroke group into recent (<4 yr) and more remote (>4 yr) post-stroke groups. The recent stroke group showed attention, working and visual memory deficits while the remote stroke group displayed attention, working memory and word list generation deficits. These data indicate that neuropsychological performance has increased in recent strokes suggesting beneficial effects of improved stroke detection and treatments.

D.E. TRAHAN. Facial Discrimination in Patients With Unilateral Vascular Lesions.
This study examined performance on the Facial Recognition Test in patients with unilateral vascular lesions. Subjects were 85 patients with right-hemisphere cerebrovascular lesions and 44 patients with left-hemisphere vascular lesions. All were administered the FRT. Results revealed twice as many RCVA patients (53%) exhibited impairment on the FRT as LCVA patients (27%). Among RCVA patients, a much higher percentage of impairment was seen in patients with neglect or visual field defect. Among LCVA patients, about the same percentage of impairment was seen in patients with and without neglect or visual field defect. WAIS-R Performance I.Q. correlated significantly with FRT scores in RCVA patients with neglect. Correlations between WAIS-R V.I.Q. and Performance I.Q. scores and FRT were not significant in other subgroups.

L.E. MELAMED. Employing the Distinction Between Magnocellular and Parvocellular Visual Cortical Pathways in Clinical Neuropsychology: A Case Study.
Livingstone and Hubel have proposed that there are three distinct visual pathways within the cortex with the magnocellular being primarily responsible for motion and depth perception while the parvocellular division consists of a primarily chromatic pathway and another that underlies high resolution form perception. RW, a 48-year-old white male with multiple bilateral posterior cortical lesions, demonstrated residual magnocellular functioning along with little or no apparent parvocellular functioning. He could discern high contrast, moving stimuli but did not respond to chromatic contrast or stationary forms nor were evoked potentials obtained for stationary visual patterns. One implication of these findings is the need for the development of assessment procedures and interpretive strategies for discerning magnocellular and parvocellular consequences in visual perceptual dysfunction.

L.M. GRATTAN, P.J. ESLINGER, A.L. BENTON, & K. MATTSON. Visuospatial Judgment After Frontal Lobe Lesions.
Although impairment of visuospatial perception has been associated most consistently with right posterior cerebral lesions, there is uncertainty regarding the role of other cortical areas in spatial cognition. To investigate the role of the frontal lobes in visuospatial perception, we examined 95 patients with cerebral lesion on the Judgment of Line Orientation test. Patients were classified into frontal versus nonfrontal, and right versus left lesion groups according to CT and MR scans. Results indicated significantly higher test scores after frontal (12.8% failure rate) than nonfrontal lesions (41% failure rate), and significantly lower scores after right (25% failure rate) than left (16% failure rate). The findings indicate a modestly lateralized and minor role for the frontal lobes in visuospatial perception.

M. SINGH & A. KUNDU. Hand Preference and the Approval of Hand Use Patterns Among Hindus and Muslims in India.
Two forms (hand-preference and hand-approval) of a 87-item handedness questionnaire were administered on eighty subjects each including both Hindus and Muslims. Both male and female subjects were included in the sample. Factor analyses for both the forms of the questionnaires revealed different factor structure for hand preference and hand approval patterns. These patterns were found to be similar for right and left handed but, differed in case of weak versus strong handed subjects. For hand preference scores, there were minimal differences between Hindus and Muslims. However, female subjects (more in case of Hindus) showed higher preference for right hand use than their male counterparts. The analyses of hand approval scores, on the other hand, indicated that Muslims were more insistent upon using right hand specially for activities related to eating behavior than Hindus. These results will be discussed in terms of cultural/environmental influences on hand preference and the approval hand usage.

A. CHATTERJEE. Picturing Unilateral Spatial Neglect: Viewer Versus Object Centered Reference Frames.
When patients with left-sided neglect bisect lines to the right of midline, they may be neglecting the left side of space [Viewer Centered (VC)] or the left side of the line [Object Centered (OC)]. To disconfound VC and OC reference frames, seven subjects with neglect were asked to center lines and objects in photographs. VC neglect would result in photographs with lines and objects on the right, whereas OC neglect would result in photographs with lines and objects on the left. Four subjects demonstrated VC neglect, 2 subjects OC neglect. One subject had variable performance, perhaps resulting from competing effects of both VC and OC neglect. Abnormal performance on line bisections may be caused by either VC or OC neglect, which are functionally dissociable.

M. MENNEMEIER, A.W. KASZNIAK, D. PATTON, & A.B. RUBENS. Brain Activation Following Caloric Stimulation in Neglect.
To determine whether improvement of neglect following cold caloric stimulation (CCS) is associated with lateralized cortical or subcortical activation, we studied two subjects using serial SPECT scans and subtraction methodology. CCS of the left ear is known to temporarily improve hemispatial and personal neglect and anosognosia for hemiplegia but the neural mechanism is still debated. Cortical activation contralateral to the side of caloric stimulation has been observed in one SPECT study of normal subjects but neither blood flow in the ipsilateral hemisphere nor in subcortical structures was examined. We found that whereas a normal subject demonstrated bilateral activation of both cortical and subcortical structures following CCS, a patient with neglect showed bilateral activation of only subcortical structures. Further, the lack of cortical activation could not be attributed directly to lesioned cortical tissue.

K.J. MEADOR & P.R. RAY. Somatosensory Extinction in Healthy Adults and Thresholds of Perception.
Bender proposed that extinction is an inherent part of sensory processing, but, prior studies examining extinction from double simultaneous stimulation in healthy adults have demonstrated only a fleeting and inconsistent phenomenon. We re-examined the phenomenon using simultaneous spatially symmetric stimuli in 8 healthy subjects with ring electrodes on the index fingers. Employing randomized blinded unilateral stimuli, mean current for minimal perceptual threshold was 3.13 mA (2.25–4.0) and, mean current for threshold to perceived 100% of stimuli was 3.97 mA (2.75–5.0). When masking stimuli were applied to the contralateral side at 2–4 times minimal sensory threshold, extinction was produced in all 16 hands with target stimulus at minimal threshold for single stimuli; this was absolute in 12/16 extremities. At 100% threshold, some extinction was noted in 10/16 extremities. Extinction is a normal component of sensory processing under some conditions.

M. GOLD, J. SHUREN, & K.M. HEILMAN. Proximal Intentional Neglect: A Dissociation of Intentional and Representational Maps.
While originally described in horizontal hemispace, neglect has been demonstrated in all three planes of space. Spatial neglect is thought to have attentional, intentional as well as representational components. Techniques have been developed that allow the dissociation of one or more of these factors. Using a fixed aperture technique that controls for attentional demands and that allows the dissociation of intentional from representational defects, we studied a patient with a right parietal infarct who demonstrated both horizontal and radial neglect. Using this technique we were able to demonstrate that the patient had a proximal intentional neglect with spared representation of radial space and simultaneously, had a mild degree of horizontal neglect with a loss of horizontal representation and sparing of intention. This dissociation not only suggests that intentional deficits can be dissociated from representational deficits but also that radial representational maps are distributed differently from horizontal maps.

R. RASTOGI & M. BANERJI. Right Parietal Lobe Dysfunction and Unilateral Spatial Neglect.
The effect of laterality and locus of lesion on unilateral spatial neglect (USN) was examined. Twenty right hemisphere lesioned (RHL), 20 left hemisphere lesioned (LHL) and 40 neurologically unimpaired medical controls participated. The brain lesioned patients were further subgrouped into parietal lobe lesioned (PL) and nonparietal lobe lesioned (NPL) patient groups. Laterality and locus of lesion were quantified from CT films. All patients were administered the line bisection test, a modified version of Albert's line cancellation test and copying drawings. It was observed that cerebral laterality and locus of lesion play an important part on the USN profile with right hemispheric lesions, especially in the parietal lobe, leading to more frequent and more severe USN in comparison to LH-PL/LH-NPL lesions or RH anterior lesions.

G.M. GRIMSHAW & M.P. BRYDEN. Are There Meaningful Handedness Subtypes?
The present study used a cluster analysis procedure to examine human handedness. The 32 item Waterloo Handedness Questionnaire was completed by 1841 subjects. Subjects indicated their hand preference for each activity on a five-point rating scale: always left, usually left, equally, usually right and always right. First, a cluster analysis was performed on items, such that items that consistently receive similar ratings clustered together. This analysis revealed three strong clusters, the first related to skilled activities, the second to unskilled "pick-up" items, and the third to bimanual activities such as swinging baseball bats and axes. The cluster structure is very similar to that observed through factor analysis of the same questionnaire (Steenhuis & Bryden, 1989). Then, a cluster analysis was performed on subjects, such that subjects with similar handedness profiles clustered together. This analysis revealed four clusters of appreciable size: a large group of consistent right-handers (n = 1368), a group of right-handers who do bimanual activities from the left (n = 181), a group of consistent left-handers (n = 154) and a group of left-handers who do writing-related activities with the left hand, but are inconsistent for other activities, with a tendency to throw with the right hand (n = 130). We hypothesize that these groups may vary on neuropsychological variables, such as dichotic listening performance and tests of manual skill.

K.E. LUH, J.R. BERGIN, H.E. DRISCOLL, & J. GEIGER. Line Bisection and Perceptual Asymmetries in Normal Subjects: What You See is Not What You Get.
Normal subjects' tendencies to bisect lines too far to the left ("pseudoneglect") were compared to perceptual asymmetries for line length comparisons and chimeric images. Subjects had significant biases to bisect lines to the left, and left-handers (n = 48) had stronger biases than right-handers (n = 63). In addition, all subjects had strong left spatial field biases for chimeric face and visuospatial images, and, when comparing the lengths of Muller-Lyer lines to arrows, appeared to attend more to the left than to the right fin (arrowhead) of each line. These highly significant perceptual asymmetries did not correlate with line bisection biases. These findings are more consistent with the hypothesis that motor factors predominate in generating the line bisection bias than the hypothesis that perceptual asymmetries for visuospatial stimuli underlie the bias.

T. HELLAND, A. ASBJØRNSEN, M. FÆREVÅG, E. LYSSAND, & K. HUGDAHL. Crossed Hand and Eye Dominance Affects the Right Ear Advantage in Dichotic Listening.
This study focused on the effect of crossed hand-eye dominance on the right ear advantage (REA) in dichotic listening in a group of dyslectics. A total of 52 dyslectic subjects, screened for hand and eye dominance, were categorized as having crossed (CD) or uncrossed hand-eye dominance (UD). They were tested with dichotic listening with CV-syllables. There was a significant REA in the UC-group, but not in the CD-group. Compared to a normal sample, both groups showed a reduced overall accuracy in dichotic listening performance. For the UD-group, the reduction was even on the left and right ear recall, while for the CD-group, the reduction was mainly in the right ear recall. The results showed that crossed hand-eye dominance has consequences for the functional lateralization in the brain.

W.F. MCKEEVER, D.A. RICH, & P. SUTER. Genetic and Nongenetic Influences on Handedness.
There are two major types of theories concerning the origin of sinistrality. One is that it is a genetic variant (e.g., Annett); the other is that it reflects reorganization of the brain in response to subtle brain damage occurring during pregnancy or birth (e.g., Bakan). We elicited pregnancy and birth stress information from the mothers of 1103 children, and also inquired as to the handedness of the biological parents of each child. Pregnancy and birth stress events did not relate to sinistrality; however, among female offspring, maternal age, maternal weight gain during pregnancy, high risk parity (as proposed by Bakan) and paternal sinistrality did relate to sinistrality of offspring. Among male offspring, maternal weight gain and maternal sinistrality related to offspring sinistrality.

W.F. MCKEEVER & D.A. RICH. Verbal and Spatial Ability in Handedness Groups: A Test of Levy's Predictions.
Levy (1969) predicted that, as a group, left-handers would have somewhat enhanced verbal abilities and somewhat reduced visual-spatial abilities as compared to right-handers, as a group. We individually tested 233 college students on a battery of two spatial tests and two verbal tests. Results indicted that right-handed subjects scored significantly higher than left-handers on both spatial tests and on an objective vocabulary test. No handedness differences were seen on a test of verbal fluency. Thus, the spatial results are consistent with Levy's hypothesis, but not the verbal test results.

E.B. LARSON, W.S. BROWN, & M.A. JEEVES. Evoked Potential Evidence for Directional Asymmetry in Interhemispheric Transmission Time.
Studies of crossed-uncrossed reaction time differences (CUD) suggest asymmetric interhemispheric transfer time (IHTT), i.e., faster right-to-left than left-to-right. IHTT can also be estimated using evoked potential (EP) latencies recorded from bilateral electrodes to unilateral visual field stimuli. *Meta-Analysis of EP Studies:* Published studies were surveyed in which asymmetries of visual EP-IHTT could be calculated. Twelve of 18 studies showed asymmetries in N1-IHTT in the direction predicted by CUD studies ($Z = 2.96$, $p < 0.005$). *Evoked Potential Study of IHTT:* EP-IHTT was calculated from unilateral left and right visual field presentations from bilateral parietal EPs in twenty-one normal, right-handed individuals. For N1, a hemisphere-by-visual field ANOVA indicated longer latencies when recorded over the ipsilateral hemisphere than over the contralateral hemisphere: hemisphere-by-visual field, F = 166.21, 1/20, $p < 0.0001$. ANOVA by direction of IHTT indicated a significant asymmetry: R-to-L = 14.6 ms, L-to-R = 23.1 ms, $F = 9.01$, 1/20, $p < 0.01$. Similar results were found for P1: hemisphere-by-visual field,

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$F = 176.26$, 1/20, $p < 0.0001$; directional asymmetry, R-to-L = 19.8 ms, L-to-R = 28.0 ms, $F = 2.85$, 1/20, $p = 0.11$. *Conclusions:* The results indicate that, like the CUD, EP-IHTT is directionally asymmetric, i.e., faster in the R-to-L direction.

T. FOGEL, M. MITRUSHINA, L. D'ELIA, C. UCHIYAMA, & P. SATZ. Performance on Motor Tasks as Indicator of Changes in Hemispheric Lateralization With Advancing Age.
It has been suggested that the right hemisphere ages more rapidly than the left; however, support for this hypothesis has not been universal. This hypothesis was tested in a sample of 64 volunteers aged 60–88 who are free from neurological illnesses and physical handicaps. Changes in hemispheric lateralization were measured by examining performance with each hand and rates of superiority of the dominant hand on motor tasks of different complexity: the Finger Tapping Test, the Grooved Pegboard, and the Pin Test. Significant decline of left hand motor skills with advancing age supports the hypothesis that the right hemisphere ages more rapidly than the left. Recommendations were made regarding specific aspects of further studies addressing this issue.

J.S. CAROSELLI, M. HISCOCK, F. LARKEY, & T. ROEBUCK. Dual-Task Interference in Right- and Left-Handers: Effects of Handicapping the Dominant Hand.
Researchers have used asymmetric interference between concurrent verbal and manual tasks to make inferences about cerebral organization. However, recent studies of left-handers support a manual dominance explanation, rather than a speech dominance explanation, for interference asymmetries. We tested these competing explanations by modifying the manual task so that both right- and left-handers performed faster with their nondominant hand. Under these circumstances, the usual pattern of interference was reversed, i.e., both handedness groups showed greater interference with the nondominant hand than with the dominant hand. This outcome is inconsistent with both the speech dominance and manual dominance model of concurrent-task interference.

A. GREEN, R. STEINER, & N. WHITE. A Follow-up Dual-Task Investigation of Lateralized Effects in Right- and Left-Handed Males.
A dual-task follow-up investigation with different handedness groups compared lateralized effects resulting from perfunctory versus ideational task performances. With a larger sample ($n = 128$) and parity between handedness groups, results showed the lateralized effects reflected manual dominance for relaxed and fast paced perfunctory vocalized language tasks. In contrast, left-handers showed a bilateral effect, and right-handers were left lateralized for ideational tasks of shadowing, paraphrasing and reading humorous anecdotes. Outcomes for spatial tasks were consistent with trends in the earlier study (Steiner, Green and White, 1992), with left-handers more right lateralized than the right-handed groups.

P. SUTER & W.F. MCKEEVER. Handedness and Performance of Neuropsychological Tests of Frontal Function.
Left and right handed subjects were administered three tests regarded as measures of frontal lobe function. These were the Wisconsin Card Sorting Test, the Controlled Oral Word Association Test, and the Design Fluency Test. Interest in possible handedness effects on these tests was stimulated by the theorizing of Levy (1969), who suggested that left handers, as a group, contain more individuals with right hemisphere speech competence than are found among right handers as a group. Levy hypothesized that the greater right hemispheric language function would produce differential verbal versus spatial ability patterns in left and right handers. In a similar vein, we reasoned that since motor speech programming is a frontal lobe function, one might expect a differential organization of the frontal lobes in the handedness groups. This hypothesis has not been systematically explored.

C. MAILLOUX & C.M.J. BRAUN. Left and Right Field Advantages are a Function of Photopic and Scotopic Retinal Adaptation, Respectively, in Simple Reaction Time.
It has not yet been asserted that simple visual reaction time can reliably yield field advantages, nor that it can reveal hemispheric specialization in normal subjects. In fact however, significant left field advantages and nonsignificant right field advantages have been frequently reported. Two simple reaction time experiments were carried out on normal subjects, one in a totally darkened room and the second in an intensely lit one. The first experiment yielded the predicted left field advantage ($p = 0.0187$) and the second experiment yielded the predicted right field advantage ($p = 0.0001$). This finding suggests that the right and the left hemisphere are dominant for responding respectively in conditions of photopic and scotopic retinal adaptation.

C.K. RICHARDSON, D. BOWERS, C.M. LEONARD, & K. HEILMAN. Utility of Digitized Imaging for Facial Asymmetry Research.
Prior research investigating facial asymmetry of emotional expressions has relied exclusively upon subjective measures. Digitized imaging is an objective alternative which we employed. Results from the digitized analysis was fairly consistent with prior research findings indicating that there was a left sided bias for males posing negative emotional expressions. The percent agreement between the digitized and subjective methods were at the chance level suggesting that other factors aside from quantity of facial movement must be involved in the perception of emotional intensity. Digitized analysis may prove critical in ferreting out which neurological and psychological factors are important in both the production and perception of emotional expressions.

T. CHERNIGOVSKAYA, I. VARTANIAN, & N. LYAKH. The Role of Linguistic Factors in Lateralization of Words.
The purpose of the study was to examine lateralization of words by normal adult listeners depending on linguistic factors characterizing the stimuli, the side of stimulation and the role of masking by white noise. The stimuli were linguistically balanced lists of words. The tests were: monaural presentation of words with noise (i) as a background, (ii) as a contralateral masking and (iii) binaural presentation with noise as a background. Reaction time and the answers were recorded. The results revealed significant left-hemisphere advantage for verbs, adjectives, words of low frequency usage, versus to right-hemisphere priority for nouns, infinitives, words of high frequency as well as for associative responses. The expert and dispersional factor analysis also show that function of noise resistance needs mechanisms of the right hemisphere. The hierarchy of linguistic factors essential for the lateralized processing is proposed.

E. FARACE & E. TURKHEIMER. Gender Differences in Problem Solving Strategy for Picture Arrangement.
Lesion studies reveal a gender difference in the effects of unilateral lesions: men have greater VIQ-PIQ difference scores following unilateral brain damage than do women. A recent meta-analysis of these studies has suggested that the effect probably results from women's relatively lower PIQ scores following left hemisphere lesions. It has been hypothesized that this effect may occur because women make greater use of verbal strategies to solve PIQ items, or alternatively, because women have greater bilateral representation of spatial function in the cerebral hemispheres. We tested the strategy hypothesis using a verbal and spatial interference paradigm with items from the Picture Arrangement subtest of the WAIS-R and normal male and female subjects. Our results indicated no support for a gender difference in problem solving strategy.

R. STEIN, M. PRIMEAU, & R. MATTESON. Hemispheric Asymmetry in Lexical Decision but not in Error Detection in Normal Subjects.
The present study examines hemispheric specialization in both lexical decision and error detection. Reaction time and accuracy were measured for 100 right-handed subjects (female undergraduates) who made lexi-

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cal decisions on 160 laterally presented letter strings. Stimuli consisted of words, pronounceable nonwords and unpronounceable nonwords. Confidence ratings were made after each trial, and error detection was inferred from them. Lexical decisions revealed the typical robust left hemisphere advantage and word superiority effect. Overall, confidence ratings revealed similar visual field and stimuli effects. However, separate analysis of ratings following lexical decision errors showed that each hemisphere's errors were detected equally often. Thus, the classic left hemisphere superiority in language processing was not demonstrated for error monitoring.

R.L. PUSAKULICH, J.P. WARD, A.R. ALVIS, & K. CLOUD. The Effect of Hand Movement Intention on Directional Saccadic Eye Biases.
A previous study of spontaneous lateral eye movements found that subjects presented with an illuminated but featureless visual field displayed a directional bias in saccadic eye movements that was a reliable characteristic of the individual and that these biases could be altered systematically in terms of dominant hemisphere by the introduction of visual features. This study was undertaken in order to assess the effects of an intention to move either the dominant or nondominant hand on these eye biases. Left- and right-handed subjects were categorized with respect to lateral saccade bias and directional shift assessed for subjects instructed to make a visually cued manual response. The intent to move either hand "damped" the endogenous eye bias and suggested differential effects for stimulus input and motoric set.

J.I. SHENKER, E. DORI, & M.T. BANICH. Hemispheric Contributions to Facilitation and Inhibition in the Stroop Paradigm.
We examined hemispheric differences in the Stroop effect. Subjects named a square's color while simultaneously ignoring a word spelling a congruent or incongruent color, or a noncolor word. We examined whether words facilitated or inhibited color naming depending on visual field (VF) of presentation. The color square and word were either both in the same VF or divided across each VF. For right VF trials, facilitation from congruent color words (color naming 89 milliseconds faster than with neutral words) significantly exceeded inhibition from incongruent color words (18 milliseconds). For left VF trials, facilitation (49 milliseconds) equalled inhibition (48 milliseconds). On between-VF trials, the pattern was intermediate to the within-VF patterns. How these hemispheric differences generalize to other attentional tasks remains to be seen.

W.F. DANIEL, J.C. NÄSLUND, & K.V. JOHANSEN. Dyslexia and Human Laterality: Evidence for a Dissociation Between Handedness and Earedness.
Four laterality measures (handedness, earedness, footedness, and eyedness) were measured in 42 dyslexic Danish subjects and in a control group of 35 Danish normal readers. Results indicate that dyslexic subjects were left-eared (but not left-handed, left-footed, or left-eyed) more often than were control subjects. Furthermore, the highest incidence of dyslexia occurred in subjects who were discordant with respect to earedness and handedness (i.e., left-eared but right-handed). These results are discussed in light of current neuroanatomical and neurophysiological knowledge of dyslexia, with particular reference to Geschwind's theory of cerebral lateralization. It is concluded that a "noisy mismatch" between the cerebral hemispheres may underlie dyslexia.

A.E. ASBJORNSEN, K. HUGDAHL, & B.H. JOHNSEN. Priming in Dichotic Listening.
The aim of this experiment was to study the effects of verbal and nonverbal priming on the right ear advantage (REA) in dichotic listening to CV-syllables. Thirty male and 30 female right-handers were instructed to solve anagrams, inspect incomplete pictures, and pedal an ergometer bicycle as activation priming immediately before they were tested with the dichotic listening task. A standard, nonprimed dichotic listening task was run as baseline. The results showed an overall enhancement of the REA as an effect of priming. This was due to a general increase in the right ear recall following all priming-tasks, and an increase in the left ear recall after the physical activation priming task.

A. VENTER & C. LORD. The Organization of Lateral Cerebral Functions in Congenital Hemiplegia.
Fifty-one children with congenital hemiplegia (28 right, 23 left) were examined on a wide range of cognitive and neuropsychological tests, and a neurological examination and compared to a control group (30) who were chosen to match the subjects on age at testing, full scale IQ and socioeconomic status to determine the effects of early unilateral hemispheric lesions on lateralized higher cerebral functions, and compensation due to neuroplasticity in the reorganization of these functions. Right hemiplegics performed significantly poorer in tests of language and visual-spatial skills than the controls. Difference between left hemiplegics and controls were not significantly different. The left-right maturation gradient of the two hemispheres could be responsible for the unexpected results in right hemiplegics.

W. NORMAN & M.A. JEEVES. Hemispheric Collaboration and Interhemispheric Processing: A Review of the Bilateral Field Advantage.
A number of studies have reported that subjects respond faster and/or more accurately when half of the stimulus information to be processed is projected to each visual hemifield than when all the information is projected to one or the other hemifield. This effect, known as the bilateral field advantage (BFA), has been demonstrated for perceptual-matching, letter-naming, and computational tasks. However, not all researchers have reported the presence of a BFA under conditions where it is expected. In this paper the empirical and theoretical literature pertaining to the BFA is reviewed. It is concluded that the phenomenon, whilst sensitive to experimental parameters such as post-exposural scanning, screen location of stimulus pairs, and inequalities of processing load, is not an artifact. A "cooperative interaction" model of hemispheric processing is proposed as the basis for understanding the BFA.

L.H. MOORE, T.E. MARKEE, W.S. BROWN, D.C. THEBERGE, & J.C. ZVI. Motor Performance and Interhemispheric Collaboration in Dyslexia.
Various forms of dyslexia have been associated with neurological complications, specifically with tactile-motor integration deficits and/or inefficient transfer of information between the two cerebral hemispheres. Twenty-one dyslexic adults were compared to 21 controls on the Bimanual Coordination Task, which is a task of tactile-motor integration and interhemispheric collaboration. When compared to control subjects, dyslexics showed a consistent pattern of deficits on performance measures which are sensitive to motor coordination and utilization of visuospatial feedback. In particular, this study revealed that dyslexics had more difficulty when the left hand had to move faster than the right. These results are discussed in light of theories of cerebral lateralization and interhemispheric collaboration.

Paper Session 11

TRAUMATIC BRAIN INJURY

S.D. GALE, S.J. JOHNSON, E.D. BIGLER, & D. BLATTER. Trauma Induced Temporal Horn Dilation: Neuropsychologic Correlates.
Temporal horn volumes based on post-injury magnetic resonance studies were calculated on 61 traumatic brain injury (TBI) patients. Additionally, ventricle-to-brain ratios were calculated on estimates of total ventricular and brain volume. Significant findings suggest a relationship between temporal horn volume, an indirect estimate of hippocampal integrity, and memory function. Furthermore, these findings suggest the sensitivity of standard neuropsychologic tests to morphometric changes in brain structures secondary to TBI. However, verbal mem-

ory tasks did not relate specifically to the left temporal horn nor visual memory tasks to the right. Results are discussed in terms of the role of mesial temporal lobe structures in TBI and memory outcome.

T.F. BERGQUIST, M.M. MACHULDA, V. ITO, & S. CHEW. Relationship Between Coping and Postconcussion Symptoms in a Healthy Adult Population.
A minority of individuals who suffer a mild head injury (MHI) go on to develop postconcussion syndrome. Studies of recovery from MHI have concentrated on cognitive variables and rate of symptom complaint while ignoring important advances in the stress and coping literature. A group of 59 healthy college students without a history of head injury rated level of perceived stress and impact of 37 postconcussion symptoms. Perceived stress was positively related to symptom impact, with the greatest relationship between depression and anxiety, speed of thinking, concentration, and physical and mental fatigue. These results suggest that persistent symptoms in some individuals following MHI may be due, at least in part, to individual differences in the perceived stress of incurring this type of injury.

H.J. HANNAY, M.A. STRUCHEN, C.F. CONTANT, G.A. STALLINGS, & C.S. ROBERTSON. Assessment of Severely Closed Head Injured Patients and the Prediction of Outcome.
Severely head injured patients may be discharged from acute care facilities before having recovered sufficiently to undergo a standard neuropsychological examination. An attempt was made to determine a criterion for initiating acute psychological testing of such patients. It was found that patients who reached a GOAT score ≥ 40 could undergo some psychological testing. For instance, 84% of the patients who reached this stage could understand the requirements of Digit Span forward but only 21.9% understood what was demanded by Trail making B. The number of days to reach a GOAT score ≥ 40 was highly related to discharge, 1 mo, and 3 mo GOS score and was a better predictor of outcome than the number of days to a GOAT score ≥ 76.

B.K. CHRISTENSEN, T.P. ROSS, R.S. KOTASEK, M. ROSENTHAL, & R.R. HENRY. The Role of Depression in Rehabilitation Outcome During Acute Recovery From Traumatic Brain Injury.
The relative contribution of depression to the prediction of functional outcome in the acute rehabilitation of 62 persons with traumatic brain injury (TBI) was investigated. The effect of depression was assessed while controlling for age, sex, education, premorbid alcohol abuse, premorbid psychiatric history, estimated premorbid IQ, blood alcohol at admission, Glasgow Coma Scale scores, time since injury, neuropsychologic functioning, and functional independence at admission to acute rehabilitation. Depression was measured using the Beck Depression Inventory and functional outcome was assessed with the Functional Independence Measure. Results indicated that depression accounted for a significant and unique proportion of variance in predicting functional outcome. These results are congruent with other studies investigating the role of depression in functional outcome using geriatric and stroke populations, and highlight the importance of assessment and intervention targeting affective functioning in TBI rehabilitation.

D. GOLDSTEIN & M. PRIMEAU. Neuropsychological and Personality Predictors of Employment After Traumatic Brain Injury.
This study investigated predictor variables of employment in 76 Traumatic Brain Injury patients referred for vocational placement through a rehabilitation hospital. Four discriminant functions and their classification rates were derived, consisting of premorbid variables (function not significant), trauma-related variables (82% classification rate), post-injury neuropsychological variables (92% classification rate), and personality variables measured by the MMPI (91% classification rate). A final function combining the most discriminating variables from each cluster yielded a 94% classification rate. Compared to those able to return to work, more unemployed subjects had been drinking at the time of injury, had a more impaired Memory Quotient and Halstead Impairment Index, higher scores on the MMPI Scale 1 (Hysteria), and lower scores on Scale 5 (Masculinity/Femininity). Clinical utility of the functions is discussed.

Symposium 5

EXECUTIVE FUNCTIONS, WORKING MEMORY, AND FRONTAL LOBE SYSTEMS IN CHILDREN WITH DEVELOPMENTAL DISORDERS

Recent advances in the cognitive neurosciences have led to the emergence of constructs involving executive functions and working memory as pivotal in understanding the cognitive deficiencies characteristic of many neurologically-based disorders. These constructs, which are commonly viewed as mediated by the prefrontal lobes, may be particularly important for understanding the neurobehavioral manifestations of developmental disorders. This symposium provides a review of recent research utilizing executive function constructs in several developmental disorders, including children with Tourette's Syndrome, Attention Deficit-Hyperactivity Disorder, early hydrocephalus, head injury, Fragile X, and autism. Each paper addresses issues concerning construct definition and measurement, relationships with other cognitive processes and psychometric intelligence, and neuroanatomical correlates. The discussion will attempt an integrative summary of the current status of research on executive functions in developmental disorders.

M.B. DENCKLA. Executive Function in Children With TS and TS/ADHD.
Executive Function, a neuropsychological domain hypothesized to link learning disabilities to the diagnosis of ADHD, is being investigated in children (7–12 years), who meet criteria for 1) ADHD alone, 2) Tourette syndrome (TS) alone and 3) comorbid TS and ADHD. Heterogeneous task demands and task contents subsumed under the Executive Function domain emerge in factor analyses of scores obtained within each of these populations and in their differing profiles of executive dysfunction. Children with TS alone showed no deficits other than slow and variable reaction times; those with TS/ADHD and ADHD alone both showed more extensive deficits. ADHD scores derived from intra-individual pairings of content-matched tasks (e.g., Vocabulary minus Word Fluency) revealed significant executive dysfunction more clearly than did single scores.

J.M. FLETCHER, B.L. BROOKSHIRE, T.P. BOHAN, K. DAVIDSON, M. BRANDT, N. THOMPSON, S.H. LANDRY, & D.J. FRANCIS. Executive Functions in Children With Early Hydrocephalus.
This study evaluated the hypothesis that the nonverbal cognitive deficits characteristic of early hydrocephalus are due to executive function deficiencies. Comparisons were made of 47 6–12 year-old children with early hydrocephalus and 42 nonhydrocephalic children on four executive function measures: Tower of London, Stroop Test, Wisconsin Card Sort Test, and 2 Visual Cancellation tests with organized and random subtests. The groups were comparable in age, sociodemographic variables, and Verbal IQ, but not Performance IQ. Results revealed no group differences on the Tower of London and Stroop tasks. Differences on the visual cancellation and Wisconsin Card Sort tests reflected problems in the focus-execute and shift dimensions of attention. Hence, these results suggest that the reduction of nonverbal cognitive skills characteristic of hydrocephalic children reflect spatial cognition and attention deficits associated with a reduction in posterior cerebral white matter characteristic of early hydrocephalus.

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H.S. LEVIN, D. MENDELSOHN, M.A. LILLY, J.M. FLETCHER, K.A. CULHANE, S.B. CHAPMAN, H. HARWARD, L. KUSNERIK, D. BRUCE, & H.M. EISENBERG. Tower of London Performance in Relation to MRI in Children Following Closed Head Injury.
To investigate the relationship of severity of pediatric closed head injury (CHI), the contribution of frontal lobe lesions, and age at testing (6-10 yr versus 11-15 yr) to cognitive deficit, 134 head injured patients were given the Tower of London (TOL) task and underwent magnetic resonance imaging (MRI). Eighty-nine normal controls were given the TOL for comparison. Severity of CHI and age at testing were strongly related to cognitive performance on the TOL including the frequency of breaking the rules. Volume of frontal lobe lesion (but not extrafrontal lesion) contributed to the prediction of performance on the TOL even after taking into account the severity of injury.

B.F. PENNINGTON & R. ROBERTS, Jr. Executive Functions and Cognitive Differences.
It is argued that prefrontally-mediated executive functions (EFs) have the potential for making an important contribution to an integrated account of cognitive differences, whether normal or abnormal, developmental or individual. However, to fulfill that potential, there are important theoretical and measurement issues that must be addressed. One key concern is the need for a coherent theoretical account of EFs that 1) addresses what is common across the diversity of tasks and behaviors affected by prefrontal dysfunction and 2) clarifies the puzzling relation between EFs and psychometric intelligence. Measurement issues include those of sensitivity, specificity and reliability. We present here 1) recent data on normal and abnormal development of EFs and 2) a competition model of prefrontal functions, both of which have implications for the relation between EFs and psychometric intelligence, and cognitive development.

Paper Session 12

FUNCTIONAL NEUROIMAGING

D. WILLIAMSON, B. CROSSON, L.J.G. ROTHI, S. SHUKLA, K.M. HEILMAN, & S.E. NADEAU. Different Aspects of Language Generation Engender Different Patterns of Asymmetry in Regional Cerebral Blood Flow (rCBF).
Clinicopathologic correlation in patients with cerebral lesions is of limited value in defining the anatomic substrate of language, in part because of the difficulty in discriminating the disordered function of impaired systems from the suboptimal function of compensatory systems. We sought to overcome this limitation by evaluating regional cerebral blood flow using [^{99m}Tc]-HMPAO SPECT in 12 subjects as they performed linguistic tasks emphasizing phonologic, semantic, and grammatic components of language in a stepwise, hierarchical fashion. Analyses examined intertask changes in blood flow in selected regions of interest (ROIs) and intratask asymmetries between selected left-hemisphere ROIs and their right-hemisphere homologues. Our findings provide strong support for the roles of Wernicke's area in lexical-semantic processing, left frontal opercular cortex in language generation, and left Brodmann's area 37 in the visual analysis of word forms. In addition, significant findings suggest that angular gyrus may play an important role in phonological and/or lexical processing, while a post-hoc examination of the data suggest that practice may change the magnitude and pattern of cerebral blood flow change associated with performance of a task.

S.B. ROURKE, R.M. DUPONT, I. GRANT, P.P. LEHR, L.M. ERCOLI, S. HALPERN, G. LAMOUREUX, & THE HNRC GROUP. Using Cerebral Blood Flow Techniques to Study Brain Metabolism: Can We See Beyond the Smoke Screen?
We have previously reported, using SPECT imaging, that both recently detoxified and long-term abstinent male alcoholics have reduced cerebral blood flow (CBF), as compared to nonalcoholic controls. Differences between groups were reduced when smoking on the day of scan was taken into consideration. To further address this potential smoking confound, we examined the effects of smoking on global CBF (using SPECT-IMP imaging) in a young (mean age = 35 yr) healthy group of male controls ($N = 36$) divided according to their smoking history: Group 1 had no prior smoking history ($n = 18$); Group 2 had a past history of smoking but no recent smoking ($n = 9$); and Group 3 had a positive smoking history and also smoked on day of SPECT scan prior to imaging ($n = 9$). Groups 1 and 2 had equivalent and significantly higher global CBF values than Group 3. We conclude that smoking has an acute effect on CBF. This potential confound must be considered before abnormalities in tracer uptake are attributed to some disorder of interest, such as alcoholism.

D.S. O'LEARY, N.C. ANDREASEN, R.R. HURTIG, G.L. WATKINS, L.L. BOLES PONTO, M. ROGERS, P.T. KIRCHNER, & R.D. HICHWA. Language and Attention in Schizophrenics and Normal Controls: A Positron Emission Tomography (PET) Study of Regional Cerebral Blood Flow (rCBF) During Binaural and Dichotic Tasks.
Using PET with [^{15}O]water, we measured rCBF in 10 schizophrenics and 10 age- and sex-matched normals. Binaural stimuli caused bilateral activation of superior temporal gyri (STG) in normals, but was more asymmetric in schizophrenics. Dichotic words and CVCs (attend to right ear) greatly increased left STG activation, and decreased activation in right STG in both groups, although the changes were smaller in patients. In normals but not patients, the rCBF asymmetry showed a striking reversal when subjects attended to their left ears. Dichotic presentation of speech stimuli thus resulted in an increase in the number of cortical units activated in the STG contralateral to the attended ear, and inhibition in the ipsilateral STG. Results suggest that the REA for language stimuli results more from neural mechanisms involved in attention than from hemispheric specialization for language.

S.M. RAO, J.R. BINDER, B.B. BISWAL, T.A. HAMMEKE, A.M. O'FARRELL, & J.H. BOBHOLZ. Functional MRI Demonstrates Temporal Patterns of Brain Activation During Sequential Finger Movements.
Functional magnetic resonance imaging (FMRI) is a new technique for identifying regional blood flow/volume changes in response to cerebral activation. FMRI is capable of sampling hemodynamic changes as often as ten times per second and may provide clues regarding the *temporal* interrelationships between functionally activated brain structures. Five normal subjects were scanned while performing sequential finger movements. Task-related signal intensity changes from 400 sequential images, acquired at the rate of 2 Hz, were observed in at least four pixels from both the primary motor cortex (PMC) and the supplementary motor area (SMA). Cross-correlation analyses indicated that pixels within the PMC or within the SMA exhibited no temporal lag in signal change associated with the movement task compared to other pixels in the same region. In contrast, the lag in signal change *between* PMC and SMA pixels ranged from 0.5 to 2.0 s (median 1.0) with SMA always preceding PMC activation. These data are consistent with electrophysiological findings and support a hierarchical model for the control of complex movements.

T.A. HAMMEKE, F.Z. YETKIN, W.M. MUELLER, G.L. MORRIS, V.M. HAUGHTON, S.M. RAO, J.R. BINDER, L.M. LISK, S. SWANSON, & J.S. HYDE. Functional Magnetic Resonance Imaging of Somatosensory Stimulation.
Functional magnetic resonance imaging (FMRI) has detected regional signal changes in response to motor movements, visual stimuli, and auditory stimuli in each of their respective primary cortices. An experiment was done to determine whether signal changes in the somatosensory cortex could be demonstrated with tactile stimulation. The palm of the hand was stimulated while the subject was undergoing fast imaging with a 1.5T MR scanner equipped with local gradient and RF coil. Significant time-

locked, signal changes of an order of 4–6% occurred in the region of the postcentral gyrus in each of 5 subjects. The results provide preliminary evidence of the sensitivity of FMRI to activation of the somatosensory cortex with tactile stimulation. The findings support FMRI as a promising technique for study of functional organization of the cerebrum.

FRIDAY AFTERNOON, FEBRUARY 4, 1994

Poster Session 5

ATTENTION, MEMORY, AND TRAUMATIC BRAIN INJURY

L. DOTY, J. SHUREN, & K.M. HEILMAN. The Influence of Intentional Set on Attention.
Experiments with brain-damaged subjects have demonstrated dissociations in attentional and intentional (motor preparatory) processing. We posited, however, that intentional set affects spatially directed attention such that preparing to move towards or in one hemispace facilitates attention in or toward that hemispace. Twelve normal subjects participated in a computer experiment where the direction of response was cued by a midline stimulus but the signal to respond could be in the same hemispace (compatible) or in the opposite hemispace (incompatible). Reaction times were faster in the compatible than in the incompatible condition, consistent with a facilitory influence of spatially directed intentional systems on spatially directed attentional systems or an inhibitory influence on the systems that direct attention to contralateral hemispace.

R. KRIKORIAN, J. BARTOK, & N. GAY. Immediate Memory Capacity for Nonsequential Information: The Configural Attention Test.
Performance data on a newly developed, nonsequential measure of immediate memory capacity was collected on groups of school children aged 7 through 12 and on a young adult sample (mean age = 22.1). All subjects had been screened to eliminate those with developmental or acquired cognitive-cerebral disorder and confounding psychological condition. The data indicated increasingly proficient performances with increasing chronological age and a relative advantage for males at some age levels. Performance was not related to intelligence [$r = .03$, ns]. There was a moderately strong relationship with another spatial attentional measure [$r = .75$, $p < .001$], and a weaker relationship with a measure of auditory verbal attention [$r = .59$, $p < .001$]. These data provide developmental performance standards for this new instrument, and the increasing proficiency with age is consistent with findings regarding other attentional and problem-solving measures. Also, the findings suggest that the Configural Attention Test may be a selective measure of nonsequential information processing and may have clinical and experimental utility in assessing differentiated attentional capacities.

J.S. BURG, C.G. STARK, R.G. BURRIGHT, & P.J. DONOVICK. Attention: Self-Report Versus Performance in Head-Injured and Non-Injured Populations.
We examined the relationship between self-report of capacity to attend and performance on standard tests of attention in closed head-injured individuals (CHI). Subjects were 24 CHI individuals, 17 adult non-injured volunteers, and 31 college students. Subjects were administered an 18 item self-report questionnaire of attention (the ATTNQ) and 10 tests of attention. Results showed high inter-item consistency of the ATTNQ. All 3 groups showed moderate correlations between the questionnaire and some tests of selective, divided and sustained attention. The CHI group had fewer correlations than the age and IQ matched adult group indicating limited self-awareness of ability to attend.

J. SHUREN, D. JACOBS, & K.M. HEILMAN. The Influence of Objects on the Allocation of Spatial Attention in the Vertical and Horizontal Planes.
To determine the influence of objects (line segments) on the allocation of spatial attention, we designed a line bisection task in which horizontal and vertical lines were either composed of two segments (one long, one short) of different thicknesses or were lines of uniform thickness. Because the vertical axis is more important for object identification, we posited that segmenting the lines would affect the allocation of spatial attention to a greater extent in the vertical than in the horizontal plane. Our study in normal subjects supports this hypothesis.

H.B. COSLETT, M. SCHWARTZ, & G. GOLDBERG. Hemispatial Effects on Language Function: The Spatial Registration Hypothesis.
Observations with normal and brain lesioned subjects demonstrate that the location to which subjects attend may influence performance on sensory and motor tasks. We report data from an investigation in which naming, oral reading, and auditory comprehension tasks were administered in both the right and left hemispaces to 29 subjects with radiologically-verified single hemispheric lesions. Four subjects performed significantly better with stimuli in the ipsilesional as compared to contralesional hemispace. All subjects exhibiting significant hemispace effects had parietal lobe lesions (2 right, 2 left). There was no clear relationship between these findings and neglect, as only one subject exhibited the neglect syndrome. The data are consistent with the spatial registration hypothesis according to which all stimuli are coded for location.

M. PARSONS & D. TUCKER. Implicit Memory in Children and Adults: Different Patterns of Performance.
This study examines the differential effects of word phonology and imageability on implicit (priming) and explicit (recognition and recall) memory performance in children and adults. A standard word completion priming task, in which both word imageability and phonologic factors were manipulated was administered to 36 college students (mean age = 19.6 yr) and 40 children (mean age 9.9 yr). There were significant differences between adults and children on measures of implicit memory, but not of explicit memory. Phonology and imageability differentially effected completion rates such that the adults in this sample were more affected by manipulations of phonological features of the target stimuli, while the children were more affected by manipulations of word imageability.

A.S. RUSSELL & W.G. SNOW. A Comparison of the Taylor and Rey Osterrieth Complex Figure in Head-Injured Patients.
We investigated the equivalence of the Rey Osterrieth Complex Figure Test (ROCF) and Taylor Complex Figure (TCF) as measures of constructional praxis and visual memory in a sample ($N = 98$) of head injured individuals. There was no difference in copy scores for the two figures but the TCF was easier to recall. The TCF should not be used as an alternate version of the ROCF for the assessment of visual memory.

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A. CHAN, N. BUTTERS, D. SALMON, & S. JOHNSON. A Comparison of the Strength of Associations in the Semantic Networks of Alzheimer's Disease, Huntington's Disease and Amnesic Patients.
One of the prominent characteristics of Alzheimer's disease (AD) is a disruption in the organization of the patients' semantic knowledge. Previous experiments using multi-dimensional scaling techniques indicated that the semantic network of AD patients, but not that of Huntington's disease (HD) patients, is characterized by abnormal clustering of concepts and the use of atypical dimensions in classification. The present study employed another scaling analysis—Pathfinder—which allows the strength of associations in the semantic networks of AD, HD and amnesic (AM) patients to be examined. The results suggested that AD patients' semantic networks, but not those of HD and AM patients, are characterized by changes in the strength of associations and consist of significantly more unnecessary links between associations. These results are consistent with our previous experiments supporting the notion that AD patients' semantic networks have undergone a structural alteration.

M. WESTERVELD, K.J. SASS, & H.G. HENRY. The Verbal Selective Reminding Test: Equivalence and Reliability of Alternate Forms for a Sample of Patients With Epilepsy.
Each of the four forms of the selective reminding test were administered in counterbalanced order to a consecutive sample of 24 patients admitted for evaluation of seizures. Our sample found the four alternate forms of the SRT to be equally difficult. There was no practice effect demonstrated. The standard SRT indices were highly intercorrelated. Factor analysis indicated that a single verbal memory factor accounted for over 90% of the variance. Alternate forms reliability was found to be modest in our sample. We conclude that the four forms of the SRT may be used interchangeably. The effect of modest alternate forms reliability on interpretation of meaningful change might be mitigated by using a composite score derived from the standard indices and, when feasible, combining multiple baseline assessments. Implications for interpretation of the selective reminding test are discussed.

J. HAUT, J. WILLIAMS, & A. HENDON. Memory and Attention Skills of Children With Neurological and Psychiatric Disorders: Implications for Clinical Utility of the WRAML.
Performances on the WRAML were assessed for 172 children diagnosed with epilepsy, head injury, substance abuse, or emotional disturbance. ANCOVA results indicated the seizure group ($m = 85$) scored significantly lower than substance abuse ($m = 95$) and emotionally disturbed ($m = 97$) groups. No differences were found for the Visual Index or Verbal Learning subtest. MANOVA results indicated significant differences on the Story Memory subtest. The seizure ($m = 8.6$) group scored significantly lower than the emotionally disturbed ($m = 10.8$) group. On the Number/Letter Combination subtest, the seizure ($m = 6.2$) group scored significantly lower than head injury ($m = 7.7$), substance abuse ($m = 8.0$), or emotionally disturbed ($m = 8.4$) groups. No differences were found on Visual Memory subtests. Findings support research with adults indicating difficulty with memory and attention in children with epilepsy particularly with verbal information.

M.J. CHOUINARD & I. ROULEAU. The 48 Pictures Test: A Two-Alternative Forced-Choice Test for the Detection of Malingering.
This study tested the validity of the 48-Pictures Test (a two-alternative forced-choice test) in detecting exaggerated or malingered memory impairments. We compared subjects who were suspected malingerers to patients with memory impairments from various etiology, and to normal subjects instructed to simulate malingering on 3 memory tests: the 48 Pictures Test, the Rey Auditory Verbal Learning Test (RAVLT), and the Rey Complex Figure Test (RCFT). On the 48-Pictures test, 3/4 suspected malingerers and 4/5 volunteer simulators presented performance around chance level (range: 42% to 60%) whereas this level of performance was never seen in our clinical sample (mean: 92.1%, range: 70%–100%). In the RAVLT, contrary to all clinical groups, the two "malingering" groups showed a decrement in performance from the last recall trial to immediate recognition. The two groups of "malingerers" also performed better than clinical groups on the immediate recall of the RCFT. We concluded that a performance around chance level on the 48-Pictures Test should seriously raise the possibility of malingering.

L. SABE, L. JASON, M. JUEJATI, R. LEIGUARDA, & S. STARKSTEIN. Dissociation Between Declarative and Procedural Learning in Demented and Non-Demented Patients With Major Depression.
Objective: To examine the presence of dissociations between declarative and procedural learning in patients with dementia and/or major depression. *Methods:* We examined 46 patients with probable AD, 14 patients with major depression (DSM-III-R criteria), 25 patients with probable AD and major depression, and 20 normal controls. Patients and controls were assessed with the Buschke Selective Reminding Test for declarative learning, and a Maze Learning test for procedural learning. *Results:* A 4-way ANOVA (depression × dementia × task × trial) showed a significant dementia × task interaction ($F(1,81) = 31.6$, $p < .001$): both depressed and nondepressed AD patients showed a significantly better performance on the Maze test as compared to the Buschke. There also was a group × task × trial interaction ($F(5,405) = 7.17$, $p < .001$) which resulted from a significantly worse performance in the delayed trial of the Maze test in non-demented patients with major depression, as compared to both depressed and non-depressed AD patients, and the control group. *Conclusion:* This study showed 3 important findings. First, patients with AD performed significantly better in the procedural as compared to the declarative learning task. Second, non-demented patients with major depression showed a significantly worse procedural than declarative delayed recall. Third, AD patients with major depression showed a similar pattern of learning (i.e., procedural better than declarative) than AD patients without depression.

F.B. GERSHBERG & A.P. SHIMAMURA. Effects of Frontal Lobe Damage on Recall and Strategy Use.
Frontal patients show reduced category clustering and reduced free recall of categorized lists. This study aimed to clarify the nature of these deficits. The role of retrieval processes were investigated by providing subjects with strategy instructions and category cues at the time of test. Although providing category names as retrieval cues may have enhanced frontal patients' clustering somewhat, it did not increase their recall. This suggests that the clustering deficit may be due in part to a deficit in the use of an effective retrieval strategy whereas the recall deficit may be due primarily to an encoding deficit. Providing a strategy which requires frontal patients to attend to the category membership of words at study is expected to increase both their recall and their clustering.

L. FREEDMAN. Verbal Memory Function in Frontal Lobe Dementia.
Memory for verbal material was comparatively analyzed among patients with frontal lobe dementia (FLD), Alzheimer's disease (AD), and unilateral left frontal lobe lesions (UFLL). Memory was assessed using repetition learning of prose material (Logical Memory) and the RAVLT. There was no difference in total acquisition and delayed recall between the FLD and UFLL groups across both memory tasks. The AD group exhibited disproportionate compromise on acquisition of prose material relative to the FLD and UFLL samples, and was severely impaired on all indices of delayed recall. These data indicate that patients with FLD exhibit only mild to moderate verbal memory compromise which clinically facilitates its distinction from AD. The absence of amnesia in FLD correlates with the lack of hippocampal pathology in this cortical degeneration.

J.T. CAFFREY, A.W. KASZNIAK, P. BEESON, & E. GLISKY. Effect of Guided Semantic Encoding on Verbal Learning and Memory in Traumatically Brain Injured Individuals.
Verbal learning and memory are often impaired following traumatic brain injury (TBI); inefficient use of semantic organizational strategies may contribute to the observed difficulty in verbal learning and mem-

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ory. It was hypothesized that providing TBI individuals with guided semantic encoding, thereby assisting their use of semantic organizational strategies, would improve their performance on a test of verbal learning and memory. Twenty-four TBI individuals and 24 demographically matched controls were studied. TBI individuals were able to benefit from guided semantic encoding in a qualitatively similar way to normal controls, but even with guided semantic encoding, their performance was impaired relative to controls suggesting additional processing difficulties.

D.B. BURTON, J.G. CHELUNE, R.I. NAUGLE, & P. VANNESS. Differential Patterns of Memory Deficit Among Patients With Frontal and Temporal Epileptic Foci on the Wechsler Memory Scale—Revised and Rey Auditory Verbal Learning Test.

Patterns of memory function on the Wechsler Memory Scale—Revised (WMS-R) and Rey Auditory Verbal Learning Test (RAVLT) among epilepsy surgery patients with well defined frontal ($n = 24$) and temporal ($n = 129$) EEG foci were compared. Difference scores were examined between selected WMS-R and RAVLT indices using MANOVA. Temporal lobe patients were found to be more susceptible to interference and benefitted more from cueing than frontals, whereas the recall of frontals was more dependent on the conceptual organization of the material. Results demonstrate that frontal and temporal lobe patients show distinct patterns of memory impairment suggesting that both brain regions are involved in different aspects of memory function.

J. DELUCA. Predicting Neurobehavioral Syndromes Following Anterior Communicating Artery Aneurysm.

The present multiple case report presents two groups of survivors from anterior communicating artery (ACoA) aneurysm rupture: amnesic and non-amnesic. The purpose of this study was to examine the similarities and differences in neuropsychological profiles between these two ACoA subgroups. The three patients in each group were consecutive admissions to acute inpatient rehabilitation, and exhibited generally intact attention, concentration and intellectual ability. The groups did not differ in clinical status on admission to the acute hospital, and all had CT scan documented frontal lobe involvement. Results showed that confabulation and personality changes were observed only among the amnesic ACoA patients. In contrast, difficulties in concept formation and perseverative responding were observed in all subjects. A neurobehavioral hypothesis addressing the underlying mechanism of the main features of the "ACoA syndrome" is discussed.

R.W. PARKS, R.E. BECKER, J.R. MATTHEWS, T. SUNDERLAND, I.E. DALTON, J. RADCLIFFE, K. PUTNAM, G. LATHAM, & H. WEINGARTNER. Effects of Scopolamine on Rey Auditory Verbal Learning in the Elderly.

Eight healthy elderly subjects were administered the Rey Auditory Verbal Learning Test (RAVLT) in a double-blind placebo controlled study with scopolamine and saline solution. Cognitive testing commenced one hour after drug administration. Scopolamine produced significant impaired performance for the mean recall for Trials 1 through 5, and recall for List B and Trial 6. Intrusion errors significantly increased for the same trials, except for List B and Trial 6. Scopolamine is a centrally active antimuscarinic agent. Experimental findings with this agent generally produce a reversible, pharmacologically induced deficit in new learning. The overall pattern of our finding with the RAVLT performance demonstrates that cholinergic manipulation of list learning is impaired in normal subjects and perhaps may be useful in neuropharmacological modeling of dementia.

B.A. WILSON & R. IVANI-CHALIAN. Adults With Downs Syndrome: Performance on a Test of Everyday Memory.

We gave the Rivermead Behavioural Memory Test for Children (RBMT-C) to 37 community dwelling adults with Downs Syndrome (DS). Ages ranged from 19 to 44 yr (mean 29 yr, SD 6 yr). We wanted to know (a) if the test could be administered to this group and (b) how the DS subjects compared with children aged 5 to 10 yr. All subjects were able to participate in the test and all were "off the floor." When compared with non-handicapped 5-year-old children, 14 of the DS subjects achieved a "normal" score, 16 a "borderline" score and 7 an "impaired" score. When compared with 10-year-old children one DS subject had a "normal" score, 10 a "borderline" score and 26 an "impaired" score. Story recall was the hardest subtest for DS people, while remembering to deliver a message was the easiest. We discuss the possible use of this test in studies comparing ageing DS subjects with Alzheimer patients.

J. ELLERY, W. BURNS, W. THIGPEN, & R. LEVITT. The Verbal & Nonverbal Indexes of the Denman & Wechsler Memory Scales.

Forty-two normal college students were administered the WAISR, WRATR, WMSR and Denman Neuropsychology Memory Scale (DNMS). Verbal Memory Indexes of the two memory scales were found to be significantly related to each other and similarly related to other scales. Nonverbal Indexes, however, were found to be unrelated to each other, and to relate differently to other scales. In a multiple regression analysis the Denman Nonverbal Memory Quotient (NMQ) was found to be significantly predicted by the verbal indexes of both memory scales as well as by the Delayed Recall Index of the WMSR; whereas the WMSR Visual Memory Index (VMI) was found to be predicted only by the Delayed Recall Index. These results support the interpretation of the Denman NMQ as overinclusive in content in comparison to the WMSR VMI. Therefore, a clinician whose purpose is to have an index that is exclusive of IQ, or other memory factors would most likely prefer the WMSR VMI as a nonverbal index.

M.S. HOUGH, S. DEMARCO, & D. FARLER. Phonemic Retrieval in Broca's and Conduction Aphasia.

Phonemic retrieval deficits may underlie some of the phonological production errors of aphasic adults in immediate repetition of real and nonsense words. This study examined the retrieval of real and nonsense target words after the presentation of real and nonsense distractor words in Broca's aphasic adults with apraxia of speech and conduction aphasic adults using a deferred repetition paradigm. The study sought to determine whether retrieval of real and nonsense target words was influenced by phonetic similarity and/or lexical nature of the distractor. A nonbrain-damaged group also participated. The task involved presentation of 70 pairs of CVC stimuli, each pair consisting of a target and distractor word. Distractors varied in their lexicality and phonetic similarity to target words. The results revealed that: 1) Both brain-damaged groups produced significantly more errors than the non-brain-damaged subjects; 2) All groups showed a lexical target word effect with a greater proportion of errors produced on the nonsense than real target words; 3) Broca's aphasic adults exhibited a greater lexical distractor effect with more errors produced on targets paired with nonsense distractors; and 4) Conduction aphasic adults displayed a greater phonetic similarity effect, with more errors on real targets in which distractors were phonetically similar to targets.

M. OZIER & G.W SCHMIDT. Alphabetic and Category Recall by Eye and by Ear.

Do we have equal access to memory via the eyes and the ears? Two experiments were conducted to compare recall for words cued by their initial letters or the names of categories to which they belong. Twenty to-be-memorized words were presented either in the visual or the auditory modality. Recall cues were presented either visually or auditorily. Subjects recalled the words according to their initial letters and category names separately. Of the results which occurred, the most dramatic was the demonstrated cost to alphabetic recall of auditory input. These results were considered in the context of the Ellis and Young (1988) proposed model for reading, listening and word production.

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L.A. SIMON, K.B. BOONE, S.I. BOKSENBAUM, & L.J. BECKMAN. Recognition Memory Test Performance in Healthy Middle-Aged and Elderly Americans.

The relationship between demographic variables and Recognition Memory Test Performance (RMT) was investigated in a sample of 123 medically and psychiatrically healthy adults ranging in age from 45–83. The nonverbal subtest of the RMT was found to be significantly associated with age, education, Full Scale, Verbal, and Performance IQ. The verbal subtest of the RMT was found to be significantly associated with Verbal, Performance, and Full Scale IQ. Group comparisons revealed that groups divided by gender and age did not differ in performance. Groups divided by level of education and Full Scale IQ did significantly differ. The need for the investigation of the effects of demographic variables on test score performance, to aid in developing appropriate parameters for test score interpretation, is highlighted.

M.E. NICHOLS, Y. ZHOU, & K.J. MEADOR. Dose Dependent Effects of Thiamine on Scopolamine-Induced Deficits in Rats.

Thiamine's important role in metabolic pathways has generally overshadowed observations which suggest that thiamine has a unique neurophysiological role in regard to cholinergic systems. In this study, we investigated the dose response of thiamine's effect on scopolamine-induced deficits on water maze performance in rats. Based on prior single dose studies in humans, we hypothesized that high pharmacological dosages of thiamine would reverse the deficits induced by the muscarinic anticholinergic scopolamine. Male Wistar rats ($n = 60$) were divided into 5 groups: (1) control- saline treated; (2) scopolamine 0.5 mg/kg + saline; (3) scopolamine + thiamine 1.5 mg/kg; (4) scopolamine + thiamine 100 mg/kg; and (5) scopolamine + thiamine 200 mg/kg. The highest thiamine dosages (100 & 200 mg/kg) both reversed scopolamine-induced deficits in water maze performance. The results are consistent with a cholinometic effect for thiamine. High pharmacological dosages of thiamine may have therapeutic utility.

E.V. SULLIVAN, P.K. SHEAR, & A. PFEFFERBAUM. Stimulus-Specific Visuoperceptual Priming in Alcoholic Korsakoff's Syndrome.

Repetition priming for visuoperceptual information is commonly tested with the Gollin Incomplete Pictures Test (GIPT). Whether such learning is generalizable to new stimuli or is confined to originally-presented stimulus items remains unclear. We administered the GIPT to 5 Korsakoff's Syndrome (KS) patients, 58 chronic alcoholics (ALC), and 67 normal controls (NC). All groups showed significant error reduction with repeated exposure to the stimuli despite impaired explicit memory for the test items in KS and impaired visuoperceptual ability for hidden figures detection in KS and ALC. Generalizability was tested in KS with two parallel but novel sets of stimuli; transfer did not occur across sets. Thus, repetition priming for visuoperceptual material can occur in KS, but the newly-acquired skill appears to be stimulus specific. (*Supported by DVA AA05965, MH30854, MH18905*)

N. TEMKIN, R. HOLUBKOV, J. MACHAMER, H.R. WINN, & S. DIKMEN. Classification and Regression Trees (CART) for Prediction of Functioning at One Year Following Head Trauma.

Classification and regression trees were used to predict outcome following hospitalization for head injury, based on a cohort of 514 cases, 436 (85%) of whom were followed prospectively to 1 yr. Neurobehavioral testing was performed 1-mo and 1-yr post-injury. Prediction trees are presented for Verbal IQ, Halstead's Impairment Index, and work status at 1 yr. Glasgow Outcome Scale and four other neuropsychological scores are presented in less detail. Depth or length of coma and age are the severity and demographic variables most predictive of late outcome, reducing variance 12% to 48%. Adding 1-mo results improves prediction of neuropsychological variables, yielding a 38% to 60% reduction in variance. Interesting interactions suggested include: age-related impairments beginning at a younger age in more severely injured patients, and education and mass-lesion effects being more prominent among those with less severe impairment of consciousness.

J. DONDERS. The Intermediate Halstead Category Test: The Total Errors Do Not Tell the Total Story.

The performance of children with traumatic brain injuries on the Intermediate version of the Halstead Category Test (IHCT) was evaluated, using Principal Factor Analysis and Ward Minimum Variance Cluster Analysis. A 3-factor solution was found, similar to that reported in previous research with children with learning disabilities, indicating that the IHCT measures more than one construct in clinical populations. Four clusters were found, with differences between the clusters being determined to a large extent by relative accuracy on IHCT subtest III, and to a lesser extent on IHCT subtests IV and V. Clinical and research implications are discussed.

M.A. ROBERTS, K.M. FRANZEN, L.L. FULLER, N.R. VARNEY, & R.J. ROBERTS. A Developmental Study of a Modified Tinker Toy Test: Normative and Clinical Observations.

Tinker Toy Test (TTT) performance is presented for normative groups of adults and children, based on a modification of the Bayless scoring procedure. Contrary to the hypothesis that developmental trends in TTT performance would be identified, findings demonstrated that the kindergarteners' performance approximated the overall elementary sample mean, as well as the normal adult mean. TTT performance was also evaluated for large groups of head-injured adults and head-injured children. The hypothesis that TTT performance would be sensitive to the effects of head-injury was confirmed for both adult and child groups. TTT performance was significantly correlated with a three-point rating of psychosocial impairment in the child head-injured sample and approached significance in the adult head-injured sample. The present findings also support the need for qualitative collateral information on executive functioning in the head-injured.

B.S. LAYTON & K. WARDI-ZONNA. Posttraumatic Stress Disorder with Neurogenic Amnesia for the Traumatic Event.

Patients who meet established criteria for head injury with neurogenic amnesia occasionally also present with symptoms of posttraumatic stress disorder (PTSD). Currently, however, there is no means available acceptably to diagnose PTSD when the causal event also has resulted in neurogenic amnesia. The reason for this diagnostic dilemma resides in the fact that the definition of PTSD implies memory for the trauma that is at least potentially accessible to consciousness. Contemporary understanding of the multifold nature of memory provides a new basis for clarifying the co-occurrence of PTSD and amnesia for the trauma. We present two cases of PTSD with neurogenic amnesia and a theoretical framework that allows sensible dual diagnosis. Dual diagnosis should lead to a rational therapy for PTSD in head injury.

S.H. PUTNAM, S.R. MILLIS, K.M. ADAMS, & G. LAMBERTY. The Relationship of WAIS-R FSIQ and the WMS-R in a TBI Sample.

The importance of considering subject variables in the interpretation of test performances has taken on increased emphasis. Matarazzo (1990) has emphasized the need to consider general intelligence because of the high intercorrelations among the majority of neuropsychological measures. Conceptualizing FSIQ as a quasi-subject variable, the current study examined the relationship between WAIS-R FSIQ and the WMS-R among a group of TBI patients and found consistently high correlations across subtests and indexes. The general trend was clearly for all WMS-R scores to increase as IQ increased. Intellectual level is a critical quasi-subject variable which must be considered when evaluating performance on tests believed to measure discrete or differentiated cognitive functions.

M.F. GREIFFENSTEIN, W.J. BAKER, & T. GOLA. MMPI-2 Versus Domain Specific Measures in Detecting Neuropsychological Dissimulation.

Chronically complaining postconcussive patients with overt malingering signs ($N = 68$) and severely brain injured patients ($N = 55$) were administered both the MMPI-2 and objective measures of malingered

amnesia. Discriminant function analyses demonstrated the superiority of the domain specific measures over MMPI-2 validity indices. Only the *Sc* scale provided satisfactory hit rates. Antisocial traits, as measured by scale *Pd*, was not predictive of malingering status. Severe TBI patients ($N = 55$) and chronic postconcussive litigants ($N = 68$) with overt malingering signs were administered both the MMPI-2 and a battery of amnesia malingering measures. Discriminant function analyses demonstrated better classificatory efficiency with the domain specific measures than with the six MMPI validity indices. Only the *Sc* scale gave adequate hit rates. The MMPI-2 may be sensitive to dissimulation of emotional symptoms only.

D. SCHRETLEN. Personality Characteristics of Traumatic Brain Injury Survivors.
Despite the widely-recognized association between traumatic brain injury and personality aberrations, little research has been reported on the personality characteristics of TBI survivors from the five-factor dimensional perspective. In this study, 34 adults who sustained brain injuries eight years earlier rated themselves, and were rated by informants, using the NEO Personality Inventory. Informant ratings of neuroticism and extraversion distinguished among outcome subgroups, as did discrepancies between self and informant ratings of neuroticism. Patients rated themselves, and were rated by informants, as lower than average in agreeableness and conscientiousness, regardless of outcome. Whether the reported personality characteristics resulted from TBI, or predisposed the patients to their original injuries remains unclear, and highlights the need for further study.

L.M. RYAN, J.R. O'JILE, W.D. GOUVIER, A. GROVES, J. PARKS-LEVY, R.C. COON, & B. BETZ. Incidence of Head Injury in a College Population: An Analysis of Sequelae and Environmental Factors.
Recent studies have shown that mild head injury is a common occurrence. In this study, we investigated the incidence of head injury and its residuals in 375 college students. Head injury was sustained by 41.3% of our subjects with mild injury reported by the majority (88% as judged by loss of consciousness or 76% as rated by PTA). Postconcussal symptoms were equivalently endorsed by both head injured and non-head injured subjects. However, comparisons of these symptoms pre- and post-injury showed a significant increase in frequency. Although postconcussal symptoms are often thought to be related to litigation, only 8.1% of our head injured subjects reported involvement in litigation. Analysis of alcohol consumption showed that head injured subjects drank significantly more alcohol per week than nonhead injured subjects. Measures of risk taking behavior were analyzed in conjunction with substance use and head injury status.

A. TELLIER, L. DELLA MALVA, B. COLLINS, A. CWINN, & M. BRENNAN-BARNES. Mild Head Injury: A Misnomer.
The neuropsychological and physical sequelae of closed head injury, particularly when the trauma is moderate or severe, have been well documented. Unfortunately for the patient suffering from a mild head injury (MHI), the possible sequelae are subtle and more difficult to assess. Nevertheless, it has become widely recognized that even the head trauma termed "mild" may result in significant behavioral sequelae. The present study was an attempt to document actual structural cerebral damage, by way of CT scanning, in a group of patients having suffered a head trauma termed "mild" as defined by the Glasgow Coma Scale (GCS) score, a commonly used index of severity. A one-year retrospective chart review identified 109 MHI patients who presented to the Emergency department of a lead hospital for trauma. Forty-five percent of MHI patients underwent CT scanning and evidence of intracranial abnormalities was obtained in 60.4% of this subsample of patients. The results are discussed in terms of the inadvisability of relying solely on the GCS as an index of severity of head trauma as this is likely to greatly underestimate the true morbidity associated with a MHI.

A. TELLIER, B. COLLINS, & L. DELLA MALVA. Traumatic Brain Injury and Insight.
Traumatic brain injury (TBI) is commonly associated with impaired insight, the level of impairment being generally proportional to the severity of the initial trauma. The present study set out to investigate the possibility that TBI patients may have preserved insight into their memory function, a research question that came about as a result of clinical observations. The level of insight of TBI patients with respect to their memory functioning was determined by comparing their subjective ratings of memory with objective data derived from neuropsychological testing and with reports of close informants. None of the reports pertaining to the moderate TBI group correlated with actual memory performance. Of the remaining patient groups, the severe TBI patients displayed better insight than the mild TBI group although the overall results were nonsignificant. The mild TBI patients tended to overestimate their difficulties. The present results indicate that severe TBI patients have a relatively greater ability to evaluate their memory performance than any of the moderate or mild TBI patients, failing to support an increase in impairment of insight with increasing severity of trauma.

L. DELLA MALVA, A. TELLIER, B. COLLINS, A. CWINN, & M. BRENNAN-BARNES. Discharge Dispensation: Implications for Diagnosis of Mild Head Injury.
Mild head injury (MHI) can result in significant neurobehavioral sequelae. Unfortunately for many MHI patients, the term "mild" still often implies an inconsequential trauma not associated with any significant deficits. Failure to properly assess such deficits can lead to misclassification of many patients. The present study was carried out to investigate whether the initial diagnosis of MHI was upheld by outcome as defined by discharge dispensation from an acute care setting and to examine the extent of neurobehavioral investigation received by MHI patients in such a setting. Of 109 MHI patients, 30.3% suffered injuries severe enough to warrant continued care upon discharge suggesting that, in addition to physical injuries, neuropsychological impairment, not adequately assessed by the GCS, may be present in a number of these patients. The extent of such impairment is difficult to determine, given that only 3.7% of the total sample was referred for neuropsychological assessment. This question is the focus of a current follow-up study.

J. ANDRIKOPOULOS. Disproportionate Attention Deficit in Malingering.
The purpose of the present study is to replicate and extend a previous study indicating that volunteers feigning poor performance on the Wechsler Memory Scale-Revised performed worse on the Attention/Concentration Index compared to a head injured population. The Malingering Group (MG) consisted of 7 patients who had financial incentive to malinger. The Head Injury Group (HI) consisted of 10 patients with a moderate to severe closed head injury. Results showed the MG performed significantly worse than the HG on Digit Span and Visual Memory Span. These preliminary results suggest that attention may be disproportionately feigned relative to memory in patients with a financial incentive. This pattern is not generally seen in patients with a significant head injury.

J.D. WASSERMAN & F.W. BLACK. Randt Memory Test Performance After Closed Head Injury.
The Randt Memory Test is a battery of subtests designed to assess acquisition and retrieval of both verbal and visual information. The purpose of this investigation was to examine the relationship between the severity of closed head injury and outcome on the Randt Memory Test. A sample of 78 adults who had sustained clinically significant closed head injuries were administered the Randt and the WAIS-R. Severity of injury was graded as nonsevere (including trivial, mild, and moderate injuries) or severe, based upon composite indices including duration of impaired consciousness and neuropathological features. Univariate and multivariate statistical procedures were interpreted to suggest that two Randt sub-

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tests (Delayed Recall Picture Recognition and Delayed Recall Five Items) account for the power of Randt composite indices to discriminate between levels of severity. Clinical utility of the Randt is discussed.

S.R. MILLIS, M. ROSENTHAL, I. LOURIE. Can Neuropsychological Measures Predict Community Integration After Traumatic Brain Injury?
There has been significant debate as to the capacity of neuropsychological test data to predict psychosocial outcome after traumatic brain injury. A core neuropsychological test battery was administered to 23 subjects with traumatic brain injury participating in the national TBI Model Systems study during initial inpatient hospitalization. Results suggest that Trails B, Rey Auditory Verbal Learning Test, and the Wisconsin Card Sorting Test were most highly correlated with status on the Community Integration Questionnaire at 1 yr post-injury. These measures accounted for 31–59% of the variance on subscales and Total score on the CIQ. Neuropsychological test performance may be predictive of aspects of community integration one year later. Tests of memory, problem-solving, and complex attentional functioning in particular seem promising for predicting "real world" behavior.

D.E. TRAHAN, K.E. GOETHE, J. DAVILA, & R. BORRELL. Learning Versus Forgetting in Patients With Severe Closed Head Injury.
This study examined rate of learning versus forgetting in a sample of 40 patients (age group 18–59) who has sustained severe closed head injury. All were administered the Visual Reproduction Subtest from Form I of the Wechsler Memory Scale, along with a 30-min delayed recall procedure. Results revealed that CHI patients performed below levels obtained by normal control subjects in previously published studies. Analyses of the Forgetting score (Acquisition Raw Score minus Delayed Recall Raw Score) revealed that CHI patients also exhibited a more rapid rate of forgetting than normal controls. However, a number of different patterns were observed. Some patients (28%) exhibited normal acquisition but accelerated forgetting, while others (20%) exhibited impaired acquisition but normal forgetting.

S. DIKMEN, J. MACHAMER, & N. TEMKIN. One Year Neuropsychological Outcome in Head Injury.
Although head injury related neuropsychological deficits and factors that influence them have been studied extensively, there is limited information about the nature and magnitude of impairments as a function of head injury in general and severity level in particular. 514 patients with head injury and 132 trauma controls were prospectively studied. Neuropsychological evaluation was performed at 1 year. The results indicate neuropsychological deficits at 1 year in the head-injured. However, the magnitude and pervasiveness of the impairments depended on the severity of the head injury. The findings raise important questions about clinically held beliefs of differential sensitivity of neuropsychological measures to the effects of brain damage. Furthermore, the substantial variability in outcome underscores the importance of examining factors that seem to exacerbate or mitigate the effects of brain damage.

K.K. BARES, N.H. PLISKIN, R.L. HEILBRONNER, M. PRIMEAU, G.M. MEYER, K.M. KELLEY, & R.C. LEE. Nature of Memory Deficits in Electrical Injury Patients.
Patients who have sustained electrical injuries commonly report memory disturbances (Hopewell, 1983). We present data describing selective memory deficits in 14 electrical injury victims who were given the Wechsler Memory Scale, California Verbal Learning Test, Rey-Osterreith Complex Figure, Malingering Memory Test, and Beck Depression Inventory as part of a comprehensive evaluation. Results indicated that electrical injury patients have significant impairments in verbal memory, particularly encoding as opposed to retention, which were significantly related to depression and intellectual ability, but not malingering. Longitudinal study of electrical injury patients in comparison to other clinical controls is needed to further understand the etiology and course of memory disturbance.

J. BLEIBERG, J. NADLER, D. REEVES, W. GARMOE, W. LUX, & R. KANE. Inconsistency as a Marker of Mild Head Injury.
Existing neurocognitive consequences of mild to moderate head injury are not always demonstrated by standard neuropsychological measures. This is due, at least in part, to problems with measurement strategies and the types of tests employed. ANAM, a computerized neurocognitive battery designed for repeated measurement that assesses both response time and accuracy parameters, was used to compare performances of five head-injured and five matched controls, across 30 trials over four days. Comparisons between head-injured and matched controls on standard neuropsychological measures revealed few differences. However, significant differences were seen between groups on ANAM measures sensitive to speed and performance efficiency. These results suggest that following mild head trauma, efficiency and consistency of performance may be compromised although the level of performance may remain intact.

E.V. ROBERTS & L.C. COWELL. Neuropsychological Impairment and Emotional Disturbance in Mild Head Injury.
25 patients with mild head injury (MHI) received a battery of neuropsychological and psychiatric tests. Speed, attention, verbal fluency, learning, memory, IQ, copying, and academic achievement were measured. Emotional status was evaluated with the MMPI and two other measures. Correlational analysis showed that patients further out from injury performed more slowly. IQ was significantly related to several MMPI scales (F, Hy, Pa, Sc) with mostly only scattered relationships between other neuropsychological and psychiatric variables. On group means comparison of 14 Ss with less psychopathology to 11 with more, past psychiatric illness was more frequent and IQ (91 vs. 101), attention span, and verbal learning were lower in the latter group. Lower IQ may be a premorbid characteristic that is a risk factor for poor outcome.

B. ROSS, N. TEMKIN, & S. DIKMEN. The Effects of Aging on Neuropsychological Outcome Following Traumatic Head Injury.
Previous studies have found that age is an important predictor of outcome following traumatic head injury. The purpose of this study was to evaluate the role of age in neuropsychological outcome after the effects of normal aging were controlled. 219 head-injured subjects between the ages of 20 and 80 were studied prospectively one yr post-injury. Even after the effects of normal aging were accounted for, older adults performed significantly worse on several neuropsychological measures. The age effect found in this study may reflect more severe damage to the brain with aging or impaired recovery processes with aging.

F.R. FERRARO. Is Closed-Head Injury (CHI) an Instance of Advanced Cognitive Aging?
A sample of studies which included various stages of closed-head injury (CHI) were investigated regarding the claim that CHI results in a slowing of cognitive information processing. Nine studies, which included 253 CHI subjects and 239 control individuals were examined which included simple reaction time (SRT) and choice reaction time (CRT) tasks. Across 65 distinct experimental conditions, the regression equation that resulted from regressing the CHI data on that in the same conditions experienced by the controls was: CYI(CHI) = 1.53 × (Control) − 56. This regression equation accounted for 90% of the variance. This suggests that the CHI individuals in this sample were 1.53 times as slow as the controls. Although this slowing factor (1.53) is very similar to that observed regarding the slowing factor associated with advanced aging, the average age of the CHI individuals in the present sample was only 28 years. Thus, the present data set supports the claim that CHI may actually represent an instance of advanced aging.

C.S. WILSON. The Relationship Between Performance on Word Finding and Verbal Episodic Memory Tasks in Progressive Dementia and Healthy Aging.
This investigation examined the effectiveness of two behavioral methods recommended by information processing theorists (recognition mem-

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ory and elaboration paradigms) to reduce the extent to which word finding difficulties contribute to the verbal learning and memory deficits of older adults with and without probable Alzheimer's Disease. A significant relationship was observed between performance on experimental and standardized word finding and free recall measures, although scores on the recognition and word finding tasks were not related. The method utilized to increase elaboration did not substantially improve memory retention. Thus, recognition paradigms appear to moderate the confounding effects of word finding difficulties and should be included in the memory assessment batteries of older adults.

Paper Session 13

CHILD NEUROPSYCHOLOGY II: DEVELOPMENT

S.J. HUNTER, R. KARRER, & M. NELSON. The Relationship Between Infants' Discriminative Looking Behavior, ERPs, and Later Cognitive Capabilities: A Preliminary Look.
Following research indicating a strong predictive relationship between infants' discriminative looking behavior and later IQ, coupled with recent evidence that auditory ERPs correlate with later cognitive functioning, we examined looking behavior and ERPs collected during a visual discrimination task at 6 months of age and compared this with the same subjects' WPPSI IQ and subtest scores at four years of age. Results of correlational and multiple regression analyses indicated a strong predictive relationship between infants' looking and later Verbal abilities indexed by Similarities ($p < .004$) and Information ($p < .02$) subtests. ERP measures were only marginally predictive. This work provides further evidence that infants' looking behavior is a stable predictor of later cognitive functioning and supports the rationale for continued examination of ERP-IQ relationships.

J.H. KRAMER & D.C. DELIS. Developmental Sex Differences in Verbal Learning.
The purposes of this study were to assess for developmental sex differences in verbal learning and to identify possible cognitive substrates for sex differences. Subjects were 113 girls and 119 boys ranging in age from 5 through 16. All children were administered the California Verbal Learning Test—Children's Version (CVLT-C). Results indicated that girls had higher levels of recall and recognition than boys. Sex differences in semantic clustering and primacy-recency effects indicated that the girls' superior performance was related to more efficient encoding strategies and more extensive use of verbal mediation. Results are consistent with the developmental literature documenting earlier maturation of left-hemisphere structures and functions in females. These findings also underscore the importance of assessing parameters of verbal learning beyond recall and recognition.

L.M. BLACK. Affect Processing Problems of Preschool-Aged Language Disordered Children.
This research documents significant affect processing difficulties in 82 developmentally language disordered (DLD) children, aged 3–5 yr, compared to 58 normal controls matched in age, SES, and nonverbal cognitive abilities. Affect processing was measured in visual (facial and situational affect) and vocal (intonational prosody) modalities, with DLD children doing poorly in both. Great care was taken to ensure that affect measures made minimal auditory-verbal requirements and were not confounded by other nonverbal abilities. Significant differences were also found within the group of DLD children, with receptive groups showing more disturbance in affect than expressive. These results contrast with findings showing poor affect discrimination among older children with nonverbal learning disabilities and right hemisphere involvement. It raises questions as to the brain-systems involved in DLD and whether affect perception is solely a right hemisphere function in children with developmental neuropsychological weaknesses.

W.F. DANIEL, J.C. NÄSLUND, & R.J. THOMA. Dyslexia in Relation to Handedness: A Meta-Analysis.
A meta-analysis was carried out on 50 studies (representing 18,155 subjects) in which the presence versus absence of dyslexia was assessed in relation to right- versus ambi- versus left-handedness. This meta-analysis indicated a significant handedness effect, with dyslexia being associated with ambidextrality more often than with right- or left-handedness. (There was no difference between these latter two groups.) Furthermore, a re-analysis of the raw data from these 50 studies indicated that there was a significant handedness effect ($F = 95.9$; $df = 2, 18{,}152$; $p < .0001$), with dyslexia occurring in 29%, 16%, and 14% of the ambidextrous, left-handed, and right-handed subjects, respectively. However the proportion of variance accounted for by handedness was rather small ($R^2 = .01$). These results are discussed with respect to four issues: 1) It is questioned whether the small proportion of variance accounted for by handedness ($R^2 = .01$) has any clinical or theoretical significance 2) Implications for the Geschwind-Behan-Gelaburda theory of cerebral lateralization are discussed 3) The ambidextrous effect is discussed in relation to findings of increased clumsiness (Bishop) and motoric impairment (Wolff) in dyslexics 4) It is suggested that the "proxy" measure of handedness, in the special case of dyslexia, is an inadequate measure of cerebral dominance for language, and that other measures, such as laterality of earedness and/or eyedness in combination with neuroimaging procedures, might be more proximal to reading-related areas of the brain.

M. WESTERVELD, K.E. MARCHIONE, J.M. HOLAHAN, A.E. SCHNEIDER, S.E. SHAYWITZ, J.M. FLETCHER, & B.A. SHAYWITZ. Wisconsin Card Sorting Test Performance in ADD Versus ADHD Children.
Ninety-six children diagnosed with Attention Deficit Disorder without hyperactivity (ADDnoH; $n = 30$) and Attention Deficit Hyperactivity Disorder (ADHD; $n = 66$) were administered the Wisconsin Card Sorting Test and the WISC-R. Results document similar performance between the two diagnostic groups on WCST measures of perseveration, however, the ADDnoH group demonstrated significantly greater instances of failure to maintain set. Significant gender differences, in the direction of poorer performance by girls, were also identified. These findings are consistent with prior reports suggesting that attention deficits are relatively more prominent in ADDnoH children, and that girls diagnosed with attention disorder tend to demonstrate relatively greater cognitive deficits than their male counterparts. Age was not significantly related to WCST performance in our sample. The implications of our findings with regard to developmental "frontal disinhibition" hypotheses of ADD and ADHD are discussed.

F.A.J. ZELKO, D. STRITE, & W. BRILL. Perceptual and Visuographic Skills in Attention Deficit Disorder.
25 ADDH children and 18 LD controls were compared on tests of visuographic, motor-free perceptual, simple motor coordination, and search skills. MANOVA results showed no group differences on measures of simple motor coordination and motor free perception. However, ADDH children did more poorly on visuographic and search tasks. Search deficiencies were primarily due to errors of commission. Error analyses suggest a direct relationship between stimulus complexity and ADDH deficits on visuographic tasks. Similar deficits were not related to stimulus complexity on visual discrimination and memory tasks. Results suggest that executive requirements of perceptual-motor tasks are particularly difficult for ADDH children, and support a role for the frontal cortex in ADDH.

Symposium 6

A CRITICAL EVALUATION OF THE CONCEPT OF COGNITIVE RESERVE

Recent data indicate that increased educational and occupational attainment (EOA) may serve as a protective factor for the development of cog-

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nitive decline. However, the meaning of these findings remains unclear. For example, the prevalence and incidence of Alzheimer's disease has been reported to be lower in individuals with higher EOA, suggesting that these life experiences may provide a reserve against the clinical expression of the disease. Similar observations have been made in normal aging and other diseases. However, apparent reserve may simply reflect the influence of EOA on neuropsychological test performance. Also, the confounding of EOA with factors such as perinatal/lifetime medical care or environmental exposures make it difficult to determine the basis of any observed protective effect. This symposium will critically examine the concept of cognitive reserve by considering clinical and cognitive neuroimaging studies of normal aging, Alzheimer's disease and HIV. Presenters will also speculate about physiologic and cognitive processing mechanisms that may mediate this reserve.

M.S. ALBERT, C. SAVAGE, K. JONES, L. BERKMAN, T. SEEMAN, & D. BLAZER. Predictors of Cognitive Changes in an Elderly Community-Dwelling Sample.
A longitudinal study was conducted among 1011 community-dwelling 70–79 year-old subjects in order to identify factors associated with maintenance of cognitive ability over a 2.5 yr interval. Participants in the study represented the top third of the population at baseline, in terms of cognitive and physical ability. A path modeling procedure known as Linear Structural Relations Modeling (LISREL) was used to assess 21 physical, demographic and psychosocial variables as potential predictors of cognitive change. The model tested was a good fit to the data (AGF = 0.95) and stable (stability index = 0.40). Other than initial cognitive performance, educational background was the strongest predictor of cognitive change. Physical measures of strenuous activity and peak expiratory flow rate were also direct predictors of cognitive change. A psychosocial measure, self-efficacy, also provided small but persistent predictive effects. These results confirm the importance of higher levels of education as an important dimension in the maintenance of cognitive ability with age, and also suggest potential points of intervention to minimize age-related cognitive change.

D.P. SALMON. The Protective Effect of Education in the Shanghai Dementia Survey: The Brain Reserve Hypothesis.
One important finding from the Shanghai Dementia Survey was that dementia and Alzheimer's disease was less prevalent in educated subjects than in subjects with no or very low levels of education. This protective effect of education may be biologically based in the recently demonstrated relationship between synapse loss and cognitive decline in patients with Alzheimer's disease. Education and other early life experiences may enrich synaptic density in the cortical association areas affected by the disease and provide the educated person with a "brain reserve" so that more brain damage than usual would have to occur before the threshold for cognitive dysfunction and dementia was reached. Thus, the dementia associated with Alzheimer's disease would be delayed in the educated person, and this would result in a lower prevalence of clinically observable dementia in educated than in non-educated subjects.

W. VAN GORP, T. MARCOTTE, P. SATZ, E. MILLER, O. SELNES, J. WESCH, J. BECKER, L. JACOBSON, H. MORGENSTERN, & B. VISSCHER. Evidence for Cognitive Reserve in HIV Infection: Additional Findings From the Multicenter AIDS Cohort Study (MACS).
This study investigates whether HIV-infected individuals who perform below average on a measure of intellectual function are more likely to show cognitive deficits relative to seronegative controls than their peers with average or above IQ scores (as measured by the Shipley Institute of Living Scale). 1,645 participants from the MACS were studied (861 seronegatives and 784 seropositives). Based upon their performance on a neuropsychological screening battery, it was found that the proportion of neuropsychological outliers did not differ between seropositives (17%) and seronegatives (15%) for the average and above IQ group, but the proportion of outliers was significantly greater for the seropositive subjects (58%) versus the seronegative subjects (36%) in the below average IQ group. These data are consistent with a threshold effect in which a CNS perturbation may be more likely to produce overt loss of neuropsychological integrity in those with less cerebral reserve compared with similarly affected individuals who have greater reserve. Theoretical implications of these findings will be discussed.

Y. STERN. Approaches to Assessing Cognitive Reserve in Alzheimer's Disease.
We have used several approaches to test the concept of cognitive reserve, which predicts that individuals with higher educational or occupational attainment (EOA) cope longer with advancing Alzheimer's disease (AD) pathology before clinical symptoms appear. Higher prevalence of AD in elders with lower EOA supports this concept, but this may simply reflect the relation between EOA and test performance. Prospective incidence studies can address the problem of diagnostic bias to some degree, since subjects must perform adequately on the diagnostic instruments at the study outset. An alternate approach to this issue is to use cerebral blood flow (CBF) in the parietotemporal area as a non-EOA-dependent marker of AD pathologic severity. There is an inverse relation between parietotemporal CBF and EOA in AD patients matched for clinical severity, suggesting delayed clinical manifestation of AD with higher EOA. We are currently using cognitive activation tasks in patients matched for parietotemporal CBF to determine if activation differs as a function of EOA and elucidate processes underlying cognitive reserve.

Paper Session 14

ASSESSMENT

M.J. SELBY, M. QUIROGA, R. YUSPEH, & J. RIRIE. The Impact of Cultural Experience on Neuropsychological Test Performance Among Subjects With Similar Education and Intellectual Ability.
A battery of neuropsychological measures was administered to 298 adult minority and non-minority male felons with similar educational levels and intellectual ability to investigate the possible impact of cultural experience on test performance. Results showed all subjects to perform similarly on tasks measuring verbal learning ability, verbal initiation, and fine motor speed and dexterity. Caucasian subject performance differed significantly from African-American and/or Hispanic subject performance on tasks measuring the ability to rapidly process complex visual information, simple and complex visual tracking, visual substitution, object naming, and visuo-constructional ability and object naming. Hispanic subject performance differed from African-American subject performance on tasks measuring visuo-constructional ability, and the immediate and delayed recall of both verbal and nonverbal material. Normative data for African-American and Hispanic subjects are provided, and implications for further research are discussed.

J. SCOTT, K. KRULL, D. WILLIAMSON, & R. ADAMS. Estimation of Premorbid Intelligence in Diffuse and Lateralized Brain Injury Patient Populations.
The present study investigated the use of the Oklahoma Premorbid Intelligence Estimation (OPIE) formula in patient populations with diffuse and lateralized brain pathology. One hundred-twenty-four subjects with diffuse brain pathology, 27 patients with left and 16 patients with right lateralized pathology were examined to validate a newly generated formula for estimating premorbid intelligence. The Oklahoma Formula combines both demographic and current WAIS-R performance to estimate pre-injury intelligence. The analysis indicates that the formula results in a distribution of predicted scores which more closely parallel the standardized mean of 100 and without the restricted range found in other methods of predicting premorbid intelligence. The results provide support for the use of the formula with clinical populations and

suggested calculation modifications which are appropriate for use with diffuse or lateralized patient populations.

T. KUPKE & R. LEWIS. Differing Contributions of Fluid and Crystallized Capacities to Paragraph Recall and List Learning in Alcoholism.
We examine the influences of fluid and crystallized ability on paragraph recall from Russell's version of the WMS (WMS-PR) and the Rey Auditory Verbal Learning Test (RAVLT). Clinical observations of recently detoxified alcoholics suggested that the WMS-PR would represent a more crystallized task while the RAVLT would be more fluid in nature. Results of multiple regression and commonality analyses using measures of mnestic, crystallized, and fluid abilities, or age and education, to predict WMS-PR and RAVLT performances supported our hypotheses. Though both tasks assess memory, the WMS-PR covaries to a greater extent than the RAVLT with variables reflecting crystallized capacities and is less dependent on fluid skills. These findings suggest that the RAVLT may be more sensitive to brain dysfunction, in general, than the WMS-PR, but it may be less specific for verbal memory impairments.

S.R. MILLIS & J.H. RICKER. The California Verbal Learning Test in the Detection of Feigned Memory Impairment.
This study was an attempt to validate three variables from the CVLT (Recognition Hits, False Positives, Long-Delay Cued Recall) as a means for detecting feigned or exaggerated memory impairment. Subjects with mild head injury ($n = 9$) who performed at chance level or worse on a forced-choice memory test, seeking financial compensation, and claiming total disability obtained significantly lower scores on Hits and Cued Recall and higher scores on False Positives than subjects ($n = 37$) with documented moderate and severe traumatic brain injury (GCS 3–12). An unreplicated discriminant function correctly classified 100% of the subjects.

L.M. PHILPOTT & K.B. BOONE. The Effects of Cognitive Impairment and Age on Two Malingering Tests: An Investigation of the Rey Memory Test (RMT) and Rey Dot Counting Test (RDC) in Alzheimer's Patients and Normal Middle Aged/Older Adults.
The effects of severity of cognitive impairment and age on the RMT and RDC were examined. Patients diagnosed with probable dementia of the Alzheimer type ($N = 49$) and healthy, middle aged/older adults, aged 46 to 80 ($N = 47$), were administered the RMT, RDC, and Mini-Mental State Examination. On the RMT, patients with mild (defined by scores on the MMSE) dementia obtained only slightly higher recall scores than those in the moderate and moderately severe groups. The moderate and moderately severe groups did not differ significantly. On the RDC, both the mild and moderate groups performed better than those in the moderately severe group. Age was found to be associated with performance on the RMT but not the RDC. Older subjects (above age 70) obtained lower recall scores than those under age 70. Based on these findings, the RDC appears less sensitive than the RMT to the presence of mild cognitive impairment and age. The present study also raises concern regarding the use of the RMT as a test of cognitive malingering.

N.L. DENBURG, P.S. FASTENAU, & E.A. FERTUCK. Cowboy Story: Resistance to Aging Found in Reading Memory.
The Cowboy Story was used in mental status exams for many decades (Talland, 1965). Initially, like WMS-R Logical Memory (LM) it tested intentional auditory memory. Here, Cowboy Story was modified into a test of incidental reading memory. Subjects read the story quietly with no indication of future memory testing. Afterwards, subjects were tested through immediate recall, delay recall, cued recall, and recognition. This paper provides preliminary data from a healthy, age- and sex-stratified community sample ($N = 90$). Concurrent validity with LM was established ($p < .0005$). Older adults performed worse than younger cohorts on the Cowboy Story ($p \leq .05$). However, this difference was very small when compared to LM ($p \leq .025$). The multimodal character of Cowboy Story may render it more resistant to the aging process.

SATURDAY MORNING, FEBRUARY 5, 1994

Paper Session 15

HEMISPHERIC SPECIALIZATION

P. CHANG, S.C. LEVINE, & J. HUTTENLOCHER. Hemispheric Equivalence In Representing Locational Information.
This experiment investigated the hypothesis that the left hemisphere is specialized for processing spatial categories, while the right hemisphere is specialized for determining precise metric distances between objects. Subjects reported the location of a dot presented within a rectangle that was shown laterally. Regardless of the field of presentation, the pattern of bias along the vertical axis indicates that subjects divided the rectangle into two categories. Dots located near the edges of the rectangle, and near the psychologically imposed category boundary were more accurately reported than dots that were not located near these boundaries. The results suggest that both hemispheres categorize space in making judgments of spatial location.

S. CHRISTMAN. Interhemispheric Interaction and Individual Differences in Stroop Interference.
Left- and right-handed Ss performed a Stroop task (naming the color in which a color word was printed) and a same-different task (judging whether the color was the same as or different than the color word). For central presentations (allowing bihemispheric access to input), the left and right hemispheres were hypothesized to control processing of the verbal and chromatic stimulus dimensions, respectively. Left-handers exhibited greater Stroop interference, consistent with evidence for greater interhemispheric interaction in left-handers. The same-different task yielded no differences between handedness groups, suggesting that handedness groups may not differ in inter-hemispheric comparison of information. Finally, significant correlations were obtained between the two tasks, indicating that (a) patterns of greater inter-dimensional interaction (and, hence, presumably greater interhemispheric interaction) generalize across tasks, and (b) both left- and right-handers exhibit meaningful variations in performance and interhemispheric interaction that can be assessed via non-lateralized presentation.

A. BELGER & M.T. BANICH. Interhemispheric Interaction Affected by Asymmetries of Hemispheric Activation (AHA).
Interhemispheric processing has been demonstrated to improve performance to the extent that a processing load can be distributed equitably between the hemispheres. The present study demonstrates that Asymmetries of Hemispheric Activation (AHA) can affect the efficiency of interhemispheric interaction. AHAs were measured for 23 right-handed subjects using a chimeric face test and related to the size of their across-hemisphere advantage on 5 interhemispheric tasks. The results indicated that relatively greater right-hemisphere activation yielded a larger across-hemisphere advantage during a left-hemisphere rhyme task, whereas relatively greater left-hemisphere activation yielded a larger across-hemisphere advantage during four right-hemisphere tasks. These findings suggest that a pattern of hemispheric activation favoring the less active hemisphere for a particular task improves interhemispheric processing by diminishing hemispheric differences in processing efficiency.

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M.T. BANICH, C.D. NICHOLAS, & D.L. KAROL. Interhemispheric Interaction: Variations Along a Spectrum.
Numerous models of interhemispheric interaction have been proposed, from metacontrol, in which one hemisphere dominates processing when both receive information (e.g., Hellige, Taylor, and Eng, 1989), to a model in which the pattern observed during bihemispheric processing is totally distinct from unihemispheric processing (Banich and Karol, 1992). We present evidence from 16 right-handed individuals for an intermediate pattern of interhemispheric interaction. When subjects decided if either of two numbers was lower in value than a previously presented target number, we found that for one aspect of the task bihemispheric processing mimicked processing on RVF but not LVF trials, whereas for another aspect of the task, bihemispheric processing mimicked processing on LVF but not RVF trials. Hence, different aspects of bihemispheric performance were being influenced by each hemisphere.

W.F. McKEEVER & K.S. SEITZ. Handedness and Gender Differences on a Tachistoscopic Test of Language Lateralization.
Efforts to validate tachistoscopic tests of language lateralization against Wada Test results have shown significant associations but the degree of congruence has been generally unimpressive. One reason for this may be that the tasks were inadequate. They yielded very low percentages of inferred left hemispheric dominance for language in normal dextral controls. A good test of language lateralization should approximate the well-established base rate for left hemisphere dominance in dextrals (95%) and discriminate the performances of dextral from sinistral subjects. A tachistoscopic task, the Bilateral Object Naming Latency Task, was administered to 98 dextral and 48 sinistral subjects. The task met the relevant criteria and appears to be a good candidate for direct validational work with carefully conducted Wada Test procedures.

P.J. SNYDER, H. WU, B. BOGERTS, R.M. BILDER, & J.A. LIEBERMAN. Cerebellar Volume Asymmetries are Related to Handedness: A Quantitative MRI Study.
Four cerebellar subregions were delineated (left, right; anterior, posterior), and their volumes measured on contiguous 3.1 mm coronal MR images in 15 dextral and 8 nondextral healthy controls. RESULTS: 1) Cerebellar volumetric asymmetries interacted with anterior-posterior level (anterior: right > left; posterior: left > right), following a pattern found in the neocortex; 2) A significant handedness difference was found ($p \leq .01$) on a composite index of cerebellar asymmetry, such that dextrals showed more asymmetry than nondextrals; 3) No handedness differences were found on a related index of neocortical asymmetry. CONCLUSION: These data suggest that the same pattern of "torque" observed at the neocortical level is also present in the metencephalon. These asymmetries, possibly resulting from differing developmental growth gradients acting on the metencephalon early in gestation, are associated with handedness differences in adulthood.

Symposium 7

DEVELOPMENTAL THEORY AND PROCESS IN THE EXAMINATION OF CHILDREN'S MEMORY

The present symposium directs attention to the theoretical, research, and clinical aspects of learning and memory functions in children. Recently, developmental neuropsychological models have been proposed for attention (e.g., Cooley and Morris, 1990) and executive functions (Welsh and Pennington, 1988). Memory functions and their disorder have a large research and clinical literature for adults. Despite a significant developmental research literature, children's learning and memory has not attracted the same degree of attention in clinical neuropsychology. In an effort to stimulate further work in this area, a theoretical framework is provided, current clinical measures are critiqued, and factors underlying the process of learning and memory are illustrated in normal and clinical samples. Recommendations are made for future directions in the clinical evaluation of children's learning and memory.

T.A. BOYD. What Have We Forgotten?: A Developmental Framework for Memory Assessment in Children.
The construction of clinical memory tests for children has not kept pace with advances in knowledge about the cognitive-developmental progression of human learning and memory. The construction of memory tasks must incorporate the profound quantitative and qualitative changes in mnemonic performance during development. The present paper provides a heuristic framework for understanding the clinical implications of these cognitive-developmental changes. A set of principles is derived for categorizing and guiding the construction of developmentally sensitive memory tasks. A selected hierarchy of research models on the development of mnemonic abilities is presented which addresses the growing use of strategies through childhood, the influence of attention on mnemonic performance, and the significance of metamemory. The emphasis is on trends that have developmental and clinical relevance.

G. GIOIA. Clinical Measures of Children's Learning and Memory Functions: Present and Future.
A variety of clinical measures are available to assess children's learning and memory. A significant gap exists, however, between critical processes outlined in the developmental memory literature and their application to clinical assessment tools. The present paper reviews representative measures with respect to developmental, information processing, and psychometric dimensions. Most measures focus upon final outcome scores ignoring the internal process variables. Those few tasks that examine strategic behavior (e.g., semantic clustering in the CVLT-C), do so at the point of recall which, it is argued, may miss the important developmental variability of strategic organization at input (encoding). Recommendations are made for tasks of children's learning and memory that formally incorporate and quantify clinically relevant encoding/retrieval strategies and metamemory behaviors.

P.A. PRATHER, A. ALEXANDER, & H.H. BROWNELL. Story Recall in Preschoolers: Paying Attention Isn't Enough.
Preschool children have limited strategies to facilitate learning and recall: primarily delay tactics and focused attention. One can speculate that ability to direct and sustain attention may predict ability to retain information in "pre-metamemory" preschool and kindergarten-age children. To examine this hypothesis, three tasks were administered to forty-two 4-6 year olds: a measure of sustained attention, vocabulary level, and story recall. Results showed positive associations between vocabulary level and story recall when attention measures were controlled, but no correlation between recall and attention when vocabulary and age were controlled. In contrast to domain-specific abilities such as vocabulary, sustained attention was not a good predictor of memory performance.

P.M. KAUFMANN, J.M. FLETCHER, & H.S. LEVIN. The Role of Attention in Learning and Memory Function Following Pediatric Traumatic Brain Injury.
Persistent attentional disturbance and its relation to memory were investigated following pediatric traumatic brain injury. Results from a group of studies are reviewed to address pediatric memory assessment techniques. Children with severe injuries had difficulties inhibiting responses to distracting stimuli. Younger children with comparable injuries performed more poorly on a continuous performance task (CPT), after removing the influence of normal developmental changes. CPT performance accounted for a significant portion (18%) of the variance in verbal selective reminding. Attention deficits interfere with the acquisition of new information and may limit the development of more sophisticated information processing strategies. Consequently, persistent attentional disturbance may have a more pervasive effect in younger children. New approaches to pediatric memory assessment should consider the influence of attention in cognitive development.

G.P. AYLWARD. Measurement of Memory and Attention in an ADD/LD Population.
Determination of the effect of attention deficits on memory dysfunction in clinical populations is important for diagnostic and treatment purposes. Consideration of strategic/non-strategic and episodic/semantic dichotomies may define these effects. This issue is evaluated in a clinical sample of 235 children (M age = 9.83 yr; M grade = 4.26) who were given the WISC-R/WISC III, Gordon Diagnostic System, rating scales, WRAML, and achievement testing. Children were grouped by "attention" measures and performance on the WRAML was assessed. Lack of group differences occurs because children obtain the same scores for different reasons. Score profiles of process variables (reaction times, processing speed, verbal/visual discrepancies, learning increments, and strategic/episodic dichotomies) may be a better approach.

Paper Session 16

MEMORY

J.B. RICH, F.W. BYLSMA, & J. BRANDT. Implicit Measures of General Skill Learning and Item-Specific Priming in Amnesia.
Item priming and skill learning were examined within a single paradigm using a semantic decision-making task. Thirteen amnesic patients and 13 normal control subjects judged whether words represented animate or inanimate objects. One 20-item list was presented repeatedly on four consecutive blocks, and a new list was presented on the fifth block. Although the amnesic group demonstrated a normal rate of skill learning (decreased decision times from block 1 to block 5), the magnitude of their item priming (increased decision times from block 4 to block 5) was significantly reduced relative to the control group. On explicit recognition testing, the amnesics showed significantly impaired accuracy, but the groups did not differ in response bias. Thus, despite normal skill learning, both implicit and explicit conceptual item learning is reduced in amnesia.

M. SCHMITTER-EDGECOMBE. The Effects of Divided Attention on Implicit and Explicit Memory Performance.
In this study the hypothesis that implicit, but not explicit, memory may reflect the operation of more automatic processes was investigated. One-hundred neurologically normal subjects rated their liking of target words on a 5-point scale. Half of the subjects completed the word rating task under a full attention condition and half of the subjects completed the rating task under a divided attention condition. Following administration of the word rating task, all subjects completed 5 memory tests, 3 implicit (category association, tachistoscopic identification, and perceptual clarification) and 2 explicit (semantic-cued recall and graphemic-cued recall), each bearing on a different subset of the list of previously presented target words. Although subjects in the divided attention condition performed significantly poorer than subjects in the full attention condition on the two explicit memory tests, there were no significant group differences in performance on the three implicit memory measures. These results suggest that, in comparison to explicit memory, implicit memory may be less dependent on the extent to which subjects are able to allocate attentional resources during initial learning. Implications of this work for neurologically impaired populations are discussed.

M.C. WILDE, C. BOAKE, & M. SHERER. Recognition Versus Recall Discrepancies in Closed Head Injury.
This study examined the validity of recognition-discriminability and long-delay free recall score discrepancies from the California Verbal Learning Test (CVLT) in detecting retrieval deficits in closed head injury (CHI). CVLT protocols of 55 moderate and severe CHI subjects were grouped into retrieval and non-retrieval deficit groups on the basis of Z score discriminability-long delay free recall discrepancies. Group comparisons were made on indices hypothesized to reveal patterns consistent with the retrieval deficits. Results showed that the presumed retrieval deficit group demonstrated fewer overall intrusions. The groups did not differ in their rate of learning, consistency of recall, or the degree of benefit from cuing on recall. Caution should be used in interpreting recognition-recall discrepancies as representing retrieval deficits in the CHI population.

J.M. WHEALIN, R.A. STERN, G.A. MASON, L.R. NOONAN, D.H. OVERSTREET, S.G. SILVA, & A.J. PRANGE, JR. Influence of L-triiodothyronine on Memory Following Repeated Electroconvulsive Shock in Rats: Implications for Human Electroconvulsive Therapy.
Clinical findings suggest that the thyroid hormone L-triiodothyronine (T3) accelerates the antidepressant effects of electroconvulsive therapy and diminishes the associated amnesia. The present study addresses the role of T3 (50 μg/kg) in protecting against amnesia associated with repeated electroconvulsive shock (ECS) in rats. Thirty-one male rats were divided into four groups: ECS/T3, Sham ECS/T3, ECS/Placebo, and Sham ECS/Placebo. Retrograde amnesia was tested using pre- and post-treatment trials in an open field apparatus. The ECS/T3 group exhibited significantly less amnesia, as evidenced by less exploration post treatment than the ECS/Placebo group. Anterograde amnesia was assessed using passive avoidance with animals trained and tested following the treatment period. The ECS/T3 group again exhibited significantly less amnesia than the ECS/Placebo group. These results suggest that T3 diminishes the amnesia associated with ECS.

P.P. WANG, W.C. HEINDEL, & U. BELLUGI. Differential Motor Learning Ability Accompanies Differential Basal Ganglia Involvement in Two Neurodevelopmental Disorders.
Recent studies of neurological patient populations have demonstrated dissociability between different forms of implicit memory. These forms of implicit memory are believed to be mediated by distinct neural systems. The differential preservation of basal ganglia volumes in Down syndrome and Williams syndrome led to the hypothesis that neurodevelopmental disorders also might result in dissociations of motor learning abilities. We report that subjects with Down syndrome show significantly better pursuit rotor performance than Williams subjects, consistent with other evidence that motor skill learning may be mediated by the basal ganglia. The results also suggest that motor learning abilities may be disrupted by specific genetic perturbations.

P.J. ESLINGER, L.M. GRATTAN, D. RIGAMONTI, S.M. AUGUST, & A. DEPATRI. Different Forms of Memory Impairment After Anterior Communicating Artery Aneurysm.
A consecutive series of patients with ruptured and clipped anterior communicating artery aneurysm (ACoA, $n = 12$) were studied with standard and experimental temporal ordering memory procedures and CT scan during early recovery. Patients with ruptured aneurysms in nonfrontal vascular distributions ($n = 10$) served as a comparison group. Although the ACoA group produced significantly more confabulatory responses, neuropsychological test results indicated no significant differences between the groups on measures of learning, retention and spatial-temporal processing. Neuroanatomic studies indicated that 75% of the ACoA group had lesions outside of the basal forebrain region, involving diverse portions of the frontal cortex and the basal ganglia. Each lesion subgroup presented with a different pattern of memory disturbance, reflecting involvement of different components in the frontal-limbic, frontal-cortical and basal ganglia systems.

Poster Session 6

AGING, DEMENTIA, AND PARKINSON'S DISEASE

K. BOONE, I. LESSER, B. MILLER, M. WOHL, A. LEE, & B. PALMER. Cognitive Functioning in a Geriatric Depressed Population: Relationship of Gender to Neuropsychological Scores.
Both male and female geriatric outpatients meeting criteria for major depression showed mild declines in nonverbal memory, word genera-

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tion, and Performance IQ. However, women also exhibited disturbances in verbal memory, attention, word-retrieval, Verbal IQ, and frontal lobe skills associated with the Wisconsin Card Sorting Test, while male patients showed slowed information processing speed. Men generally demonstrated a more lateralized pattern of neuropsychological dysfunction consistent with right hemisphere disturbance, while women displayed a pattern of bilateral cognitive decline. The discrepancies in the literature regarding cognitive deterioration in geriatric depression may be due to differences in the gender distribution of the samples studied.

E. KOZORA & C.M. CULLUM. Commission Errors Associated With Nonverbal Recall in Normal Aging.
Commission errors from the WMS-R Visual Reproduction subtest were analyzed in two groups of healthy older adults, ages 50–69 and 70–95. Two types of intrusion errors and four types of perseverative responses were examined. Older subjects made significantly more Partial Intrusions, Element Perseverations and Feature Perseverations. The groups did not differ on measures of Full Intrusions, Test Perseverations or Motor Perseverations. Correlations were negative and significant between the WMS-R General Memory Index and Full Intrusions, Partial Intrusions and Perseveration of Elements. The present findings suggest that some types of intrusion and perseveration errors occur in normal aging; therefore, commission errors in nonverbal recall should not necessarily be considered as pathognomonic for abnormal neurologic decline in older subjects.

M. MITRUSHINA, C.L. UCHIYAMA, & P. SATZ. Heterogeneity of the Patterns of Cognitive Functioning in Normal Aging.
This study explores the presence of homogeneous subgroups among 156 normal elderly Ss based on their performance on a battery of neuropsychological tests. Ss ranged in age between 57 and 85 yr and included 62 males and 94 females with a mean age 70.7 yr, mean education 14.1 yr, and mean Full Scale IQ of 117.2. Six clusters were extracted, 3 of which might represent preclinical stages of the dementing process with distinct patterns of deficits. The results of this study can be used in support of 2 explanations of discrete subtypes seen in Alzheimer's Disease: 1) as extension of distinct subtypes which are inherent in cognitive profiles of normal elderly; 2) the process of degeneration might differentially affect different brain areas, resulting in different patterns of cognitive deficits.

P.A. LICHTENBERG & M. NANNA. The Role of Cognition and Depression in Predicting ADL and Ambulation Skills in the Oldest Old Rehabilitation Patients.
Sixty consecutive patients aged 85 or greater admitted to an inpatient rehabilitation program were studied to find out the predictive abilities of demographic, medical, cognitive and affective variables in determining ADL and ambulation scores as measured by the Functional Independence Measure (FIM). The Mattis Dementia Rating Scale, was the only one to be correlated significantly with both ADL ($r = .27$; $p < .05$) and ambulation ($r = .36$; $p < .05$) scores. Gender was correlated with ADL skills ($r = .26$; $p < .05$) indicating that women attained higher ADL scores than did men. DRS scores accounted for 8% of ADL variance and 16% of ambulation variance, above and beyond demographic medical variables.

P.A. LICHTENBERG, S.R. MILLIS, & M. NANNA. Use of The Visual Form Discrimination Test With Urban Geriatric Medical Inpatients.
The suitability of Benton's Visual Form Discrimination Test (VFD) for detecting cognitive dysfunction among urban geriatric medical inpatients was investigated in a pilot study of 59 patients. Significantly higher VFD scores were found in a group of cognitively intact subjects than were found in a group of demented subjects. Both groups, however, demonstrated lower mean scores than were reported in the original normative sample. At the .72 specificity level, a sensitivity of .77 was found. The VFD, as a part of neuropsychological assessment, appears useful in the assessment of cognitive functioning in geriatric medical patients.

A.M. PAOLO & J.J. RYAN. WAIS-R Digit Symbol Patterns for Persons 75 Years and Older.
This study addressed the hypothesis that elderly individuals display a "warming-up" pattern on the Digit Symbol subtest when performance is recorded at 30, 60, and 90 s (Kaplan, Fein, Morris, & Delis, 1991). Patterns of performance for the three 30 s intervals were explored in a sample of 223 normal persons 75 yr and older. Means for age, education, and Full Scale IQ were 80.66 yr ($SD = 4.99$), 10.90 yr ($SD = 2.92$), and 103.6 ($SD = 14.29$). Hierarchical cluster analyses using Ward's method were utilized to group subjects in two through five clusters. Although some elderly persons displayed the "warming-up" pattern, it was not the most frequent and cannot be considered characteristic of persons 75 yr and older.

A.M. PAOLO, A.I. TRÖSTER, S.L. GLATT, J.P. HUBBLE, & W.C. KOLLER. Utility of the Dementia Rating Scale to Differentiate the Dementias of Alzheimer's and Parkinson's Disease.
The Mattis Dementia Rating Scale (DRS) was used to distinguish 36 AD and 58 PD subjects. They were divided into mild and moderate-severe AD and PD dementia groups based on the total DRS score. Overall, the AD subjects were more cognitively impaired than those with PD. Mildly demented AD subjects displayed more severe memory impairment than PD subjects with mild dementia. For those with moderate-severe dementia, AD subjects evidenced more impairment in memory, while PD subjects displayed more severe constructional problems. The greater impairment in constructional abilities was not due to increased rigidity, tremor or bradykinesia. Discriminant function analyses correctly classified 77% of the mildly impaired subjects and 79% of the more severely impaired AD and PD subjects.

S. HALL, S.L. PINKSTON, A.C. SZALDA-PETREE, & A.R. CORONIS. The Performance of Healthy Older Adults on the Continuous Visual Memory Test and the Visual-Motor Integration Test: Preliminary Findings.
The performance of 53 healthy older adults (age 60–92) was examined on the Continuous Visual Memory Test (CVMT) and the Visual-Motor Integration Test (VMI). Subjects were divided into the following 3 groups: age 60–69, age 70–79, and age 80–92. Findings for the 60–69 and 80–92 age groups are considered tentative due to small sample size ($n = 14$ and 8, respectively). Descriptive statistics were computed for each of the tests for the three age groups. In addition, individual scores for the CVMT total score, CVMT d-Prime, and CVMT Delayed Recognition were compared to the cutoff scores recommended in the CVMT manual and the percentage of subjects falling below these values was computed. Normative data for the three age groups on the CVMT and the VMI are presented. On the CVMT, an unsatisfactorily large percentage of subjects were classified as impaired using the cutoffs provided in the CVMT manual, particularly on the delayed recognition measure and for all scores in the age 80–92 group. These preliminary findings suggest that the CVMT may not be an appropriate measure of nonverbal memory for older adults. The subjects' performance on the VMI suggests that this test shows promise as an objective measure of graphomotor constructional ability in healthy older adults, and potentially, for individuals with neurological disease.

M. HARTMAN & S.F. SWEENY. The Stroop Test: One Source of Age Differences Identified.
Examination of Stroop Test performance (Color Naming, Word Naming, and Interference) for 171 healthy older and 210 younger adults indicated that in addition to overall slowing for the older group, age differences were greater for Color Naming than Word Naming, and greater for Interference Naming than Color Naming. Furthermore, Stroop Interference Naming was predicted by Word Naming speed, the

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difference in speed for Color Naming versus Word Naming, and age. These results indicate that an increase in the relative availability of the conflicting response leads to slower interference times, thus confirming the hypothesized role of response inhibition on the Stroop Test. In addition, they localize one source of age differences to the relatively larger effects of aging on color naming compared to word naming.

M. MITRUSHINA & P. SATZ. The Utility of Mini-Mental State Examination in Assessing Cognition in the Elderly.
The present study used a sample of 156 healthy elderly Ss between 57 and 85 years of age to explore concurrent validity of 3 MMSE components: serial seven subtractions, 3-word recall and copying pentagons, which are most frequently used in clinical practice as indicators of specific cognitive deficits. Correlational analyses were used to explore the relationship of 3 MMSE tasks and scores on neuropsychological tests. The results of this study indicated that performance on individual MMSE components by elderly individuals should be interpreted with caution due to the effect of education on individual task performance, questionable specificity of the tasks in assessing circumscribed cognitive domains, emphasis on verbal tasks and high misidentification rate.

C.L. UCHIYAMA, M. MITRUSHINA, & P. SATZ. The Direct and Indirect Effects of Demographic Variables on Neuropsychological Performance in Geriatric Persons: A Structural Equation Model.
The direct and indirect effects of demographic variables on neuropsychological performance in senescent individuals were examined using a LISREL structural equation model. One-hundred fifty-six geriatric subjects were individually administered a comprehensive neuropsychological battery and an extensive medical history questionnaire. The model assessed the effects of 3 independent latent variables (Medical History (including age), Psychological Functioning, and Global Cognitive Functioning (including education)) on one dependent latent variable (Neuropsychological Functioning). The best-fitting model (Goodness-of-Fit Index = .91) revealed that all 3 latent variables had direct effects on neuropsychological functioning, and that Medical History and Global Cognitive Functioning also exhibited indirect effects. These findings suggest that the influence of demographic variables on neuropsychological functioning for geriatric persons is complex, and that certain variables should not be interpreted independent of each other due to their moderating indirect effects.

B. COLLINS, A. TELLIER, L. DELLA MALVA, J. VERDON, & J.R. NAVARRO. Relationship Between Blood Pressure and Neuropsychological Performance in a Cognitively-Intact Elderly Sample.
The purpose of the current study, using data collected as part of the Canadian Study of Health and Aging (a nation-wide epidemiological study), was to investigate the relationship between blood pressure and neuropsychological performance in a cognitively-intact sample of elderly Canadians. MANOVA failed to discriminate the neuropsychological test performance of groups of subjects with and without past or present hypertension (by self-report). However, a significant correlation was obtained between diastolic blood pressure taken at the time of testing and performance on the Token Test. The finding that certain neuropsychological measures are sensitive to elevations in blood pressure indicates that hypertension cannot be totally disregarded in studies of normal cognitive aging.

G.A. HOPP, M. GRUT, L. BÄCKMAN, & R.A. DIXON. A Two-Year Study of Healthy and AD Very Old Adults.
This study examines the performance of very old healthy and demented adults on the Mini Mental Status Exam (MMSE) and the Wechsler Adult Intelligence Test—Revised (WAIS-R) on several occasions over a two year period. Analyses indicated that the measures provided reliable assessments of both groups. The healthy elderly subjects showed higher levels of performance than those with AD across five occasions. The performance of the healthy group did not vary significantly over the two year period, while the AD group showed significant decline on the Verbal subtests of the WAIS-R. A modest relationship was found between the MMSE and performance on the WAIS-R.

J.J. RYAN & D.D. TRENT. Speed of Information Processing and WAIS-R Performance Among Persons 75 Years and Older.
The role of response time on WAIS-R subtest scores was investigated using 213 normal elderly. Means for age and education were 80.6 yr (SD = 4.97) and 10.9 yr (SD = 2.97). A total response time (TRT) score was gleaned from each of the Picture Arrangement (PATRT), Block Design (BDTRT), and Object Assembly (OATRT) subtests. A principal components analysis (with varimax rotation) of 11 subtest scores, response time measures, and age yielded three robust factors. Factor I was the verbal-comprehension construct and Factor II represented the perceptual organization construct. Factor III consisted of BDTRT, PATRT, and PA and was designated a measure of response time. It was concluded that response time provided unique variability in accounting for WAIS-R scores and that PA was a poor measure of nonverbal intelligence.

M.-S. HUA & S.-H. CHANG. Factor Structures of Perception and Language Tests and Normal Aging.
In the present study, two experiments in which three age subject groups with a total of 120 normal healthy adults attended each experiment were conducted to investigate the possible underlying factor structures of 5 Benton's perception tests and aphasia battery, and then using the factorial scores to examine the issue regarding whether normal aging processes have an adverse impact on such two area functioning. On the perception tests, two factors, visuospatial perception and visuoconstructive ability, were identified with principal component analysis procedure. Further data analysis shows normal aging processes only having an adverse effect on the elderly's visuospatial perception functioning. With regard to aphasia battery, five factors including verbal comprehension, sound-word association, lexical-semantic analysis ability, automatic writing skills and visuomotor coordination skills were identified. Further data analysis with factorial scores indicates that normal aging processes have an unfavorable impact on verbal comprehension, sound-word association and lexical-semantic analysis functioning.

C.M. LEMSKY, G.E. SMITH, J.F. MALEC, & R.J. IVNIK. Development of Decision Rules to Identify Persons at Risk for Functional Decline Using Cognitive Measures.
The relationship between cognitive test performance and observer-reported functional status was assessed in 293 persons diagnosed with a dementing condition, and 303 controls (mean age = 79.9) from the Alzheimer's Disease Registry at Mayo Clinic. CART analysis was used to create decision rules (using cut-off scores) to identify persons most at risk for functional decline. The results suggest that scores from the Dementia Rating Scale, the MMSE, the perceptual organizational factor of the WAIS-R, age and education may be used in combination to identify persons in need of functional assistance. Decision rules to predict performance in specific functional domains also will be presented.

F.C. GOLDSTEIN, A. BACON, L. BARNES, & R.C. GREEN. The Influence of Word Frequency and Item Familiarity on Naming Performance in Alzheimer's Disease.
Frequency refers to how often words appear in text whereas familiarity reflects the extent to which individuals think about or encounter items in their everyday experience. The influence of these two variables on the naming performance of patients with Alzheimer's disease (AD) was examined. Sixteen AD patients named items whose printed referents occurred infrequently in English but whose familiarity was systematically varied. Accuracy significantly improved as the items became more familiar. Frequency, however, also affected performance. Items with high frequency names were identified more accurately than those with low frequency names. Thus, both word frequency and familiarity affect

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naming performance in AD. The results are discussed in terms of lexical access and semantic identification models.

F.W. UNVERZAGT, M.R. FARLOW, A.M. TORKE, & B. GHETTI. Neuropsychological Functioning in Gerstmann-Straussler-Scheinker Disease and Alzheimer's Disease: A Preliminary Report.
Gerstmann-Straussler-Scheinker disease (GSS) is an inherited prion disease characterized clinically by presenile onset of progressive ataxia, pyramidal and extrapyramidal signs, and dementia. Neuropathologically, GSS is characterized by extra-cellular amyloid deposition in the cerebrum and cerebellum, and in one family, the Indiana kindred (IK), neurofibrillary tangles in a distribution similar to Alzheimer's disease (AD). Individuals with GSS from the IK were compared to AD patients on a battery of clinical neuropsychological tests. GSS patients were significantly more impaired than AD patients on several tests including: verbal fluency, constructional ability, simple sequential tracking, and manual motor functioning. Both groups experienced similar levels of intellectual decline. Similar frequencies of impairment, but not necessarily levels of dysfunction, were noted in memory and naming tests. Results are discussed as they relate to neuropathology.

F.W. UNVERZAGT, M.R. FARLOW, S.R. DLOUHY, A.M. TORKE, & B. GHETTI. Neuropsychological Functioning in Affected and At-Risk Gerstmann-Straussler-Scheinker Disease Patients.
Gerstmann-Straussler-Scheinker disease (GSS) is an inherited prion disease characterized clinically by presenile onset of progressive ataxia, pyramidal and extrapyramidal signs, and dementia. Inheritance is autosomal dominant. Neuropathologically, GSS is characterized by extracellular amyloid deposition in the cerebrum and cerebellum. To date, no formal neuropsychological studies of the cognitive changes associated with GSS have been reported. We present neuropsychological data on 31 at-risk and 3 affected members of a large kindred with GSS. Affected GSS subjects had very high rates of clinically significant impairment. These patients show a mild dementia syndrome early in their course with a common tetrad of deficits marked by IQ decline, verbal memory impairment, poor verbal fluency, and manual motor incoordination. Several at-risk subjects had high frequencies of impairment in a pattern similar to the affected subjects. A high percentage of these are gene-carriers showing "presymptomatic" deficits.

M.E. NICHOLS, K.J. MEADOR, & D.W. LORING. Progressive Subcortical Gliosis: A Rare and Heterogenous Form of Dementia.
In recent years, there has been increasing recognition of an uncommon idiopathic dementia which presents insidiously in young adults, with progressive personality changes and variable forgetfulness. Nonspecific global deficits are present on neuropsychological testing. Histologically, these cases have all been characterized by a severe diffuse subcortical astrocytosis with variable cortical involvement, in the absence of any pathologic changes associated with other identifiable etiologies. We present the case of a 35-year-old man with historic, physical, and biopsy findings consistent with this diagnosis. This case is the first report with MRI findings. Despite severe subcortical gliosis on biopsy, no white matter abnormalities were noted on MRI, just diffuse atrophy. Identification of the varied presentations of this unusual gliotic degenerative dementia may facilitate its diagnosis in the future.

M. NICHOLAS, L.K. OBLER, R. AU, & M.L. ALBERT. Naming Errors in Alzheimer's Disease and Normal Aging: Ratings of Semantic Relatedness.
Investigations into the mechanism of the naming impairments in Alzheimer's Disease and in normal aging have contrasted semantic system deterioration in dementia to lexical retrieval problems in aging. In this study, five raters scored error responses on the Boston Naming Test produced by 17 mildly and 16 moderately demented Alzheimer's subjects, and 30 healthy elderly and 24 young controls, using a five-point scale of semantic relatedness. Probable misperceptions and no-responses were not rated. Although the demented groups produced more errors and misperceptions, their errors were not rated as different from controls' errors on the semantic relatedness scale. Our findings are not consistent with the hypothesis that those with dementia of the Alzheimer type experience gradual loss of semantic information.

J. BORTZ & A. KASZNIAK. Interpretation of Situational Affect in Alzheimer's Disease.
Patients with Alzheimer's disease (AD) demonstrate impairment on many types of semantic memory tasks, including those involving the interpretation of emotional cues (e.g., Allender & Kaszniak, 1989). Mechanisms mediating semantic competence in AD have been debated. One explanation is that the fundamental store of semantic knowledge is lost to the disease process itself. Alternatively, it has been proposed that such deficiencies result from inefficient lexical search and access. We administered three versions of an affect interpretation task to 18 AD patients and 20 controls. Encoding procedures were varied across trials. Facilitation effects were documented in all groups. These findings support the hypothesis that semantic stores of affect knowledge and their associations are preserved in AD, but may be severely disorganized or inefficiently accessed.

C. SOCHA-GELGOT, D.L. CHUTE, M.V. SPIERS, B. WEISS, & D. LIBON. An Assessment of Retrograde Amnesia in Senile Dementia of the Alzheimer's Type and Vascular Dementia.
In this study, remote memory performance in 15 patients with Alzheimer's Disease (AD) and 15 patients with cerebrovascular dementia (CVD) was compared to a healthy control group. The Boston Remote Memory Battery, Goldberg Barnett Remote Memory Questionnaire, Kimura Recurring Figures Test, Mini-Mental State Exam, California Verbal Learning Test (9-word version), Boston Naming Test, Geriatric Depression Scale—Short Form, and the reading subtest of the Wide Range Achievement Test-Revised were administered to all subjects. Results indicate that: (1) elderly controls performed significantly better than the AD and CVD groups on anterograde measures; (2) the CVD group did not perform better than the AD group on most anterograde memory measures; (3) no significant differences were found between groups on anterograde non-verbal memory measures; (4) control subjects performed significantly better than the AD and CVD groups on remote memory measures across all decades; and (5) the AD and CVD groups did not differ significantly on remote memory measures across recent and remote decades. Overall, both demented groups exhibited a preservation of older memories with a "soft" temporal gradient noted for more recent decades. Both theoretical and clinical implications are discussed.

S.A. JOHNSON, J.R. SADEK, J.S. PAULSEN, N. BUTTERS, D.P. SALMON, & M.R. SWENSON. Sparing of Verbal Recognition in Late Stage Huntington's Disease.
Thirty-six patients with Huntington's Disease (HD) and 36 patients with Alzheimer's Disease (AD) were administered the Mattis Dementia Rating Scale (DRS) and the California Verbal Learning Test (CVLT). Each group of patients was divided into three equal subgroups (mild, moderate, and severe) based upon severity of dementia. All measures of the CVLT were examined to determine which verbal learning indices best differentiated HD and AD patients at various levels of dementia. In the mildly impaired group, HD patients showed more intact learning, greater benefit of recognition format, semantic clustering, fewer intrusions, and fewer false positive responses. As dementia severity increased, there were fewer measures that differed between groups. Number of false positive errors and a recognition versus recall contrast measure remained different at all levels of dementia severity. These results support previous findings that AD and HD patients' memory deficits are distinctly different and easily differentiated. More specifically, the present study extends

our understanding of verbal learning and memory characteristics by validating a relative sparing of recognition memory in later stages of HD.

S. WOOD, M. HISCOCK, K.F. MORTEL, B. BREITMEYER, & J.S. CAROSELLI. Perception and Utilization of Color by Patients With Mild to Moderate Alzheimer's Disease.

The ability to utilize color was investigated in 12 patients with mild to moderate probable Alzheimer's disease (DAT) and 12 age and gender matched normal controls. All were tested for visual acuity as well as red/green and yellow/blue color vision. Subjects completed a modified Raven's Matrices task under four conditions: no color, color-as-attention-enhancer, color-as-aid, color-as-distracter. The groups were equivalent in visual acuity and color vision. DAT patients performed less accurately than controls in all four conditions of the cognitive task. Both groups performed best in the color-as-aid condition and worst in the color-as-distracter condition, with effects significantly greater for the DAT group. Results indicate that color is a potent stimulus attribute for DAT patients.

D.E. TUPPER, J. HAWKINS, & M. NANCE. Tinkertoy and Executive-Motor Correlates of Stage of Huntington's Disease.

Huntington's Disease (HD) patients represent an important group for research into the nature of frontal-subcortical relationships in the brain. This study was designed to relate performances on the Tinkertoy Test (TTT) as a measure of executive functioning to stage of HD progression, as well as to explore the relationship of the TTT to motor decline in HD and to other neuropsychological measures. Seventy confirmed HD patients, stages 1 to 4, were given a battery of neuropsychological and executive measures. Using ANOVAs, only four variables (TTT Number of Pieces and Complexity, Dominant and Nondominant hand Pegs) showed significant relationships to stage of HD. Results suggest that measures of executive-motor functioning relate to stage of HD but that frontal-executive and pure constructional tasks do not. Implications for subcortical versus cortical executive deficits are discussed.

L. FREEDMAN, W.G. SNOW, & C. MILLIKIN. Anomia in Alzheimer's Disease.

The incidence of anomia and its relationship to intellectual and verbal ability was determined in a sample of 97 subjects diagnosed with probable Alzheimer's disease (AD). Using a cutoff score of ≤49 on the Boston Naming Test (BNT) yielded an 80% incidence of anomia. An incidence of 70% was obtained employing a lower cutoff of ≤47. The nonanomic subsample exhibited statistically higher scores on FSIQ, VIQ, PIQ, and animal fluency (AF) than the anomic subsample. Modest correlations were obtained between BNT scores and FSIQ, VIQ, PIQ, and AF (r's range .44–.59). Phonemic fluency (FAS) was weakly related to naming ability ($r = .19$). These data suggest that a high incidence of anomia exists in first-time tested AD patients and that naming ability may have clinical value as a marker of disease stage in this disorder.

D.X. RASMUSSON & J. BRANDT. Stability of Asymmetric Patterns of Cognitive Performance in Alzheimer's Disease.

Fifty-nine probable AD patients were assessed at six mo intervals for 1.5 yr in order to determine whether any showed greater verbal than visuospatial impairment or vice versa. Over half of the patients met criteria for cognitive asymmetry on one or more assessments. However, only nine (15%) met criteria on all three visits (not greater than expected by chance). All asymmetric profiles by the same patient on two or more visits were in the same direction. Low Verbal, Low Spatial and Symmetric groups did not differ on any clinical or demographic variables at entry. Contrary to earlier findings of greater verbal impairment in early onset cases, Low Spatial patients tended to have the earliest age of onset, and Low Verbal patients the latest. Limited autopsy data suggests that asymmetric patients were more likely to have neuropathologic markers for AD plus other conditions (i.e., Parkinson's disease or multiple infarctions).

A. CHAN, N. BUTTERS, D. SALMON, & S. JOHNSON. Predicting the Rate of Deterioration in Alzheimer's Disease: An Application of the Pathfinder Analysis.

Progressive deterioration in cognitive functioning is a hallmark of Alzheimer's disease (AD). Despite its progressive nature, our understanding of how to predict the rate of decline is limited. The present study examined the relationship between the degradation of semantic memory in these patients and their future rate of cognitive decline. The Pathfinder analysis was used to generate the semantic network for each patient. Each network was then compared to that of normal subjects resulting in a similarity index representing how deviant a patient's semantic network is from that of normal individuals. The network similarity index, as shown by a regression analysis, could predict the rate of decline with high accuracy ($r = .91$). These results suggest that measures of the structural disorganization of semantic memory may be most useful for predicting the rate of progression of this disease.

C. FENNEMA-NOTESTINE, A. CHAN, D. SALMON, W. HEINDEL, & N. BUTTERS. A Comparison of Reaction Time and Word Stem-Completion Priming Paradigms.

Investigators have suggested that priming within certain reaction time and long-term priming paradigms (e.g., word-stem-completion) is mediated by semantic memory. However, the performance of patients with Alzheimer's disease (AD) on such priming tasks has been used both to support and to refute a possible breakdown in semantic knowledge in AD patients. That is, AD patients' impairments on long-term priming tasks have been interpreted as arising from deficits in the structure of semantic knowledge, whereas these patients' normal performance on reaction time measures have suggested to some that semantic knowledge is intact. This suggests that the two tasks are not mediated by the same underlying neuropsychological processes. To further examine this notion, the present study compared reaction time and stem-completion priming within a group of elderly subjects. Results revealed that performance on these two types of priming tasks was not significantly related. That is, performance on reaction time priming measures did not predict performance on the stem-completion priming task, even with the delay in the reaction time paradigm. This indicates that reaction time and long-term priming tasks which both appeared to tap semantic memory may, in fact, involve different underlying processes.

B. COLLINS, A. TELLIER, L. DELLA MALVA, J.R. NAVARRO, & J. VERDON. The Differential Validity of Neuropsychological Measures in the Prediction of Financial Competence Among Elderly Subjects With and Without Cognitive Impairment.

The purpose of the current study, using data collected as part of the Canadian Study of Health and Aging (a nation-wide epidemiological study), was to evaluate the relative effectiveness of a number of rationally-selected neuropsychological variables in predicting competence to handle financial affairs among elderly Canadians with and without cognitive impairment. Functional ratings obtained from close informants were used to classify subjects into "No Difficulty" and "Difficulty" groups. The single function obtained on discriminant function analysis was highly significant and predicted group membership with 86% accuracy. Selectivity was very high (92%). Sensitivity of 78% was less impressive. Of the various neuropsychological functions examined, sustained attention, secondary memory, and psychomotor speed appeared to be most strongly related to ability to handle one's financial affairs. However, in combination, measures of these processes accounted for only about 50% of group differences. This finding, in conjunction with the modest sensitivity of the discriminant function, indicates that other factors play a role in determining functional status in this sphere and suggests the need for specific functional assessment in evaluation of financial competence.

D. DEMAREST, M. HAUT, M. FRANZEN, R. KEEFOVER, & E. RANKIN. Assessment of Functional Status in Dementia of the Alzheimer's Type.

Evaluation of functional status is critical in the evaluation of patients with dementia and has many outcome implications. This study investi-

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gated a scale directly assessing functional status and compared the performance of mild and severe dementia subgroups. The Direct Assessment of Functional Status (DAFS) was administered to 43 individuals referred for evaluation to a multi-disciplinary dementia clinic and 35 normal controls. Subjects with DAT generally were more impaired on all variables compared to controls. Subjects with Mild impairment did not differ from controls on DAFS Time, Communication, Financial, Grooming, and Eating subscales. Functional deficits may evolve over time. Longitudinal studies should be conducted. More sophisticated ways to assess loss of functional skills need to be developed for patients with DAT who have mild cognitive impairment.

D. HUGHES, C.M. FILLEY, & C.M. CULLUM. Executive and Memory Functions in Delusional and Non-Delusional Patients With Alzheimer's Disease.

Delusions are the most frequent psychotic phenomena in Alzheimer's Disease (AD). It has been suggested that greater cognitive deficits may be associated with the occurrence of delusions in AD, although this issue has not been thoroughly explored. To assess whether memory and executive function deficits per se are associated with delusions in AD, the Hopkins Verbal Learning Test (HVLT) and the Stroop test (Victoria version) were administered to 10 delusional and 10 non-delusional AD patients equated for level of dementia. Results revealed that delusional patients did not differ from non-delusional patients on measures of memory or executive function given similar levels of dementia. These findings may suggest more complex relationships between specific cognitive abilities and the development of delusional phenomena. Moreover, they underscore the need for further study of potential neuropsychological underpinnings of delusionality in AD.

J.V. FILOTEO, D.C. DELIS, M.J. ROMAN, N. BUTTERS, D.P. SALMON, T.L. DEMADURA, J.S. PAULSEN, & M. SWENSON. Mechanisms of Visual-Perceptual Deficits in Patients With Huntington's Disease or Alzheimer's Disease.

This study investigated the visual-perceptual abilities of patients with Huntington's disease (HD) and Alzheimer's disease (AD) using a global-local divided attention task. Subjects were presented global-local stimuli (e.g., a larger "3" made up of smaller "1"s) and asked to identify targets regardless of whether they appeared at either the global or local levels. The results indicated that, compared to normal controls, both the HD and AD patients were impaired in identifying target stimuli on this task, with the AD patients showing greater impairment than the HD patients. When the target stimulus changed hierarchical levels across consecutive trials, the AD patients were significantly slower in responding to the second of the two consecutive trials as compared to the HD patients and the normal controls. These results suggest that the AD patients are impaired in disengaging their attention. In contrast, the HD patients performed similarly to the normal control subjects in terms of their speed in responding to the second of two consecutive stimuli. Correlational analyses indicated that the AD patients' impairment in disengaging attention was significantly related to their accuracy in identifying target stimuli, whereas the HD patients did not demonstrate such a relationship. These results suggest that a deficit in disengaging attention may underlie the visual-perceptual deficits in AD patients, whereas an impairment in covert attention may not be associated with HD patients' visual-perceptual deficiencies.

M.-E. MEADOWS, R.A. COHEN, B. O'DONNELL, M. MOONIZ, & D. DRACHMAN. The Predictive Ability of Electrophysiological and Neuropsychological Testing on Functional Outcome in Dementia.

The predictive value of event-related potentials (ERPs) and neuropsychological (NPSY) data on subsequent functional outcome was assessed. We used a structured telephone interview to ascertain the outcome of patients ($n = 25$) on 7 functional dimensions four years after the initial study (O'Donnell et al., 1990). Separate analyses of the ERP and NPSY data showed that the P300 was a significant predictor of 4 functional outcomes (alive, recognition of family members, continence and institutionalization). Significant NPSY predictors included the logical memory, orientation, picture completion and digit span subtests on the outcome variables continence, recognition of family members, adequate ADLs, adequate communicative abilities, and institutionalization. When both the ERP and NPSY data were used as predictor variables, the NPSY data was a better predictor of functional outcome.

S. STARKSTEIN, R. MIGLIORELLI, A. TESÓN, L. SABE, S. VÁZQUEZ, & R. LEIGUARDA. Cerebral Blood Flow (CBF) Correlates of Disinhibition in Patients with Mild Dementia.

Objective: To examine the CBF correlates of disinhibition in patients with dementia using SPECT with TC 99m-HMPAO. *Methods:* We carried out TC 99m-HMPAO SPECT scans in 8 patients with mild dementia who met the Gustafson and Nilsson's criteria for disinhibited behavior (i.e., personality changes, breakdown in social conduct, impulsivity, unconcern, hypergraphia, and stereotyped and perseverative behavior), 8 patients with mild dementia and no behavioral changes, and 8 age-matched normal controls. *Results:* A 3-way-ANOVA with repeated measures (group × side × region) showed a significant group × region interaction ($F(12,126) = 3.74$, $p < .0001$). Patients with disinhibition and mild dementia had a significantly lower CBF in the orbitofrontal cortex, temporal basal cortex, and basal ganglia than both patients with mild dementia but no disinhibition and normal controls. Patients with disinhibition and mild dementia showed significant ventral-dorsal CBF asymmetries in the frontal (orbital < dorsolateral) ($p < .01$) and temporal lobes (basal < lateral) ($p < .01$). *Conclusion:* The present study demonstrated that disinhibited behavior in patients with mild dementia may result from dysfunction in orbitofrontal and basotemporal cortical areas.

S.E. STARKSTEIN, R.G. ROBINSON, R. LEIGUARDA, & T.J. PREZIOSI. Anxiety and Depression in Parkinson's Disease.

Objective: To examine the presence of anxiety and depression in patients with Parkinson's disease (PD). *Methods:* We examined a consecutive series of 40 patients with PD who attended the neurology clinic. The psychiatric evaluation consisted of the Present State Exam, the Hamilton Depression and Anxiety Scales, the Mini-Mental State Exam, the Social Ties Checklist, and the Northwestern Disability Scale. *Results:* 21 patients (52%) met DSM-III criteria for generalized anxiety disorder. While sixteen of these 21 anxious patients were also depressed, only 4 of the 19 nonanxious patients were depressed ($x^2 = 14.7$, $df = 1$, $p < .01$). Depression, but not anxiety, was significantly associated with great deficits in activities of daily living, and greater cognitive impairments. *Conclusion:* This study showed 3 main findings. First, 40% of a consecutive and non-selected series of patients with PD had a generalized anxiety disorder. Second, while anxiety was significantly associated with depression, some patients showed anxiety in the absence of depression. Third, while depression was significantly associated with long duration of illness and more severe cognitive and physical impairments, anxiety was not associated with greater impairment.

J.J. DUNKIN, S. OSATO, A.F. LEUCHTER, & A. LARUE. Relationships Between EEG Power and Coherence and Neuropsychological Tests in Dementia.

Recent developments in the quantification of EEG has led to the computation of potentially more powerful indices of brain function, but has also led to confusion in the determination of which measure is the most appropriate for a given purpose. In this study, we examined relationships between neuropsychological tasks and EEG absolute power, as assessed by microvolts squared, and EEG coherence, a measure of the synchronization of the EEG signal between two brain sites, in subjects with dementia. Using a multiple regression model, we examined these relationships while controlling for age and overall level of impairment. Results indicate that coherence was more powerful and specific in localizing brain impairment than power, which appears to be a global, but not specific indicator of encephalopathy. It is concluded that coherence is a better measure for localizing brain function since it assesses func-

tional communication between brain areas used simultaneously in the performance of complex tasks.

G.E. SMITH, R.J. IVNIK, & J.F. MALEC. MAYO Cognitive Factor Scale (MFCS) Scores: Derivation, Norms, and Preliminary Studies of Clinical Utility.

We have confirmed a 5-factor model to account for the covariance structure of a "core battery" of the WAIS-R, WMS-R and AVLT administered to older persons. In the present study, factor scores from this model, for an independent clinical sample of 169 older patients, were used in multiple regression analysis to derive the minimal set of subtests necessary to explain most variance in the full factor scores. Administration 17 of the 24 combined WAIS-R, WMS-R and AVLT subtests appears sufficient to achieve >80% shared variance. These subtests provide a "short battery" for the calculation of MAYO Cognitive Factor Scale (MCFS) scores. MCFS scores from the diagnostic evaluation of patients who subsequently received neuropathological confirmation of Alzheimer's Disease or normal aging support the utility of these scores.

M. SANO, L. BERKMAN, A. LAWTON, J. WILSON, & Y. STERN. Relationship of Quality of Life (QOL) to Severity of Dementia in Alzheimer's Disease.

In order to examine QOL in patients with AD we used the Sickness Impact Profile (SIP), a behavior based inventory used to assess health status in patient populations. We administered a surrogate version of the SIP to the caregivers of 45 patients with Alzheimer's Disease (AD) who were screened for clinical trials and found to be medically healthy. The SIP provides 12 category scores and 2 dimension scores; each ranges from 0 to 100% dysfunction. Maximum dysfunction was found in the psychosocial dimension (29.4) and in the categories of Alertness Behavior (65.4) and Social Interaction (24.7). However, these domains were not correlated with disease severity. Dysfunction on the physical dimension was low (7.4) but it was significantly correlated with disease severity ($r = .435$; $p > .01$). These results 1) demonstrate maximum dysfunction in AD in psychosocial areas and 2) indicate there may be an increasing dysfunction in the physical dimension of QOL with increasing severity even when patients remain medically healthy.

J.T. BECKER, J.R. HODGES, K. GRAHAM, K. DOYLE, & S.T. DEKOSKY. Semantic Dementia: Neuropsychological and Neuroradiological Evidence from Case G.C.

Semantic Dementia describes a progressive deterioration in cognitive functions, most notably semantic memory. We report here a patient in whom detailed neuropsychological and neuroradiological data are available. G.C.'s cognitive functions were marked by a consistent inability to access information about words, objects, or concepts, regardless of the modality of inquiry. An important consequence of the loss of semantics was a severe surface dyslexia, where meaning was no longer able to support the reading of irregular words. MRI scan of the head revealed focal left temporal lobe atrophy, and a SPECT scan revealed global low flow, most marked over the left temporal region. These findings reveal important information processing defects, and are consistent with previous work suggesting that this syndrome is due to Pick's disease.

L. HORN, C. ORTEGA, C. COHEN, A. STRASHUN, & Y. LAU. Clinical-Demographic, Neuropsychological and NeuroSPECT Correlates of Hallucinations and Delusions in Dementia.

Correlates of psychotic symptoms were investigated in a sample of 66 outpatients with senile dementias, 25% of whom had a prior psychiatric history. We studied visual and auditory hallucinations and two types of delusions: that one's possessions are being stolen ("stealing") and that one is not in one's own home ("not home"). Visual hallucinations were associated with decreased cognitive function, as indicated by Mini Mental State (MMS) score, prior psychiatric history and low education; on neuropsychologic exam drawing from a model was impaired. Auditory hallucinations were associated with unskilled work history and with decreased right hand performance on Purdue Pegboard. "Not home" delusions were associated with prior history of psychiatric disorder, low MMS scores and slowing of the right hand on the Purdue. "Stealing" delusions were more common in black than in white Ss and were not associated with cognitive deficit. The relationship between neuroSPECT data, neuropsychologic findings and psychiatric symptoms is presented.

D.A. CAHN, A.U. MONSCH, D.P. SALMON, N. BUTTERS, W.C. WIEDERHOLT, & E. BARRETT-CONNOR. Discrimination of Alzheimer's Disease From Normal Aging by the Clock Drawing Test in a Community-Dwelling Sample.

Previous studies have reported that the Clock Drawing Test (CDT) is highly effective in detecting cognitive impairment and have proposed the test as a screening instrument for dementia. Because these studies used optimally-healthy normal control subjects, the reported classification rates may have been artificially inflated. This study reports the sensitivity and specificity of the CDT for detecting dementia in a community-dwelling sample of elderly subjects. Forty-two patients with clinically diagnosed Alzheimer's disease and 237 cognitively intact subjects were administered the CDT. When qualitative elements such as errors and strategies were incorporated into the CDT score, the sensitivity was 84% and the specificity was 72%. Although lower than previously reported values, the present results suggest that the CDT may be a useful screening instrument in community samples. However, much better discriminability was achieved with the DRS, indicating that functions such as memory and verbal fluency should be assessed during screening.

A. COO, R. AU, R.F. WHITE, J. COBB, P.A. WOLF, & R.B. D'AGOSTINO. Age & Education Adjusted MMSE Norms in the Framingham Study.

Age and education have been shown to affect Mini-Mental State Exam performance (MMSE), making the use of a single unadjusted cut-off score of questionable validity in diagnosing dementia. We examined the impact of these factors by administering the MMSE to 2,077 elderly subjects participating in the community-based Framingham Study. MMSE scores were examined for individuals with and without dementia, and divided into age and educational strata. Cross-sectional analyses indicated age and education had a significant influence on MMSE scores even when probable dementia cases were excluded. Our data report an age associated decline influenced by educational status both in individuals with and without dementia. We conclude that age/education adjusted norms would improve diagnostic accuracy, particularly in persons with <7 years of education.

A. FOUNDAS, B.L. MACAULEY, A.M. RAYMER, L.M. MAHER, L.J.G. ROTHI, & K.M. HEILMAN. Apraxia in Alzheimer's Disease.

Studies of patients with brain damage suggest that the praxis systems, which primarily mediate transitive gestures, are located in the left hemisphere of right handers. The neurological substrates of Alzheimer's disease and strokes are different, which may cause these patients to demonstrate different behaviors. On a gesture to command task, the Alzheimer and stroke patients were significantly impaired as compared to the controls. Alzheimer and stroke patients were equally apraxic, and did not differ in their performance of transitive gestures. The Alzheimer patients, however, were significantly more impaired than the stroke patients on intransitive gestures. Within the Alzheimer group we found a significant positive correlation of degree of dementia and degree of language deficits to degree of apraxia. This suggests that in Alzheimer's disease a partial degradation in the central conceptual system may mediate deficits in memory, language, and praxis systems.

J.H. RICKER & M.W. JACOBSON. Visuoperception and Visual Memory Vascular Dementia.

This study investigated the relationship between visuoperception and visual memory in ischemic vascular dementia (IVD). Twenty subjects

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(mean age = 79.6) with probable IVD were administered measures of perceptual skills and visual memory. Hierarchical multiple regression indicated that perception contributed significantly to variance in recognition memory for novel faces. This was not found for recognition of famous faces. Results are comparable to previous reports in young, elderly, and Alzheimer's disease subjects. Results imply that perceptual deficits exert greater impact on the memory process during encoding, rather than recognition of remote visual information, suggesting that remote visual memories are activated through systems different from those used in acquisition.

H. COHEN, M. LAFRAMBOISE, & A. LABELLE. Dysprosody in Parkinson's Disease.
Cohen et al. (1993) had found that timing aspects of speech were impaired in PD. In this study, we investigate whether another aspect of prosody, accuracy—producing appropriate intonation for declarative, imperative and interrogative sentences—is also affected in PD. Twenty PD and 11 control subjects produced 18 sentences (2 presentation conditions [auditory, visual] × 3 linguistic modes × 3 sentences) each. We hypothesized that appropriate intonation of sentences presented in the visual modality would be more difficult to produce for PD patients. ANOVA performed on F_0 measures extracted from the digitized speech samples revealed that PD subjects' production of intonation was significantly impaired, but only when they were required to read the sentences. The data suggest that intonation is another motoric aspect of prosody that is impaired in conditions that approximate natural speech production. This specific modulation deficit in the execution of linguistic and communicative operations in PD suggests one of the ways in which we can better evaluate and appreciate the role of subcortical structures in cognitive functioning subserved by frontal and prefrontal cortical regions.

S. BOUCHARD, H. COHEN, H. WHITAKER, & P. SCHERZER. Verbal Logical Reasoning in Parkinson's Disease.
Cognitive impairment appears to be a common feature of Parkinson's Disease (PD). With respect to language, deficits in fluency, memory and comprehension of verbal material are the more common findings in PD. Not much attention, however, has been directed at more complex language functions such as logical reasoning. In this study, we compared the performance of 38 nondemented PD and 19 control subjects on a complex test of verbal logical reasoning. Problems were of four logical forms within three types of premises (i.e., counterfactual, realist with/without counterexample). Results showed that the groups differed in the type of errors made with PD subjects choosing more often conclusions that are contrary to premises. This may reflect an alteration of logical reasoning capacities in PD rather than a general cognitive impairment due to the complexity of the task. In this light, the possible role of subcortical nuclei in complex cognitive functions such as reasoning is of particular interest. Whether this participation in complex cognitive functions is accomplished directly or indirectly via connections with the prefrontal cortex or is the consequence of prefrontal involvement in PD has yet to be clarified.

P. MCNAMARA, M. KRUEGER, & R. DURSO. Sentence Comprehension in Parkinson's Disease: A Comparison with Broca's Aphasics.
In this study we asked whether language-related abnormalities in Parkinson's Disease (PD) might be related to a deficit in grammatical knowledge. *Methods:* There were 5 Broca's aphasics, 10 Parkinson's and 10 healthy controls. Subjects were asked to 1) provide grammaticality judgments for sentences which contained either an argument prepositional phrase (PP) or an adjunct PP, and 2) answer questions (from memory) about the thematic roles in a target sentence. *Results:* There were no significant differences between PD patients and aphasics on the sentence memory test but PD patients, like healthy controls, judged both adjunct and argument sentences correctly while aphasics made significantly more errors on adjunct sentences. *Conclusions:* Language abnormalities in PD may not be due to a deficit in grammatical knowledge.

M.J. ROMAN, D.C. DELIS, J.V. FILOTEO, T.L. DEMADURA, N. BUTTERS, D.P. SALMON, & C.S. SHULTS. Performance in Patients With Parkinson's Disease on a Global-Local Reaction Time Task.
Visuoperceptual processing in patients with Parkinson's disease (PD) was investigated using a global-local reaction time task. Stimuli consisted of a large number (global level) composed of smaller numbers (local level); these stimuli were either "consistent" (same number at both global and local levels), or "inconsistent" (different numbers at the two levels). Subjects were instructed to focus on either the global or the local level and identify the number at that level. Relative to controls, the PD group was impaired in identification of inconsistent stimuli at the global level. In an exploratory analysis, PD subjects were divided into subgroups based on their relative performance on traditional clinical tasks of verbal and visuoperceptual ability, and their global-local task performance was compared to controls. The "High Verbal" PD subgroup demonstrated impaired processing of inconsistent stimuli at the global level, whereas the "High Spatial" PD subgroup did not display visuoperceptual deficiencies. Results suggest that visuoperceptual functioning in PD may vary as a function of the disparity between patients' visual and verbal skills.

R. FAMA & R.A. BORNSTEIN. Contextual Verbal Memory Performance in Parkinson's Disease.
This study further investigates serial position effects in Parkinson's Disease (PD) and addresses the potential confound of bradyphrenia in the interpretation of previous findings. Eighteen subjects with idiopathic PD and 14 healthy controls were compared on a contextual verbal memory test. Subject groups did not differ in terms of age or education. No significant differences between the PD and control groups were found, although trends were noted on the immediate recall condition. These findings differ from those previously reported, particularly for the delayed recall condition. The influence of bradyphrenia on learning and recall of contextual verbal material in PD and on other neuropsychological measures will be addressed.

R. FUCETOLA & M.C. SMITH. Utilization of Sensory Feedback and Learning in Parkinson's Disease.
The goals of this study were: (1) to investigate the manner in which Parkinson's disease (PD) subjects utilize kinesthetic and visual feedbacks on a novel drawing task, and (2) to see whether PD subjects are impaired in learning the task. With a pressure-sensitive pen, 20 older adult controls and 20 PD subjects copied a series of figures onto a digitizer tablet under various feedback conditions. Results suggest PD subjects have difficulty maintaining and learning to improve the size and speed of drawing under some distorted feedback conditions. However, under other conditions they are able to improve their performance over time at a level comparable to that of controls. Basal ganglia disease may impair the ability to effectively utilize kinesthetic feedback and make some types of learning difficult under conditions in which this feedback is distorted.

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AGING

M. BEST, R. AU, L.K. OBLER, & M.L. ALBERT. Vocabulary Decline in Normal Aging: A Longitudinal Perspective.
Previous research on vocabulary ability in elderly populations found that vocabulary skills remain stable as people get older. However, a qualitative analysis of vocabulary performance suggests an age-related decline. This study examined the qualitative nature of this decline and how these results fit into current theories of lexical retrieval in the aging population. Subjects were 27 men and women whose initial ages ranged from 61–80. All subjects were administered the vocabulary subtest of the WAIS-R twice, with a 7 yr inter-test interval. Using an expanded

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qualitative scoring protocol we found an age-related decline in vocabulary performance, characterized by a decline in superior responses and an increase in inferior responses. We conclude that this pattern of decline reflects a breakdown in lexical retrieval.

C. BARTH, M. NICHOLAS, R. AU, L.K. OBLER, & M.L. ALBERT. Verb Naming in Normal Aging.
The ability to name objects declines with age (Borod, Goodglass, Kaplan, 1980), as does the ability to recall proper names (Cohen, 1990). To determine whether age similarly affects verb access, the Action Naming Test (Obler and Albert, 1979) was administered to 66 subjects, initially ages 30–79, three times in seven years. All groups except the thirty year olds significantly declined on items correctly named before cues. We found a pattern of error responses that differed from that reported for object naming. Our results suggest differences in cognitive organization and/or processing for verbs and nouns in normal aging.

A.K. TROYER, R.E. GRAVES, & C.M. CULLUM. Executive Functioning Mediates the Relationship Between Age and Recent-Memory Recall Among Healthy Older Adults.
Normal aging is characterized by declines in executive functioning (EF) and in recall from recent episodic memory, yet little is known about the possible interactions between these abilities and aging. To explore the effects of age-related differences in EF on recall, 51 subjects age 60–91 were given tests of memory and EF. Regression analyses indicated that, when considered alone, age was a significant predictor of recall ($p < .001$); however, age was not a significant predictor of recall when the effect of EF was partialled out ($p = .37$). The unique contribution of EF accounted for 36% of the variance in recall. A significant portion of the age-related differences in episodic recent-memory recall, therefore, may be related to differences in the executive skills required for optimal performance on these tests.

M.C. TIERNEY, W.G. SNOW, & A. NORES. Utility of Verbal Fluency Measures in the Differentiation of Normal Aging From Alzheimer's and Parkinson's Dementia.
We investigated differences between groups of patients with moderate Alzheimer's Disease (AD) ($n = 16$), severe AD ($n = 27$), moderate Parkinson's dementia (PD) ($n = 12$), and age-matched normals ($n = 35$) on letter and animal fluency tests. We also examined the classification accuracy of previously reported cut-off scores for these tests. Normals performed better than dementia groups on both tests. On letter fluency, moderate AD and PD patients performed similarly and both performed significantly better than severe AD patients. However, on animal fluency, the PD patients performed better than the severe AD patients, whereas there were no differences between moderate and severe AD patients. Better classification rates were found with cut-off scores for animal than letter fluency but classification accuracies for both tests were lower than previously reported.

D. MARSON, K. INGRAM, & L. HARRELL. Neuropsychological Correlates of Competency Loss in Dementia Using a Specific Legal Standard.
Neuropsychological criteria for loss of competency are needed to assist physician decision makers who currently lack objective measures for competency assessment. The investigators developed two clinical vignettes which reliably and validly test subject competency (medical treatment decision capacity) under a specific legal standard (capacity "to understand" treatment situation and choices). Thirty subjects (10 normal elderly and 20 AD patients) were administered the vignettes, and also neuropsychological measures theoretically linked to competency function. Measures of simple conceptualization, confrontation naming, simple auditory comprehension, verbal abstraction, and social judgment correlated strongly with the legal standard scores of AD patients ($r > .60$, $p < .003$), but not older controls. Using stepwise multivariate regression, only simple conceptualization emerged as a significant overall predictor of declining competency under the standard (mult $r^2 = .79$, $p < .0001$). The results suggested the value of neuropsychological measures for competency assessment in dementia.

Symposium 8

ASSESSMENT OF MEMORY AND ATTENTION IN CHILDREN: NEW DEVELOPMENTS

This symposium addresses theoretical and clinical issues in the assessment of memory and attention in children. The lack of reliable and valid instruments to measure these neuropsychological domains in child clinical populations has resulted in development of new assessment tools. The presentation will span a continuum of instruments from recently published tests to more experimental models. Theoretical issues concerning construct validity are addressed as well as discriminative validity in outcome studies involving children with head injuries, epilepsy, substance abuse, learning disabilities, and attention deficits. Findings indicate that these instruments offer a promising approach to improved evaluation of memory and attention in children.

J.S. HAUT & T.S. CALLAHAN. The Impact of Attentional Functioning on Memory Performance.
The Wide Range Assessment of Memory and Learning (WRAML) is a recently developed memory test for children and adolescents. Research has indicated that attentional functioning plays a significant role in performance on the WRAML; however, there is not allowance for attentional factors in WRAML scoring. Rather, performance on the WRAML is viewed as memory performance uninfluenced by attentional factors. Data are presented in support of the view that attentional functioning should be considered when interpreting WRAML scores. Theoretically, the "gray" area between attention and memory functioning may be greater in children because of developmental factors in the use of mnemonic strategies.

J. WILLIAMS, P. SATZ, & L. D'ELIA. Color Trails for Children: Sensitivity to Attentional Factors in Neurologically High Risk Groups.
The Trail Making Test is frequently used to assess attention deficits. However, this test is limited by reliance on letter recognition, lack of age and IQ based norms, and protocol alterations due to photocopying. Recently, Color Trails was developed to address these limitations. In an initial study, traditional Trails and Color Trails were found to measure the same neuropsychological domains. A second study compared performance times for children with learning disabilities, attention deficits, or mild neurological conditions. Color Trails 2 was found to be the most sensitive of the four tasks, particularly when attention deficits were present. Comparisons with normal controls indicated significantly slower times for child clinical groups on Color Trails. Results suggest that Color Trails is an effective clinical tool in child neuropsychological assessment.

K. ZAUCHA, R. ASARNOW, P. SATZ, R. LIGHT, & R. LEWIS. Assessment of Memory Performance in Children: Considerations From the UCLA Studies of Mild Closed Head Injury.
There are conflicting findings across studies as to the presence and nature of memory impairments in children experiencing mild closed head injury (CHI). This prompted the development of experimental memory measures that incorporate different aspects of memory performance (e.g., the nature of errors, temporal coding) to study 137 mild CHI, 132 other injury and 114 non-injury children. These new measures were also normed on 423 children age 8 to 16 from the Los Angeles area. As a whole, these measures show promise in discriminating subtle performance differences within the memory domain. Specifically, the number of extra- and intra-list intrusions differentiated the groups better than more customary memory measures such as overall recall.

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R. LIGHT, R. ASARNOW, P. SATZ, K. ZAUCHA, & R. LEWIS. **Assessment of Subcomponents in Attentional Functioning in Children.**
Despite the belief that attentional functions are critical in cognitive development, assessment of the construct of attention has evolved slowly. Part of the problem reflects the multifactorial nature of attention. The Continuous Performance Test (CPT) (a measure of sustained attention) and the Span of Apprehension Test (SAT) (a measure of selective attention) were used to investigate the effects of MHI in children. Preliminary data suggests minimal differences between those with MHI, other injuries, and normal controls on attentional tasks; however, developmental effects were apparent on the attentional measures. Results indicate that these computerized measures of attention assess unique variance that is not found in standard neuropsychological tests, and the two attentional tasks appear to measure different constructs.

Paper Session 18

EMOTIONAL AND SOCIAL PROCESSING

Z.C. LAI. **A Large-Scale Neurocognitive Network Proposed to Subserve the Processing of Emotional Information.**
A large-scale neurocognitive network in the right hemisphere (RH) is proposed to subserve emotional processing of environmentally delivered information including facial expressions, prosodic vocal intonation, and body gestures. Each node of the network is hypothesized to make a unique contribution to emotional processing: 1) inferior parietal lobule to apprehend motivationally significant information in the periphery; 2) superior temporal sulcus to specify affective meaning of the stimulus more precisely; and 3) orbital prefrontal cortex to hold affectively relevant information in representational memory over time. The network is dedicated for emotional processing, and is parallel, versus serial, in operation. Damage to individual nodes is proposed to result in a unique processing deficiency, discernible across experimental measures. Twenty-two subjects, from 6 to 16 years with focal brain damage, were administered a computerized battery of emotional processing measures designed to test the theory. The results and implications of this preliminary study will be discussed.

D. BOWERS, C. RICHARDSON, K.M. HEILMAN, & L. EYELER. **Dissociations Between the Perception and Production of Facial Emotions.**
Patients with focal lesions of the right versus left hemisphere were required to voluntarily produce facial expressions either to verbal command or by imitating facial expressions from photographs, coupled with a task in which they had to identify/name the facial emotions they attempted to imitate. Findings were consistent with the view that those systems that underlie the perception of facial affect are distinct from those involved in the voluntary expression of facial emotion. Although both hemispheres appear capable of executing motor programs for facial expressions, only right hemisphere lesions appear to selectively disconnect the link between accurately appraised facial emotions and the execution of targeted facial expressions. Additionally, different "behavioral" subgroups were identified which selectively characterized the right versus left hemisphere patients.

C. CIMINO, G. BEHNER, & M. ALLEN. **Asymmetries in Emotional Processing: A Comparison of Right Hemisphere, Valence and Preparatory Models.**
Three experiments tested predictions from right hemisphere, valence and preparatory models of hemispheric asymmetries in emotional processing. Selected faces from the Ekman and Frieson series were equated for inter-judge agreement on expression and within-model discriminability between expressions, a factor which has been poorly controlled in prior experiments. Using a go/no go reaction time task in which laterally presented emotional stimuli served as warning stimuli to a neutral imperative stimulus, results from reaction time and accuracy data for all three experiments most consistently supported the right hemisphere model. The present findings are discussed in relation to task demands and the importance of differentiating between perceptual versus more experiential aspects in distinguishing among neuropsychological models of emotional processing.

M.R. BASSO, B.K. SCHEFFT, W.N. DEMBER, & M.D. RIS. **Anterior Lateral Asymmetries and Emotional Expressions of Approach-Avoidance Behaviors.**
This study tested predictions from Davidson's (1992) model of emotion. According to this view, emotions are expressions of approach or avoidance behaviors, and they result from differential activation of the left and right frontal lobes; the left is specialized for approach, while the right is specialized for withdrawal. To test these hypotheses, subjects underwent a mood induction procedure, and alpha lateral asymmetries were related to changes in self-report mood scales. Since the only scales that were related to cortical arousal were those that are clear expressions of approach-avoidance behaviors, the results were robustly supportive of Davidson's model. Anxiety was associated with greater right than left arousal, while sensation-seeking was related to greater left than right activation.

L.M. GRATTAN, P.J. ESLINGER, K.E. MATTSON, D. RIGAMONTI, & T. PRICE. **Evidence for a Specialized Role of the Frontal Lobes in Social Self Awareness.**
The interpersonal difficulties associated with frontal lobe damage may be partly attributed to inaccurate self-knowledge. We tested the hypothesis that frontal lobe lesions would alter a specific type of self-awareness, i.e., social self-awareness. A behavioral competency rating scale (PCRS) was administered to 44 patients with frontal and non-frontal focal cerebral lesions and to their relatives. Analysis of patient-relative discrepancy scores for social/emotional and instrumentally based abilities indicated a double dissociation: The frontal lesion group over- or underestimated social/emotional competencies more frequently than instrumental abilities, while the non-frontal lesion group demonstrated the reverse pattern ($x^2 = 6.02$, $p = .02$). Lesion analysis suggested that orbital, polar and posterior ventromedial frontal lobe regions play a particularly important role in monitoring social self-awareness.

SATURDAY AFTERNOON, FEBRUARY 5, 1994

Paper Session 19

MEDICAL ILLNESS

R.M. CARBOTTE, S.D. DENBURG, & J.A. DENBURG. **Neuropsychological Deficits Associated With a Thrombotic Diathesis in Systemic Lupus.**
Antiphospholipid antibodies (APLA) have been associated with thromboembolic disease in SLE, manifesting in the CNS as transient ischemic attacks or cerebral infarctions. APLA may also be associated with microvascular thrombosis, causing subclinical neural compromise as reflected in neuropsychological dysfunction. We evaluated the cognitive functioning of 39 female SLE patients whose APLA status was determined on three separate occasions by coagulation assays for lupus anticoagulant. Patients who were persistently positive ($N = 12$) were compared with patients who were persistently negative ($N = 16$), transiently positive ($N = 11$) and normal controls ($N = 35$). Persistent APLA positivity was associated with generally poorer than normal performance on most vari-

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ables and with significantly poorer verbal and visual-spatial memory, fluency, productivity and motor speed as compared with the persistently negative patients and the normal controls. The transient expression of APLA was also associated with deficits, although to a lesser extent. These results suggest that a thrombotic diathesis associated with APLA plays a specific role in the development of cognitive impairment in SLE.

S.W. HENDERSON, P.J. LANGLAIS, K.M. MOSER, C. ARCHIBALD, C. WATT, W. MAZZEI, W. AUGER, P. FEDULLO, M. WINKLER, & S. JAMEISON. Neuropsychologic Sequellae Following Pulmonary Thromboendarterectomy: A Prospective Study.
Patients with chronic, major vessel thromboembolic pulmonary hypertension are treated with pulmonary thromboendarterectomy (PTE), a surgical procedure requiring prolonged cardiopulmonary bypass (4–5 h), hypothermia (20°C), and circulatory arrest (20 min/side). Physical functioning improves markedly following PTE, but no study to date has examined neuropsychologic functioning following PTE. Studies have demonstrated generalized neuropsychologic impairments following cardiac surgery. The present study prospectively examined potential differences in pre-PTE versus post-PTE neuropsychologic functioning in 38 patients (13-d retest interval). Compared to pre-PTE functioning, post-PTE patients showed mild impairments in memory, and improved simple motor skills and mood. No significant changes were seen in attention/concentration, forgetting, or verbal fluency. These results suggest that the physical and cognitive benefits of PTE far outweigh the deleterious effects.

F. INGRAM, K.G. HENKE, H.S. LEVIN, P.T. FISHEL INGRAM, & S.T. KUNA. Sleep Apnea and Vigilance Performance in Community Dwelling Older Adults.
Impaired vigilance performance has been reported in older subjects with sleep apnea syndrome (SAS). The current study is an attempt to extend these findings and to investigate additional factors which might have implications for vigilance in the older adult. Fifty-nine older adults (age: 62 ± 5 mean $\pm$ SD, range 54–75 yr; Respiratory Disturbance Index-RDI: 8.8 ± 14.4 mean $\pm$ SD, range 0–67.5) were categorized as SAS versus not-SAS based on various classification criteria (i.e., Apnea Index-AI $\geq$ 5 and 10, RDI $\geq$ 5, 10 and 15) and compared on vigilance performance as assessed by the computer program "Steer Clear." Vigilance performance did not discriminate the groups independent of how they were formed. Groups were then formed based on vigilance performance (HiVig vs. LowVig) and compared on assorted sleep variables, periodic leg movements, and self-reported hypersomnolence and depression. Only age discriminated the HiVig versus LowVig groups, accounting for 31% of the observed variance. Our findings suggest that subject selection may unintentionally bias findings regarding the neuropsychological functioning of individuals with SAS, that vigilance may be impaired only in relatively more "severe" SAS, and that severity of SAS in older adults may not be well characterized by current classification standards. Age clearly impacted vigilance performance, despite the constricted age range sampled, and should be taken into account in future research. Supported by a grant from The Moody Foundation, and by NIH grants HL 2353 and HL 27520.

G. GLOSSER, B. BIX, W. HOLMES, C. BALLAS, M. MERITZ, C. HUTELMEYER, & J. TURNER. Relationship Between Psychiatric Diagnosis and Neuropsychological Impairments in Individuals Infected with HIV.
Neuropsychological impairment and DSM-III-R Axis I psychiatric diagnoses were evaluated in a heterogenous group of HIV infected individuals ($N = 103$) and a group of seronegative individuals with similar risk factors for HIV infection ($N = 53$). Neuropsychological and psychiatric disorders were both common in the HIV infected group, but there were no relationships between these two aspects of neuropsychiatric dysfunction in infected patients. Results indicate that psychiatric disorders in HIV infected individuals tend to predate infection and decrease over time following knowledge of seroconversion suggesting that they are primarily a function of psychosocial factors; while neuropsychological disorders are specific to HIV infected patients and tend to increase over time following infection suggesting that they are due to neurological factors.

R.L. MAPOU, W.A. LAW, L.R. TEMOSHOK, K. WAGNER, J.L. MALONE, & D.R. SKILLMAN. Neuropsychological Effects of Interferon Alfa-N3 in Asymptomatic HIV Disease.
Seventeen asymptomatic HIV+ individuals were evaluated neuropsychologically before and during natural interferon-alpha (IFN) treatment. Included were measures of attention, response speed, language, visual skills, learning, memory, and mood. All 17 were evaluated twice, and ten were evaluated three times. Repeated measures MANOVA revealed only two significant effects of visit. Practice effects were found on the Paced Auditory Serial Addition Test ($p < .03$), and less improvement over trials was found on the pursuit rotor ($p < 0.01$). The reason for the latter finding was unclear, but may have reflected a ceiling effect. Individual change scores indicated that performances generally remained stable or improved across evaluations. In contrast to prior studies reporting significant neurobehavioral effects of IFN treatment, few such effects occurred in HIV+ patients treated with this form of natural IFN.

Symposium 9

CONTRIBUTIONS OF COGNITIVE NEUROPSYCHOLOGY TO THE STUDY OF DEMENTIA

In recent years many clinical neuropsychological researchers have employed cognitive theory and methods in the study of neurobehavioral disorders. These approaches have been used to characterize underlying mechanisms of cognitive dysfunction, study subtle deficits not detected by conventional clinical measures, and extend the boundaries of standard clinical assessment procedures. This symposium will focus on recent contributions of cognitive neuropsychology to the study of dementing disorders, with presentations on Alzheimer and Parkinson disease, multiple sclerosis, and HIV-1 infection. Symposiasts will discuss advances in models of dementias developed through cognitive neuropsychology and the advantages and limitations of interpretation of these measures.

D.I. MARGOLIN, D.S. PATE, & M.A. BATTISTA. Cognitive Neuroscience Approach to the Subcortical Dementia Hypothesis.
"Subcortical dementia" (SCD) is an hypothesis about how human intelligence is differentially impaired by two broad classes of neurodegenerative disease. Determining the validity of this hypothesis is an enticing challenge for cognitive neuroscientists. The techniques employed need not be complex. Using a brief, standardized cognitive sampling instrument, the Neurobehavioral Cognitive Status Examination (NCSE), we found that Alzheimer's disease (AD) and Parkinson's disease (PD) groups did have different patterns of cognitive impairment and in some subtests made qualitatively different types of errors. However, the PD pattern was not entirely consistent with the current leading description of SCD. Most notably, even very mildly demented PDs had prominent constructional deficits. There will be no easy resolution to the SCD controversy, but the multidimensional data analyses characteristic of the cognitive neuroscience approach seem well suited to the task.

S.M. RAO & P.A. ARNETT. Assessment of Executive Functions in MS Patients: Beyond the Wisconsin Card Sorting Test.
Patients with multiple sclerosis (MS) are frequently impaired on clinical measures of conceptual reasoning, such as the Wisconsin Card Sorting Test (WCST). In a previous study (Arnett et al., in press), we have demonstrated that impaired performance on the WCST is associated with lesions of the prefrontal white matter. We have recently expanded our studies of "executive functions" in MS patients by adopting several

experimental tasks derived from cognitive neuropsychology, many of which may be sensitive to prefrontal lobe dysfunction. These tasks typically assess (1) temporal processing (e.g., recency discrimination), (2) script generation, and (3) planning. To date, these functions have not been studied systematically in MS patients. Results of controlled studies involving these experimental tasks will be presented, along with a discussion of future research directions for the study of executive functions in MS patients.

E.M. MARTIN, L.C. ROBERTSON, & D.J. SORENSEN. Selective Attention in HIV-1 Infection.
Mental slowing is prominent in advanced HIV-1 infection and AIDS dementia complex. Subclinical mental slowing can be demonstrated in nondemented HIV-seropositive subjects using reaction time (RT) measures and specifically affects attentional processes. This presentation will review a series of experiments from our laboratory that examine potential mechanisms of disrupted attentional processing in asymptomatic and nondemented symptomatic HIV-positive subjects compared to matched seronegative controls. Our studies indicate that performance of cognitively effortful tasks requiring division of attentional resources is selectively affected early in the course of infection. Additional studies of divided attention in analysis of hierarchical visual stimuli are currently in progress and will be discussed.

E.N. MILLER. Cognitive Testing Using Reaction Time and Traditional Neuropsychological Procedures.
We studied the relative usefulness of reaction time (RT) testing and traditional neuropsychological procedures using a sample of 1034 men from the Los Angeles component of the Multicenter AIDS Cohort Study, half of whom were infected with HIV. Subjects were administered 4 measures of simple RT, 6 measures of choice RT, and a 30-min battery of traditional neuropsychological procedures (Trail-Making, Rey Auditory Verbal Learning, Symbol Digit, Digit Span, Verbal Fluency, Grooved Pegboard) at semi-annual intervals. Choice RT measures showed 6-mo test-retest reliability (.43–.68) comparable to that seen using the traditional neuropsychological measures (.47–.77). The RT and traditional measures agreed on classification of subjects as outliers 85% of the time, even though factor analysis showed that the RT measures formed a separate factor from the traditional measures. For subjects who developed HIV-Associated Cognitive-Motor Disorder during the study, the magnitude of decline observed on the RT tasks was comparable to the decline observed on the traditional neuropsychological tasks. Findings suggest that the RT tasks measure skills that are different from those assessed using traditional neuropsychological procedures, but that both types of measures are valuable for clinical assessment.

Paper Session 20

TOXIC EFFECTS

L. MORROW, A. LEDERER, S. STEINHAUER, & R. CONDRAY. Occupational Exposure to Organic Solvent: Neurobehavioral Effects.
Neuropsychological function and psychiatric symptomatology were evaluated in 15 journeymen painters with ongoing solvent exposure. Fifteen nonexposed persons were recruited from local unions to serve as controls. For painters, estimates of lifetime exposure to solvents was obtained with a structured interview that assessed various factors (e.g., type of paint application). The Pittsburgh Occupational Exposures Test battery, and the Symptom Checklist 90-Revised (SCL-90-R) were administered. Several neuropsychological tests, specifically those measuring learning and memory and motor speed were reduced in the painter group. In addition, the painters had significant elevations on the majority of psychiatric indices. Lifetime exposure accounted for 42% of the variance of the SCL-90-R Global Severity Index. The results suggest significant cognitive and affective changes in occupationally exposed workers. It is unlikely that the cognitive deficits are due to mood changes, as there were no significant correlations between SCL-90-R scores and cognitive test scores. The fact that exposure estimates were strongly related to self-reported psychiatric symptoms is compatible with the suggestion that affective changes may be an early manifestation of solvent encephalopathy.

K.R. KRULL, L. TIVIS, C. BLANCO, K. HAMES, & L.T. SMITH. Neurophysiological and Neuropsychological Functioning in Adolescent Alcohol Abusers.
Groups of alcohol abusing, conduct disordered, and normal control adolescents were compared on a battery of neuropsychological tests and electrophysiological measures. Tests sensitive to frontal lobe functions, and auditory and visual event-related potentials (ERPs) collected during a bimodality selective attention task were examined. Alcohol abuse and familial history of alcoholism were associated with impaired performance on neuropsychological and electrophysiological measures. The effect of alcohol abuse was greater than familial history, particularly on frontal lobe measures. The results are taken as evidence for neurotoxic effects of alcohol during periods of cortical maturation, such that cognitive processes like abstract reasoning and flexibility are more severely impaired.

P.K. SHEAR, E.V. SULLIVAN, M.D. DAVILA, B. LANE, & A. PFEFFERBAUM. Correlates of Mammillary Body and Cerebellar Abnormalities in Chronic, Nonamnesic Alcoholics.
Chronic alcoholics with Korsakoff's syndrome (KS) commonly show changes in the cerebellum and the mammillary bodies. This study used qualitative brain MRI ratings to examine the incidence and severity of cerebellar and mammillary body atrophy in chronic, nonamnesic alcoholics, as well as the relationships between those abnormalities and measures of neuropsychological ability, alcohol history, and nutritional status. Subjects were 33 alcoholic men and 20 healthy male controls. Results revealed disproportionate impairment in the alcoholic group on tests of ataxia, with a trend towards a relationship between the cerebellar vermis rating and ataxia scores. Cerebellar and mammillary body ratings were not significantly intercorrelated. In addition, 48% of these patients had mammillary body atrophy, confirming that such abnormality is not specific to amnesic alcoholics. *(Supported by DVA, AA05965, MH18905, MH30854)*

L.M. KWON, S.B. ROURKE, & I. GRANT. Intermanual Differences on Motor and Psychomotor Tests in Alcoholics: No Evidence for Selective Right Hemisphere Dysfunction.
The integrity of each cerebral hemisphere is often examined by comparing performance on each side of the body. To determine whether selective right hemisphere dysfunction is present in alcoholics, we evaluated intermanual differences in grip strength, motor speed, fine-motor dexterity, and novel non-verbal problem-solving ability in 147 recently detoxified alcoholics (RDA: mean abstinence 30 d), 80 long-term abstinent alcoholics (LTA: mean abstinence 3.7 yr), and 100 nonalcoholic controls (NAC). All subjects were right handed males, matched for age and education, and both alcoholic groups had similar drinking histories. Using percent difference scores to assess intermanual differences, we found no evidence to implicate the right hemisphere selectively. We conclude that although RDAs demonstrate some motor and psychomotor impairments, there is no evidence using these tests to suggest that the right hemisphere is selectively more vulnerable to the effects of chronic alcohol abuse.

A.I. DRAKE, T.L., JERNIGAN, N. BUTTERS, P.K. SHEAR, & S.L. ARCHIBALD. Volumetric Changes on Magnetic Resonance Imaging in Chronic Alcoholics: A One Year Follow-up.
Magnetic resonance imaging (MRI) of the brain was performed on a group of 27 alcoholics. Subjects were scanned approximately 3 wk after their last drink, and again 12–14 mo later. At the follow-up visit, 14 of the alcoholics had relapsed and 13 had remained abstinent. Although

the groups did not differ in terms of age, education, or neuropsychological testing at baseline, the abstainers tended to have greater white matter volumes and lower cortical fluid volumes than the relapsers on admission to treatment. This finding suggests that alterations in brain morphology may be predictive of treatment outcome. There were significant interactions between status and change over time for both the cortical and subcortical fluid measures. Those alcoholics who maintained their abstinence during the follow-up interval demonstrated a decrease in cortical and subcortical fluid volumes, while those who relapsed showed little change in fluid volumes. There was also a non-significant trend for abstainers to show greater increases in white matter volumes relative to the relapsers. The findings of improvement in brain structure with abstinence may, in part, account for the cognitive recovery observed in abstinent alcoholics.

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