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Poster Session 1

TBI, TOXIC EXPOSURE, ASSESSMENT, MALINGERING

S. RASKIN & C. MATEER. Neuropsychological Aspects of Mild Traumatic Brain Injury.
148 individuals with MTBI were administered a battery of tests measuring attention, memory, and executive functions. Factor analyses revealed specific aspects of these cognitive processes being measured. The attention measures loaded on factors for auditory mental control, auditory sustained attention, and visual attention. The memory measures loaded on a factor for verbal recall, and one for visual recall. The executive functions measures loaded on a factor for abstract thinking, speeded set-shifting, and planning. These factors are used to discuss aspects of MTBI and those measures that are likely to be most useful in evaluating these patients.

R.C. MARTIN, W.D. GOUVIER, & J. HAYES. The Effects of Gender and Mild Head Injury Within a College Student Population on a Measure of Verbal Learning and Memory.
Research has highlighted the need for investigation of potential learning and memory difficulties within college populations having experienced mild head injury (MHI). The present study examined performance on the Rey Auditory Verbal Learning Test in a sample of MHI students, healthy students, and a clinical sample of MHI patients. Significant effects were found for presence of MHI and gender. MHI patients performed worse than either student group on the 1st learning trial indicating relative attentional problems. Analysis of learning trials 2-5 revealed effect for gender with females performing consistently better across trials than males. No significant group or gender effects were found for immediate or delayed recall. However, measures of proactive and retroactive interference demonstrated differential gender and group effects. These findings and their implications for MHI college populations will be discussed.

J.R. O'JILE, L.M. RYAN, J. PARKS-LEVY, W.D. GOUVIER, B. BETZ, A. GROVES, R.C. COON, & M.L. TRETTER. Psychosocial and Behavioral Factors Associated With Mild Head Injury in a College Sample.
Psychosocial factors affect both the incidence and the outcome of head injury. In the present study, psychosocial and behavioral factors associated with mild head injury were investigated in a college sample. Measures of psychological and emotional functioning (MMPI), post concussion symptoms, risk taking attitudes and behaviors, and driving performance were administered to 66 head injured subjects and 151 controls. Differences were found between groups on MMPI scales (Hy, Hs, Sc, MAC, and ORG) although mean scores for both groups were within normal limits. Analysis of risk taking revealed that head injured subjects engaged in more risk taking behaviors. Post concussion symptoms (PCS) were significantly correlated with Hy, Hs, and ORG scales for both groups, while PCS were significantly correlated with Pt ("worry") for head injured subjects only.

J. DYWAN, R. RODEN, & T. MURPHY. Orbitofrontal Symptoms are Predicted by Mild Head Injury Among Normal Adolescents.
We asked 199 grade 10 high school students to complete the Brock Adaptive Functioning Questionnaire (BAFQ) along with information about family, health, and school achievement. The BAFQ have been designed to measure 12 areas of function that have been theoretically associated with frontal lobe processes. Students' scores on the 12 scales were submitted to a factor analysis which yielded 2 factors. The first appeared to capture variance usually associated with orbitofrontal processes while the second represented items usually associated with dorsolateral processes. Grade point average was most reliably predicted by the orbitofrontal factor. The best predictor of the orbitofrontal factor was self-reported head injury (incidence = 38%). The constellation of behaviours that made up the orbitofrontal factor were characterized best by high levels of arousal and dyscontrol. We propose that mild head injury may contribute to what we see as normal variation of young adolescent populations.

A.A. RUSSO, S.C. JOHNSON, D. RYSER, S. MACNAMARA, B. BAILEY, W. ICKE, D. BLATTER, S. GALE, C. ANDERSON, & E.D. BIGLER. Functional Assessment Following Traumatic Brain Injury: Correlations of the DRS, FIM, and MRI.
This study examines the relationship between quantitative magnetic resonance (MR) imaging and functional outcome using the Disability Rating Scale (DRS), Functional Independence Measure (FIM), and Glasgow Coma Scale. Twenty-three subjects with existing FIM scores and MR data were rated in a retrospective fashion using the DRS at hospital admission and discharge. Analysis found inter-correlations between all functional measures, and significant relationships with certain brain structures. The left temporal horn of the lateral ventricle had the most significant correlations with functional measures. These results increase the possibility of accurately predicting functional recovery using neuroimaging together with rating scales.

A. HALTINER, N. TEMKIN, & S. DIKMEN. Agreement Between Reports of the Behavioral Sequelae of Moderate-to-Severe Head-Injury Provided by Patients and Their Significant Others.
This study examined the neurobehavioral outcome of moderate to severe head injury as reported by the patients themselves and their significant others, and the consistency between their views, at 6 months post-injury. Our findings revealed that both patients and their significant others reported problems in many areas, although the severity of these neurobehavioral changes was rated as mild. Compared to their significant others' views, patients reported more difficulty in the area of cognitive functioning. There was no difference between patient and significant other ratings in the other areas assessed. Correlational analyses revealed moderate agreement between patient and significant other ratings of cognitive and somatic problems, and less agreement in other areas. Implications of these findings for evaluating head-injury outcome will be discussed.

S.M. DOSS. Impaired Self Awareness of Personality Traits in People with Frontal System Dysfunction Due to Traumatic Brain Injury.
This study examined the Unawareness Phenomenon in people with frontal system dysfunction due to traumatic brain injury (TBI) by investigating decreased self-awareness of personality traits. Twenty experimental subjects with TBI and their spouses, and 20 matched control subjects and their spouses were asked to complete a sorting task of 60 personality traits and a rating scale instrument, the PCRS. Subjects and their spouses evaluated each other on the two instruments. TBI subjects' were hypothesized to show evidence of less self-awareness than control subjects on the sorting task and 8 targeted questions of the PCRS; and TBI subjects' would show evidence of decreased self-awareness of "Bad Intellectual" and "Bad Social" dependent variables on the sorting task. Evidence of impaired self-awareness of personality traits was found on the sorting task, particularly for the "Bad Intellectual" and "Bad Social" dependent variables. Evidence of impaired self-awareness was also found on 2 PCRS questions with intact awareness on 6 of the PCRS targeted questions.

T.V. RYAN, A.J. GIULIANO, D.G. CORNELL, G.L. HAWK, & G. ORAM. Capital Murder: Neurocognitive Impairment in Comparison to Other Violent and Nonviolent Incarcerated Offenders.
The present study compared a group of capital offender ($N = 32$) to incarcerated violent criminals ($N = 68$) and nonviolent criminals ($N = 37$) on several neuropsychological measures. These groups were matched on age, education, race, and gender. Multivariate analyses revealed significant differences between the capital offenders group and the violent group on the Category Test, with the former more violent sample committing a higher number of errors. The capital group also was more impaired than the nonviolent group on the Category Test and Trails B. In contrast, group comparisons of performance on WAIS-R Vocabulary and Block Design subtests and Rey Complex Figure (Copy and Delay) were not significant. These results suggest that as the degree of violence increases, more significant neurocognitive impairment emerges. Relevance to psycholegal issues as well as implications for future studies are discussed.

V. BRUMM, A. ROSENBAUM, & R.A. COHEN. The Neuropsychology of Impulsivity and Martial Violence.
This study examined neuropsychological correlates of impulsivity and propensity for violence. Most subjects were court referred marital violence offenders. Subjects were assessed on a number of standard measures of executive and attentional control, as well as specific experimental measures sensitive to impulsivity, including tasks requiring inhibition of responding for specific durations. While batterers were not impaired on most neuropsychological measures, mild impairments of impulse control were noted on certain tasks, as well as below average expressive vocabulary. Severity of neuropsychological dysfunction was also associated with pattern of marital violence and degree of impulsivity as measured by a self-report measure. The results suggest a relationship between impairments of impulse control and propensity for marital violence.

B.K. CHRISTENSEN, T.P. ROSS, R.S. KOTASEK, M. ROSENTHAL, & R.R. HENRY. Factor Structure of the Beck Depression Inventory in a Sample of Persons With Traumatic Brain Injury.
The factor structure of the Beck Depression Inventory (BDI) was investigated in a sample of persons with traumatic brain injury (TBI). One hundred and seventy persons receiving comprehensive TBI rehabilitation served as subjects. Principal components analysis, with varimax rotation, produced a 5 factor solution. These factors were labeled: (1) symptoms of major depression, (2) symptoms of TBI, (3) hopelessness/anhedonia, (4) negative self-appraisal, and (5) cognitive distortions. Cumulatively, these 5 factors accounted for 55.6% of the sample variance. The current factor structure is incongruous both with Beck's proposed 3 factor solution, and factor solutions from other populations. These results indicate that the underlying dimensionality of depression in TBI may differ significantly from that of other populations. Clinical and research implications are discussed.

J.W. THIGPEN, W. BURNS, J. ELLERY, & R. LEVITT. Discrimination Between Normal Subjects and Patients With Moderate to Severe Closed Head Injury on the Denman Neuropsychology Memory Scale.
40 patients with CHI were found to have an average of 30 points lower mean score on the DNMS full scale memory quotient, verbal memory quotient, and nonverbal memory quotient than did 42 normal subjects. Percentage of correct classifications of subjects into normal and brain damaged groups using the DNMS full scale memory quotient was approximately 80% with or without analyses using education or full scale IQ as a covariate. A priori clusters of subtests on the DNMS which showed the most accurate classification of subjects into the two groups were those which contained delayed recall tasks. Results were interpreted to provide evidence for the discriminative validity of the DNMS with closed head injury.

J. VILKKI & S. VIRTANEN. Decreased Past Time and Normal Present Time Judgement After Closed-Head Injury (CHI).
Twenty-three subacute CHI patients and 14 controls read randomized digits at a subjective one per second rate during predetermined intervals and estimated the total duration of each interval immediately afterwards. The past time estimates of CHI patients were shorter than those of controls especially on the longest (80 seconds) interval ($p < .001$). The groups did not differ on the present time estimates, i.e., the numbers of digits read during the intervals. Past time estimates were unrelated to the Mini-Mental State of the Galveston Orientation and Amnesia Test scores in the CHI group. The hypothesis that CHI causes a decrease of prospective past time estimate was confirmed, but contrary to the expectation the underestimation was not secondary to attention or memory deficits.

E. VAKIL, R. SHERF, M. HOFFMAN, & M. STERN. Direct and Indirect Measures of Temporal Order and Spatial Location Memory: Control Versus CHI Subjects.
In two experiments 40 CHI and 42 control subjects were tested on temporal and spatial memory under intentional and incidental retrieval conditions. A list of words was presented repeatedly (4 times in Exp. 1 and 8 times in Exp. 2) in fixed or varying order in the temporal task and in a fixed or varying spatial position in the spatial task. The number of words recalled, as well as their temporal and spatial judgments, were the direct measure of memory. The effect of consistency of order or location was the indirect measure of memory. Results suggest that the groups significantly differed on the direct but not the indirect measures. This study highlights two major points: 1) intentionality in the retrieval stage determines the effortfulness with which information is processed; 2) the more automatic the task, the better preserved it is following closed-head injury.

R.J. RIDDER & M. HISCOCK. Newly Learned Word Associates Generate a Priming Effect in Closed Head Injury Patients With Amnesia.
Twenty closed-head-injured (CHI) patients and 20 normal controls were tested on a primed lexical decision task in which the association between stimulus and target words was either old (semantic condition) or new (episodic condition). Associations between unrelated words were established in the episodic condition via paired-associate learning. The CHI group showed a significant facilitation of lexical decision-making in the episodic condition. This priming effect was comparable to that obtained in the semantic condition and equal to that of the control group. Experiment 2 confirmed that the episodic priming effect is based on the new associations rather than direct priming, i.e., merely having seen the target word during the prior paired-associate learning task.

E. SHERMAN, E. STRAUSS, & F. SPELLACY. Neuropsychological Test Correlates of WAIS-R Factor Scores.
The WAIS-R factor scores of 262 head-injured adults were compared to neuropsychological tests assumed to measure similar abilities. Results suggested good construct validity for the first two factors of the three-factor solution of the WAIS-R. The Verbal Comprehension factor was associated with word retrieval and verbal memory; the Perceptual Organization factor with object perception, visual-spatial memory, visual reproduction and visual information processing. Executive functioning, as measured by the Wisconsin Card Sorting Task, was associated with both factors. Memory tests were uncorrelated with the third factor, Freedom From Distractibility (FFD) and its association with executive functioning was inconsistent. Few of the measures of attention (with the exception of Trails A and B and the Stroop Test, measures with a strong visual processing component) correlated with this factor. This fact, along with the minimal variance accounted for the the FFD within the factor solution, cautions the use of the FFD as a unitary and reliable measure of attention in brain-damaged populations. The limitations of the WAIS-R in measuring attention highlights the need for administering more specific neuropsychological measures of attention in the assessment of clinical populations.

M.C. WILDE, C. BOAKE, & M. SHERER. A Reevaluation of Memory Deficit Subtypes in Closed Head Injury Using the California Verbal Learning Test.
The California Verbal Learning Test (CVLT) protocols of 57 severe CHI subjects were grouped according to the method of Crosson et al. (1989) in order to evaluate the existence of memory deficit subtypes. The distribution of subjects falling into groupings representing impaired and normal performance on the two recognition measures differed significantly from that obtained by Crosson et al. (1989). As predicted, group comparisons disclosed that the encoding deficit group showed poorer performance on the List A learning trials and displayed a greater number of free and cued recall intrusions. Contrary to prediction, the encoding group did not show a relatively greater recency effect or a greater improvement in recall when given semantic cues and a semantic encoding strategy. The results are discussed within the context of characterizing memory deficits in CHI using process memory scores.

M.C. WILDE, C. BOAKE, & M. SHERER. WAIS-R Broken Configuration Errors in Nonpenetrating Traumatic Brain Injury.
Final broken configuration errors on the WAIS-R Block Design subtest were studied in 3 groups of 45 moderate and severe nonpenetrating traumatically brain injured (TBI) patients. The mean percentage of final broken configurations was compared in two groups of patients who had undergone unilateral craniotomy (left and right) and a group with diffuse brain CT scan findings but no history of neurosurgery. The mean percentage of final broken configuration errors on designs with and without clear internal edge features was also compared. Patients with right craniotomies produced more final broken configurations than those with left craniotomies and diffuse injury. The left craniotomy group did not differ significantly from the diffusely injured group. There was a non-significant trend for more broken configuration errors to occur on designs without clear internal edge features.

D.A. GANSLER, N. McGRATH, E. KAPLAN, N. MOCZYNSKI, & J. NORTON. The Utility of the Dementia Version of the California Verbal Learning Test (CVLT-D) in a Traumatic Brain Injury Population.
The Dementia Version of the CVLT (CVLT-D), is a 9 word list learning task identical in administration procedure and indices to the 16 word CVLT, and may be an appropriate instrument for impaired patients with diminished processing capacities. However, there are no controlled studies validating the CVLT-D's sensitivity in detecting impairment while fulfilling its purpose of adjusting to the reduced processing levels of more impaired patients. For validation purposes, the CVLT-D performance of twenty patients suffering traumatic brain injury (TBI) of varying severity was compared with twenty age and education matched normal controls. Statistical analysis was organized according to the five factor structure of the CVLT (general verbal learning, response discrimination, learning strategy, proactive effect, and serial position effect). Significant between-groups differences occurred across all five factors covering learning/memory capacity and information processing. It is concluded the CVLT-D is appropriate in its information processing demands with TBI patients without losing its sensitivity to cerebral dysfunction.

K.P. REEDER, M. ROSENTHAL, P.A. LICHTENBERG, & D. WOOD. Impact of Age on Functional Outcome Following Traumatic Brain Injury.
This multi-center investigation evaluated the effect of age on recovery of functioning as measured by Functional Independence Measure (FIM) and Disability Rating Scale (DRS) scores during acute rehabilitation in the national model systems project. One hundred and sixty-five subjects matched on injury severity, as measured by Glasgow Coma Scale, were divided equally into three age groups with the following ranges: 16–34, 35–49, and 50–86. A Multivariate and four univariate ANOVAs were conducted to test the effect of age on functioning. Results showed age accounted for approximately 6% and 2% of the variance in FIM and DRS scores, respectively. Hence, these data suggest age has little impact on functional status at admission or discharge from rehabilitation programs, despite multiple studies demonstrating increased morbidity and mortality.

R. OTTO, C. LEAVELL, J. ROSENBAUM, H. BROADBENT, & H. LEAVELL. Early Rate of Cognitive Recovery and Outcome in Traumatic Brain Injury.
This study investigated the relationship between rate of improvement on neuropsychological (NP) measures early in TBI recovery and patient status at six months post-injury as measured by the same NP measures and by independent global ratings of functioning. Thirty-five moderately to severely injured patients were evaluated at three points in their recovery. Early recovery in simple attention showed the strongest relationship with later NP outcome, followed by retention of learned declarative material. Only one NP change score was predictive of later global functional outcome, this again being a measure of simple attention. It may be that early rapid recovery of attentional functions holds special significance for overall cognitive and functional outcome.

W.M. HIGH, Jr., C. BOAKE, L.D. LEHMKUHL, C. IVANHOE, S. YABLON, & C.N. NEWTON. Comparison of Neurobehavioral Outcome Following Gun Shot Wounds and Blunt Trauma in a Rehabilitation Setting.
Over a six year period, 489 patients were entered into the TBI Model System National Database; 36 sustained gun shot wounds (GSWs) while 453 sustained blunt trauma (BT). Twenty-one (58%) of the GSWs and 310 (68%) of the blunt trauma group were able to undergo neuropsychological testing before discharge. Subjects underwent neuropsychological testing after obtaining normal scores on the GOAT on two

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consecutive days. For the patients with neuropsychological testing, the GSW group was significantly younger than the BT group. There were no differences between the groups on educational level. There were no differences between the groups on lowest GCS score, duration of impaired consciousness, or PTA. However, a significantly greater proportion of the GSWs had abnormal pupillary findings compared to persons sustaining BT. Length of stay was also approximately 38% longer for the GSW group, but failed to reach statistical significance. Functional Impairment (FAM) was similar on admission to the rehabilitation hospital or service whereas the GSW group was significantly more impaired at discharge. No significant difference was observed on the DRS on admission or discharge although the GSW group tended to be more disabled. On the neuropsychological tests, the GSW group performed significantly more poorly on COWA, digit span backward, Symbol Digits Modalities Test (written), and Block Design. The total score on the NRS was not significantly different for the two groups. However, clinician ratings of conceptual disorganization, disinhibition, guilt feelings, memory deficit, agitation, inaccurate self-appraisal, excitement, and poor planning were worse for the blunt trauma group.

A.M. SANDER, W.M. HIGH, & L.D. LEHMKUHL. The Relationship of Blood Alcohol Levels to Neurological/Neuropsychological Outcome Following Traumatic Brain Injury.

The present study investigated the effect of alcohol blood levels at the time of injury upon outcome in patients who had sustained traumatic brain injuries. Subjects were 503 patients tested at 4 different rehabilitation centers which are part of a multi-center study of recovery from traumatic brain injury. The outcome measures used included length of time taken to follow commands, duration of posttraumatic amnesia, scores on a neuropsychological test battery, and scores on the Disability Rating Scale (DRS) at both admission and discharge from a rehabilitation hospital. The results revealed that, once the effects of injury severity, age, and education were accounted for, alcohol blood level at the time of injury accounted for a significant proportion of the variance in DRS admission and discharge scores, as well as in scores on a test of verbal learning (Rey Auditory Verbal Learning Test). The effect of blood alcohol levels on the remainder of the outcome variables was not significant. Implications for future research will be discussed.

R.O. HOPKINS, S.D. GALE, S.C. JOHNSON, E.D. BIGLER, D.D. BLATTER, & L.K. WEAVER. A Case Study in Review: Severe Anoxia Without Concomitant Brain Atrophy and Neuropsychological Impairments.

Anoxia may result in cognitive deficits as well as neuropathological changes. We have recently seen a case of a patient who suffered a severe anoxic episode, who has made a remarkable recovery. A neuropsychological test battery was administered and quantitative analysis of MRI scans were carried out. W.R. does not exhibit residual cognitive deficits and there are no major morphologic abnormalities despite a severe anoxic injury. There is a slight enlargement of the ventricle to brain ratio which may be an indication of ventricular dilation. The size to the temporal horns are within normal limits, which suggest that there is no hippocampal atrophy. W.R. exhibited normal memory performance and does not appear to have hippocampal morphologic changes which are commonly associated with anoxia.

C. JORDAN, E. SHAPIRO, A. KUNIN, & D. ZELINSKY. The Effects of Lead Overburden on Neuropsychological Performance: A Pilot Study.

The relationship between lead level, duration of exposure, age of exposure and neuropsychological performance was studied in 55 children over age 2. Children with higher lead levels had lower Wechsler IQs. Severity of lead burden was also related to attention as demonstrated by poorer performance of high lead children on ratings of attentiveness and on tests dependent on attention (PPVT-R and KABC Magic Windows). Duration of exposure did not correlate with performance. A correlation between age of exposure and IQ in younger children, such that poorer performance is associated with older ages of exposure, but not older children may suggest a threshold effect for age of exposure.

K. WOODS, J. RUFFER, J. MOLLMAN, K. JUDY, & C. ARMSTRONG. The University of Pennsylvania Longitudinal Project on the Effects of Radiotherapy: Early- and Late-Delayed Effects on Cognition.

This is a replication and extension of our previous report on the sensitivity of neuropsychological tests for identifying the effects of radiotherapy (XRT). Subjects included twenty patients (mean age = 35.4) who had undergone biopsy or resection of a low-grade primary brain tumor. Intrasubject, repeat measure analyses at 1.5 months post XRT (12 cases) revealed decrement only in long term memory retrieval, followed by a rebound. One year post baseline (nine cases) there were no decrements in memory, and significant improvement in processing speed occurred. At two years (six cases) improvement continued in central processing speed, though decrement in one measure of long-term memory re-emerged. At three years, (four cases) central processing speed continued to improve, and memory scores continued to decline although significance was not reached.

M.-E. MEADOWS & R.W. BUTLER. The Neuropsychological Effects of Cranial Irradiation in Adult Brain Tumor Patients.

The cognitive effects of cranial irradiation (CRT) have not been well documented in adult brain tumor survivors. An analysis of patients who had tumors resected prior to neuropsychological testing was conducted. Patients either received CRT ($n = 21$) or did not receive CRT ($n = 13$) as part of their treatment. A backward stepwise regression analysis was conducted using the neuropsychological test scores as the dependent variables and tumor location, time since tumor resection, age, socioeconomic status, type of tumor, and CRT as the independent variables. CRT significantly predicted performance on tests of perceptual interference, learning, and attention. Impairment, however, was not global and group differences were significant only for two conditions of the Stroop. CRT may not be highly detrimental to cognition within the first two years post-irradiation.

M. WELSH, G. HUMES, & N. COOKSON. Disk-Transfer Task Intercorrelations: The Tower of Hanoi and the Tower of London.

Two disk-transfer tasks, Tower of Hanoi and Tower of London, are presumed to measure executive functions such as planning and working memory. Both have been used as putative assessments of frontal lobe function. In this study, we administered both tasks to 61 normal adult subjects to test the assumption that the two tasks are measuring the same cognitive processes, despite differences in task structure, administration, and demands (e.g., number of moves required, timed vs. untimed). The results revealed low to moderate significant correlations between performances on the two tasks. The strongest association was between the more complex 4-disk TOH and the TOL ($r = .40$). Subjects also found the TOL to be an easier task than the TOH. The strength of the intercorrelations suggest that TOL performance explains only 10–16% of the variance in TOH performance. Thus, the common assumption that the two tasks are isomorphic must be reevaluated.

T.P. ROSS. The Reliability and Validity of the Tower of Hanoi, Tower of London, and a Modified Porteus Maze Test.

The stability and concurrent validity of the Tower of Hanoi (TOH), Tower of London (TOL), and a Modified Porteus Maze Test (M-PMT) was examined in a college sample ($N = 160$). The temporal stability (Mean interval = 37.5 days; $N = 44$) was poor for the TOH ($r = .41$) and TOL ($r = .44$), but adequate for the M-PMT ($r = .71$). The association between these three measures and other executive tests ranged from $r = .17$ to $r = .50$. Principal component analysis of an executive test battery resulted in a three factor solution, with the M-PMT, TOH, WCST and Trails B loading on a "self-regulation/planning factor." This study supports the usefulness of the M-PMT, but at present, the TOH and TOL procedures need refinement.

G. HUMES, M. WELSH, & N. COOKSON. The Contribution of Working Memory to Performance on Disk-Transfer Tasks.
Working memory (WM) is the on-line processing and manipulation of information to accomplish future problem solving goals. It has been proposed that this cognitive process is mediated by the prefrontal cortex. It also has been assumed that disk-transfer tasks (e.g., Tower of Hanoi & Tower of London) tap working memory skills. This assumption was tested in a study of 61 normal adults who were administered the following measures: Tower of Hanoi, Tower of London, Sequential Memory (nonverbal WM), Sentence Span (verbal WM), Wechsler Story Memory (short- and long-term memory). The two disk-transfer tasks significantly correlated at a low to moderate level with the Sequential Memory test, but not with Sentence Span. Surprisingly, the two WM tests did not intercorrelate, and instead Sentence Span correlated with short- and long-term memory. Nonverbal WM explained only 10–16% of the variance in disk-transfer performance, suggesting that other cognitive processes are likely involved.

M. BASSO, L. BIELIAUSKAS, & B. ROPER. The PPVT as an Estimator of Premorbid Intelligence in Stroke Patients.
Testing the hypothesis that vocabulary is a "hold" ability, the PPVT's efficacy as an estimator of premorbid intelligence in patients with vascular lesions was examined. Patients were categorized by laterality of lesion and by degree of impairment as assessed by the Mini-Mental Status Exam. To evaluate its accuracy, PPVT scores were compared to IQ estimates based on demographic variables (Barona et al., 1984). The results show the PPVT IQ is unaffected by left or right hemisphere infarcts. In patients with significant cognitive impairment, the PPVT and Barona IQ scores were equivalent, suggesting the PPVT provides accurate premorbid estimates of intelligence. Since the PPVT had greater efficacy in estimating scores in extreme ranges, the findings also demonstrate an advantage of the PPVT over the Barona.

J.A. SUHR, R.A. STERN, I.C. LESHKO, E.A. SINGER, A. FRANCO, B. LEE, G.M. PACHECO, & E. KAPLAN. The Boston Qualitative Scoring System for the Rey-Osterrieth Complex Figure: Preliminary Validity Findings.
This report provides initial validity evidence for the Boston Qualitative Scoring System for the Rey-Osterrieth Complex Figure (BQSS). We determined whether several qualitative aspects of the scoring system (e.g., Planning, Fragmentation, Size, Perseveration, Confabulation, Rotation, Neatness, and Asymmetry) as well as global Presence & Accuracy and Retention scores could differentiate between several patient samples. Results showed that: Copy Planning distinguished patients with right vs left hemisphere seizure focus; Delay Presence & Accuracy, Copy Perseveration, and Immediate Perseveration distinguished TBI patients from normals; and Copy Presence & Accuracy and Copy Perseveration distinguished demented from depressed patients. The traditional 36-point scoring system did not distinguish any of the patient groups. These results, along with previously reported reliability findings, indicate that the BQSS is a psychometrically sound, diagnostically sensitive measure of visuoconstructive ability and visuospatial memory.

F.W. BYLSMA, J.H. BOBHOLZ, D. SCHRETLEN, & D.D. CORREA. A Brief, Reliable Approach to Coding *How* Subjects Copy the Rey-Osterrieth Complex Figure (CFT).
A brief, reliable method of scoring qualitative aspects of CFT copy performance is presented. The resulting "Q-Score" is based on whether structural elements are reproduced using contiguous lines, the order in which structural elements are produced, and completion time. The scale has good internal consistency (Chronbach's *Alpha* = 0.83) and excellent interrater and score-rescore reliability (*rs* = .99). Compared to accuracy scores, Q-scores discriminate among independent clinician judgments of CFT copy organizational strategy with greater sensitivity. Factor analysis of the scale yielded 5 factors that closely resemble previous *a priori* groupings of structural elements. Patient groups differ on some, but not all, of the factors. The Q-Score holds promise as a brief and useful metric for both clinical and research purposes.

M.C. DOLSKE & R.I. NAUGLE. Scoring Variations of the Finger Oscillation Test (FOT).
Administration and scoring of the FOT varies across neuropsychology laboratories (Boll, 1981). This study compared four commonly used methods utilizing data from forty consecutive clinic patients. Comparisons (paired t-tests) were made between the following: average of first five trials (method A), average of first five trails within a range of five (method B), average of ten trials (method C), average after dropping the highest and lowest scores out of ten trials (method D). A significant difference was found between method A and all other methods for the dominant hand. No differences were found between any method for the nondominant hand. These results suggest that common scoring procedures may produce dominant hand scores that are inflated in comparison to normative data obtained using a different method.

E.B. McCLURE, N.M. THOMPSON, G.A. ROGENESS, & M.J. BEYER. The Rey Figure: Evidence for Executive Dysfunction in Fragile X Females.
We examined the efficacy of the Waber-Homes Rey Osterrieth Complex Figure (ROCF) scoring system in evaluating planning and organizational skill in women with Fragile X Syndrome. Nineteen FraX women ($N = 19$) and a matched group of mothers with developmentally delayed children ($N = 20$) were evaluated. FraX women, primarily those with full genetic mutations, produced ROCF copies that were significantly more poorly organized than those of the comparison subjects. Whereas the FraX ROCF organization scores were associated with aspects of executive functioning, relationships with spatial and motor skills were found in the comparison group. Results indicate that the Waber-Holmes ROCF scoring system reflects varied cognitive skills in different populations, and highlight the importance of regarding executive function as a multifaceted construct.

F.E. ROSE, R.F. WHITE, R. DIAMOND, E. EISEN, D. WEGMAN, M. KRENGEL, P.A. CYRUS, R.G. FELDMAN, & R. LETZ. Validation of a Computerized Neuropsychological Test Battery in Patients With Subcortical Lesions.
The Neurobehavioral Evaluation System (NES) is a computerized neuropsychological test battery originally designed to identify behavioral changes associated with exposure to neurotoxicants. The present study extended the validation of the NES to subcortical lesions by comparing the performance of a group of patients with idiopathic Parkinson's disease (PD), Multiple Sclerosis (MS), and normal controls. Results identified differences between patient groups and normal controls, contributing the NES' validity. Specifically, PD subjects evidenced motor and visual memory deficits, while motor, attention, visuospatial, and visual memory deficits were observed in the MS patients relative to normal controls. Results also suggested that the NES may be differentially sensitive to specific cognitive changes associated with PD and MS. Thus, it may be useful in the differential diagnosis of subcortical diseases.

E.M. FIELSTEIN, M.A. WILLIAMS, J.A. LA MARCHE, & T.J. BOLL. Use of a 7-Subtest Short Form of the WAIS-R: Errors of Estimation as a Function of IQ Level and Subtest Scatter.
The present study investigated the validity of a 7-subtest short form of the WAIS-R and determined the relative contribution of IQ and subtest scatter in the production of error. Subjects were 240 patients referred for outpatient neuropsychological evaluation. The results showed that despite high validity coefficients, over 20% of the sample showed greater than five point discrepancies between estimated and actual Performance IQ. Level of IQ was found to be a significant predictor of error rates. The degree of subtest scatter showed a greater role in explaining error, even when the effects of IQ were partially out. The implication of this

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study is to use caution when estimating IQ with this 7-subject short form in cases of high subtest scatter whether IQ level is relatively high or low.

L. ROY, C. BULLARD-BATES, J. NOGLE, L. HILDEBRANDT, & L. DAMIS. The Neurobehavioral Cognitive Status Examination: A Factor Analytic Study With Stroke Patients.

The Neurobehavioral Cognitive Status Examination is composed of 10 psychometrically distinct subscales. A previous study with CVA patients identified a single factor solution interpreted to be left hemisphere language/verbal. In this study, principle component factor analysis of the NCSE subscales was conducted on the total sample ($N = 127$) and on a more refined subset. The first three factor solution was interpreted as left hemisphere language/verbal, ability to function in one's environment, and visuospatial factors. In the second analysis, these first two factors again emerged along with a mixed factor. This failure to maintain a pure visuospatial factor is considered indicative of a deficit in visuospatial tasks on the NCSE. It was noted that the NCSE loads heavily on language and verbal functions limiting its usefulness with language impaired populations.

G.J. REY, B.E. LEVIN, M.C. BROWN, E. FELDMAN, R. RIVAS-VAZQUEZ, M. ARIAS, & A.L. BENTON. Application of the Benton Tests to Hispanic Adults: A Preliminary Analysis.

Nine of the tests described by Benton, Sivan, Hamsher, Varney and Spreen (1994) were given to 75 normal Hispanic adults. The distributions of scores were compared to those of the standardization samples of English-speaking subjects. Median scores were found to be nearly identical in all tests. The relative frequency of defective performances was also found to be equivalent. The influence of gender, age, and education was similar to those reported for the original standardization studies. Overall, the performance of the subjects in the two language communities were quite comparable. Additional data on a larger sample of Hispanic subjects are being collected in order to formulate normative standards for clinical application for this population.

G.J. LAMBERTY, S. PARADISO, R.G. ROBINSON, & M.J. GARVEY. CERAD Word List Test Performance in Patients With Stroke and Major Depression.

Twenty-three patients with stroke and 29 patients with major depressive disorder (MDD) were evaluated using the CERAD word list memory task. Results indicated that there were no gross differences between stroke and MDD groups. However, when the stroke group was split into left (LCVA; $n = 9$) and right (RCVA; $n = 14$) hemisphere groups, significant trends were noted which indicated weaker performance for LCVA patients than either RCVA or depressed patients. Depressed and RCVA patients did not differ significantly from published normative standards. These results suggest that the CERAD memory task is sensitive to focal left hemisphere dysfunction, but not to generalized impairment. Further study with larger samples and focal lesion information should help to define these relationships.

J.E. ARRUDA, D. VALENTINO, R.A. STERN, & L. COSTA. Confirmatory Factor Analysis of Quantified Electroencephalogram Measured During a Continuous Performance Test.

Principal components analysis (PCA) has been used in quantitative electroencephalogram (QEEG) research to statistically reduce the dimensionality of the original QEEG measures to a smaller set of theoretically meaningful component variables. However, PCAs involving QEEG have frequently been performed with small sample sizes, producing solutions that are highly unstable. The present study confirmed the existence of a 5 component model using the confirmatory factor analysis (CFA) procedure on QEEG data obtained from 106 normal volunteers while performing a continuous performance test (CPT). This is the first study, to our knowledge, that has confirmed a previously derived QEEG model using an independent sample and the CFA procedure. These results support the use of QEEG data as a stable, valid measure of electrophysiological, and perhaps, neurocognitive function.

J.J. GONZALEZ, Y. ADIR, A.S. KUAFMAN, & J.E. McLEAN. Race and Gender Differences in Cognitive Factors: A Neuropsychological Interpretation.

Data by gender and race on the KAIT for ages 11-93 were factor analyzed. The sample of 1,901 adolescents and adults, taken from the KAIT standardization sample, was divided as follows: African-Americans (133 females, 93 males), Hispanics (73 females, 67 males), and Whites (773 females, 762 males). Six principal factor analyses of the 8 KAIT subtests were conducted, two for each race (one for males, one for females). Based on previous research, discrepancies in cognitive performance in brain damaged individuals have been attributed to apparent gender and race differences. Neither Inglis and Lawson's nor McGlone's neuropsychological hypotheses about gender differences in processing information were supported. The race/gender differences found, however, have implications for assessing patients with suspected or known brain damage.

R.S. SCHEIBEL & C.A. MEYERS. Cognitive Dysfunction Following Surgery for Intracerebral Glioma.

The relationship between cognitive function and malignancy, therapy (radiation, chemotherapy), and lesion lateralization was examined in 245 patients following surgery for a glioma. On a neuropsychological battery there was no difference between the high and low malignancy groups, but differences were found for lateralization and therapy. Scores on Digit Symbol were lowest following therapy and were not related to lesion location. In contrast, several other measures did not differ among the therapy groups but were related to lateralization. Left hemisphere lesions were associated with lower scores on verbal tests, while right hemisphere patients had lower scores on the Facial Recognition Test. These findings suggest that neuropsychological tests may be useful for distinguishing between the diffuse effects of therapy and the focal effects of the tumor and surgery.

R. HART, J. LEVENSON, C. SESSLER, A. BEST, S. SCHWARTZ, & L. RUTHERFORD. Validation of a Cognitive Test for Delirium.

Patients with delirium, dementia and major psychiatric illness were administered a newly developed test designed to identify delirium in an ICU setting. Two alternate forms were highly correlated (rICC = .90). Delirium patients performed worse than the other groups and dementia patients performed worse than the psychiatric groups. An optimal cut-off score derived from ROC analysis resulted in a sensitivity of 100% and a specificity of 96% (misclassification of several severely demented patients). Scores on the Cognitive Test for Delirium (CTD) correlated highly with scores on the MMSE, but not with a nurse rating scale for symptoms of delirium. The CTD appears to be a stable measure of cognitive function able to accommodate ICU patients and differentiate individuals with delirium from those with dementias and major psychiatric disorders.

L.M. GRATTAN, J.E. HERRON, P.J. ESLINGER, & R.R. PROVINE. Systematic Analysis of "Pathological Laughter."

"Pathological laughter" has been associated with a diversity of characteristics, mechanisms and neuropathological conditions. However, no standard model exists for analysis and comparison across cases. We systematically investigated the "pathological laughter" of a patient after left hemisphere frontal-parietal stroke for the structural, contextual and social/emotional components of the laugh process. Findings indicated that most structural and contextual features of M.M.'s laughter were well preserved. Although the placement of laughter in M.M.'s speech stream remained normal, the ability to inhibit laughter during speech was not. Under conditions of spontaneous speech the dorsolateral frontal-parietal region may play a specialized role in modulating and suppressing laughter during speech.

J. GRACE, J. ALLEN, J. SUHR, J.D. NADLER, & M.W. McKENNA. Quantitative and Qualitative Performance of Stroke Versus Normal Elderly on Six Clock Drawing Scoring Systems.
Several objective scoring systems for clock drawings have been developed. In this study, we examined clock drawings by elderly stroke patients and by community based elderly. The Clock Drawing Test was administered to 43 normal controls and 104 stroke patients. Significant differences were found between normals and lesion patients on all scoring systems for both quantitative and qualitative features. The quantitative indices were not helpful in differentiating between the various lesion groups (left vs. right vs. bilateral; cortical vs. subcortical; anterior vs. posterior). The qualitative features were helpful in lateralizing lesion site and differentiating subcortical from cortical groups.

A.B. SHUTTLEWORTH-JORDAN. On Not Reinventing the Wheel: A Perspective on Test Usage in a Developing Country.
The aim of this paper is to appeal against an attitude of nihilism with respect to test usage which occurs because tests have not been designed for application on a particular population, or because appropriate normative data are not yet available. In South Africa this attitude, in its extreme form, promotes a view that all tests in common usage on westernized populations should be abandoned and new culturally relevant and appropriately standardized tests should be designed. In settings dealing with rural and illiterate or semi-literate populations, such a stance has relevance. However, this paper cautions against an erroneous exaggeration of cultural effects which fails to take into account the acculturation process. Clinical and research data on urbanized African (Xhosa first language) subjects are used to demonstrate the absence of clinically significant cultural effects on frequently employed, standard test material.

M. KELLY, L. BINDER, M. VILLANUEVA, & M. WINSLOW. Motivation and Neuropsychological Test Performance Following Closed Head Injury.
The effect of motivation on neuropsychological performance in closed head injury (CHI) was assessed. Motivation was determined using the Portland Digit Recognition Test. Three groups were compared: (1) mild CHI, medicolegal referral, good motivation, (2) mild CHI, medicolegal referral, poor motivation, (3) moderate/severe CHI, rehabilitation referral, good motivation. Tests included the WAIS-R, Trailmaking Test, Wisconsin Card Sorting Test, Rey AVLT, WMS-R Logical Memory, Finger Tapping Test, and portions of the Sensory Perceptual Examination. Mild CHI patients with good motivation performed better than the other two groups on most tests. There were many tests on which mild CHI patients with poor motivation and those with moderate/severe CHI were indistinguishable. Consistent with previous reports, somatosensory and recognition memory tasks were identified as markers of poor motivation.

H.D. BLACKWOOD & M. MELKONOFF. The Effect of Litigation on Performance on Tests for Malingering.
Tests for malingering presented by Lezak were administered to 49 patients evaluated in the context of litigation and to 27 patients evaluated with no known pending compensation. Significant differences between the two groups were found only on 15-item correct lines and 15-item correct items, with the litigation group performing better because of its younger age. No significant differences were found on the other eight variables. In addition, responses suggested as indications of malingering were found to occur frequently in the no-compensation group, e.g., errors in dot counting and "out of sequence" patterns in dot counting response time. These results contradict the view that litigation necessarily has a major influence on performance of patients undergoing neuropsychological evaluation and raise questions about the clinical utility of these tests in any setting.

C. HISCOCK-KALIL, S. DESAI, & M. HISCOCK. Detection of Malingering: The Hiscock & Hiscock Digit Memory Test (DMT) Compared With the Modified Two-Alternative, Forced-Choice Paced Auditory Serial Addition Test (PASAT-FC).
The Hiscock and Hiscock Digit Memory Test (DMT) and the forced-choice modification of the Paced Auditory Serial Addition Test (PASAT-FC) was administered to 78 university students under one of two conditions: naive faking and control. Both tests significantly differentiated naive faking subjects from control, $p = .0001$. The DMT showed no significant difference for control subjects between retention intervals, but did show significant differences for naive faking subjects. Unexpectedly, the PASAT-FC showed significant differences in controls as well as naive faking subjects between time intervals. The DMT continues to be a very sensitive measure of detecting malingering.

D. SLICK, G. HOPP, E. STRAUSS, & M. HUNTER. Use of the MMPI-2 and the Victoria Revision of the Hiscock Digit-Memory Test for Evaluating Validity of Closed-Head Injury Symptoms.
The Victoria Revision of Hiscock and Hiscock's Digit Memory Test (a two-alternative forced-choice recognition test) and the MMPI-2 were given to normal subjects instructed to feign brain damage and post-concussive symptoms, normal controls, litigating patients and nonlitigating patients with complaints of memory dysfunction. Validity indices from both tests were found to be significantly correlated, but results argue for use of multiple measures of motivation in cases where malingering is suspected. The efficiency of using below-chance performance as a cut-score for results from the VR-II was shown to be poor due to low sensitivity. A cut-score based on performance at or below chance has potential for greater clinical utility, but without comprehensive normative data, this criterion should only be interpreted as suggesting rather than confirming that exaggeration or feigning may be present. Response time from the VR-II also showed promise for assessment of motivation.

J.A. KNIGHT & J. MEYERS. Comparison of Malingered and Brain-Injured Productions on the Rey-Osterrieth Complex Figure Test.
The effect of intentionally-distorted performances on the Rey-Osterrieth Complex Figure Test (ROCF) were examined by comparing 100 brain-injured patients, and 100 age- and education-matched controls with 70 malingerers (60 college students and 10 rehabilitation professionals). Four ROCF trials were administered: Copy, Immediate, Delayed, and Recognition Recall. Results based on age and education-adjusted *t* scores showed that malingerers produced a pattern of poorer performances than the brain-injured subjects across most measures. The scores from the Recognition Recall trial contributed uniquely to identifying malingered performances via false positive, false negative, and atypical item endorsement patterns not previously studied. Additional procedures for discriminating malingered performances will be discussed.

N.L. KIRSCH & M. CZARNOTA. Chance Levels of Performance on the Wisconsin Card Sorting Test.
Simple forced choice measures are frequently used for the detection of symptom invalidity or malingering because chance levels of performance can be readily calculated. In a related study we demonstrated that a subcomponent of the perseverative response score from the Wisconsin Card Sorting Test (WCST) can be used successfully to distinguish suspected malingerers from brain injured controls. However, chance levels of performance or significant deviations from chance cannot be calculated directly for any WCST measure because individual trials are not independent events and certain response (e.g., perseverations) are not equally probable across trials. Therefore, we used a Monte Carlo-type approach to provide estimates of chance WCST performance. Results are presented based on 5000 computer-generated random WCST protocols for each of 55 different configurations (e.g., 6 concepts, 120 trials). These results provide a conservative criterion for suspected response invalidity or malingered performance on the WCST.

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N.L. KIRSCH & M. CZARNOTA. Perseverative Emphasis, Exaggerated Performance, and Suspected Malingering on the Wisconsin Card Sorting Test.
The utility of the Wisconsin Card Sorting Test (WCST) as a measure of exaggerated performance was investigated using three matched groups: 10 patients with purported brain injuries (MAL) and two groups of patient controls. Preliminary examination of random WCST protocols has demonstrated high occurrence of an adjusted number of isolated perseverations (IP^a) relative to perseverations in runs. We hypothesized that MAL subjects would be more likely to randomize WCST responses and therefore achieve perseverative emphasis (PEm) scores (IP^a divided by number of responses in the longest perseverative run) greater than 1.0. Results indicated that both PEm and IP^a reliably discriminated MAL subjects (87% and 90% diagnostic efficiency, respectively). However, PEm combined with total number of trials greater than or equal to 116 occurred significantly less frequently (10.48%) in a larger sample of 105 TBI patients. Additionally, diagnostic efficiency improved to 90% by using this two variable classification rule. Methodological considerations and clinical extensions of the current research are discussed.

N.A. PACHANA. What Can a Case of WKS Tell Us About Tests of Malingering?
Many tests designed to detect malingered performance during a neuropsychological examination rely on an assumption of intact memory in the patient. Thus such tests may prove less useful in the presence of bona fide memory impairment. Wernicke-Korsakoff Syndrome (WKS) patients present an ideal opportunity to study such tests, as virtually all other cognitive functions aside from memory are intact in such individuals. A case history of a young woman with WKS and her performance on a neuropsychological battery including several tests of malingering are presented. Her performance on these measures is discussed in terms of the validity of the tests for measuring malingering in a patient with genuine cognitive dysfunction and no deliberate wish to feign deficits.

L.M. BINDER & M.L. ROHLING. A Meta-Analytic Review of the Effect of Financial Incentives on Recovery After Closed Head Injury.
We evaluated the effect size (ES) of financial incentives on disability, symptoms, and objective findings after closed head injury (CHI) through meta-analysis. We located 12 papers with a total of 1277 subjects from which ES's could be calculated. Overall, after weighting for sample size, a moderate ES of .53 was found. Abnormalities associated with CHI could be reduced by 22% if financial incentives were eliminated. The effect was particularly strong for mild head trauma. Seven studies with 759 subjects allowed for a cause and effect analysis, and the ES of .52 indicated that a substantial portion of CHI-related findings are caused by financial incentives.

THURSDAY MORNING, FEBRUARY 9, 1995

Paper Session 1

CHILD DEVELOPMENT I

E. SHERMAN, L. JANZEN, & M. JOSCHKO. Sustained Attention and Impulsivity in Tourette Syndrome: Relationship to Attention Deficit Disorder and Obsessive Compulsive Behaviour.
The purpose of this study was to determine whether children with Tourette Syndrome (TS) have impairments in sustained attention and impulsivity that are *not* accounted for by Attention Deficit Hyperactivity Disorder (ADHD). A secondary goal was to determine whether poor performance on a continuous performance task (CPT) was related to the presence of obsessive-compulsive behaviour (OCB). Fifty-nine children were compared on the CPT: 17 children with TS (TS-Only group), 9 children with TS and ADHD (TS-ADHD group), 16 children with ADHD (ADHD group), and 18 controls. Of the TS children as a group, 9 children (36%) had OCB. Contrary to recent findings, only the TS-ADHD group made more errors of omission than controls. In addition, neither TS-ADHD children or TS-Only children showed impulsivity as compared to controls, as measured by errors of commission. Instead, only children with TS and comorbid OCB were impulsive in comparison to controls. The implication is that TS children as a whole do not appear to have measurable deficits in sustained attention and that impulse-control problems in TS children are likely related to comorbid OCB, not comorbid ADHD.

S.D. GREWE, K.O. YEATES, R.A. BORNSTEIN, & E. BLUMENSTEIN. Subtypes of Behavioral Disorder in Children With Tourette's Syndrome.
Sought to identify behavioral disorder subtypes in 87 children with Tourette's syndrome (TS). Parent ratings on the Child Behavior Checklist were subject to a cluster analysis. The five cluster solution was chosen because of its stability and interpretability. Two clusters had relatively benign patterns of behavioral adjustment. Two other clusters demonstrated attention problems and affective disturbance. The last cluster displayed somatic complaints and oppositional behavior. The clusters did not differ in age or in onset or duration of TS. They did differ on measures of tic severity and obsessive-compulsive symptoms, as well as in the parent-reported incidence of attention deficit disorder. They also differed in Performance IQ, Arithmetic standard scores on the WRAT-R, and several neuropsychological measures, including the Seashore Rhythm Test, Tapping Test (non-preferred hand), and Wisconsin Card Sorting Test. Thus, children with TS demonstrate discrete patterns of behavioral adjustment that are associated with variation in the expression of TS and in neuropsychological functioning.

R.M. BILDER, G. REITER, K. BERNSTEIN, & J.A. LIEBERMAN. Deterioration of Cognitive Function Accompanies the Onset of Schizophrenia: From Premorbid SAT to Postmorbid FSIQ.
There is ample evidence of neuropsychological (NP) dysfunction in schizophrenia; both neurodevelopmental and deteriorative hypotheses have been advanced to explain this dysfunction. There is so far little objective evidence to distinguish between these alternatives. We used Scholastic Aptitude Test (SAT) results to provide unbiased, prospectively obtained information about premorbid ability in a sample of patients participating in a study of first episode schizophrenia. Records were also obtained from a matched sample of healthy controls. All subjects had the WAIS-R, administered on average 8 years after the SAT, and among patients, on average two years after the onset of psychotic symptoms. Both premorbid SAT scores and current FSIQ were impaired in patients relative to controls. SAT scores strongly predicted current FSIQ in both groups, and we applied the control regression equation to predict current IQ among patients. Patients' median current FSIQ was 8.9 points lower than predicted, indicating a significant drop in ability accompanying the initial onset of schizophrenia. The results are compatible with the hypothesis that both developmental and deteriorative processes occur in schizophrenia.

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M.D. RIS, A. WEBER, H. BERRY, N. LESLIE, & M. HUNT. Adult Psychosocial Outcome in Early Treated Phenylketonuria (PKU).
The psychosocial adjustment of 25 patients, ages 18 years and older, with early-treated PKU was studied. On most outcome measures, patients were indistinguishable from 15 sibling controls. However, on the SCL-90-R, 20% of the patients demonstrated significant morbidity. Unlike neuropsychologic outcome, the psychosocial outcome of these patients was unrelated to concurrent or historic biologic/dietary disease factors, though there was a strong relationship demonstrated between neurocognitive measures and psychosocial morbidity. Findings are discussed in the context of prevailing notions about alterations in biogenic amines in PKU.

J. ROVET, S. COLE, D. ALTMANN, I. NULMAN, D. SCOLNIK, & G. KOREN. Neurodevelopmental Outcome in the Offspring of Mothers With Epilepsy.
We compared 58 children whose mothers were treated for epilepsy with phenytoin (DPH) or carbamazepine (CBZ) therapy during their pregnancy and 58 matched controls whose mothers did not have epilepsy nor had taken a known teratogen. All children were assessed for intelligence and specific abilities (Bayley or McCarthy), language, temperament, and malformations. Children of epileptic mothers scored lower in global IQ and language scales. Those exposed to DPH had poorer language scores than those exposed to CBZ. Regression analyses revealed that maternal IQ, epilepsy and seizure frequency significantly predicted IQ, while among children of epileptic mothers, type of drug (DPH worse) was a stronger predictor of language ability than type of epilepsy or seizure frequency. Present results suggest intrauterine drug exposure and maternal epilepsy may have independent effects on different cognitive abilities.

G.P. LEE, D.W. LORING, & K.J. MEADOR. Disordered Time Perception in Children Following Transient Unilateral Cerebral Dysfunction.
Estimates of the passage of time were obtained following unilateral amobarbital injection in epileptic children to determine if hemispheric specialization for time perception existed. Children were asked to estimate how much time had passed during left and right Wada tests after the period of drug effect and following return of normal neurological status. Children underestimated the amount of time that had passed after right hemisphere anesthesia to a statistically significant degree. Results could not be accounted for on the basis of laterality of seizure onset, amobarbital dosage, severity of memory disturbance, nor the actual difference in duration of hemispheric anesthesia between left and right injections. Findings are supportive of an association between right hemisphere damage and a disordered sense of time.

Paper Session 2

VISUAL PROCESSING

H.B. COSLETT & C. JURKOVICH. Limb Movements and the Control of Gaze: Fingers Point and Eyes Follow.
The factors controlling visual attention and gaze were investigated in a patient with prominent visuo-spatial deficits and left-sided neglect secondary to bihemispheric lesions. Performance on single word oral reading was significantly enhanced when he tapped next to the word as compared to reading with hands in his lap. He performed significantly better when tapping at the left as compared to right margin of the word, suggesting that the benefit is spatially restricted and is not attributable to a general hemispheric activation. Placing his static hand next to the word or having the examiner tap did not significantly influence performance. These data are consistent with the hypothesis that spatial coordinates which direct limb movements may also serve to direct gaze.

M. MENNEMEIER, T. ALBELDA, & V. STEVENSON. Sustained Attention in Extrapersonal Space.
Normal subjects search to a greater extent for targets located along the horizontal than vertical or radial axes of extrapersonal space. A 3-D model of the "visual search field" (VSF) is, therefore, ellipsoid (i.e., football-like). The 3-D shape of the VSF is thought to be dictated by asymmetries in the ability to deploy focal attention. We examined the ability of normal subjects to sustain attention for peripherally located objects while fixating a central point. This procedure eliminates visual search and establishes a "field of sustained attention" (FSA). The shape of the FSA corresponded to that of the VSF. Visual attention was extended farther and sustained longer along the horizontal than vertical axis. Factors related to sustained attention may help explain the ellipsoid shape of the VSF.

D. GELDMACHER, D. ROWLAND, & T. RIEDEL. Age Effects on Letter Cancellation Tasks.
Aging has a significant impact on measures of visuospatial attention and information processing. Most research approaches characterizing age-related change rely on reaction time measures of performance. This study was designed to determine the effectiveness of simple bedside tasks for measuring similar effects. Twenty-six young and 23 elderly subjects each performed 21 sequential random array letter cancellation tasks. The tasks varied on multiple stimulus characteristics in order to broadly assess function and avoid stimulus-specific effects. Performance was measured as the number of correct responses divided by the time to completion, corrected for accuracy. Older subjects had lower performance scores on all 21 forms (corrected $p < .025$). These results suggest that the timed cancellation format can detect age-related changes in selective attention and visuospatial information processing.

D.A. GIDEON, G.J. EGAN, C.D. KILTS, & R.E. GROSS. Functional Neuroanatomy of Face Emotion Perception: A PET Neuroactivation Study.
An activation paradigm was used in PET neuroimaging of regional cerebral blood flow (rCBF) to investigate a hypothetical cortical-limbic circuit for the decoding of affective facial expressions. PET images were acquired during the bolus administration of 50 mCi of $[^{15}O]H_2O$ to two male 26 year old normal subjects and during the presentation of six facial emotion processing tasks involving static or dynamic positive, negative or neutral stimuli. Using subtractive imaging, dynamic expressions resulted in an activation of temporal lobe structures on the left for happy and on the right for angry faces. Right frontal gyrus activation occurred in both. Distinct but interconnected neural substrates for emotion perception may exist which reconcile the seemingly contradictory hypotheses of right hemisphere dominance versus differential lateralization for valence.

A. CHATTERJEE & M.H. SOUTHWOOD. Anton's Syndrome and Visual Imagery.
Neural structures mediating visual perception and imagery are largely shared. Recent PET studies implicate the primary visual cortex in imagery processes. We studied two patients with Anton's syndrome to learn if cortical blindness results in a specific pattern of imagery impairment. One patient, who confabulated spontaneously, had preserved visual imagery for shapes, colors and features of single objects, but performed poorly when multiple objects or features needed comparison (imagery simultanagnosia). The second patient, who only confabulated in response to direct questions, was severely impaired in all of the imagery tasks. Cortical blindness is probably associated with a variety of imagery deficits, analogous to the number of perceptual deficits associated

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with occipito-temporal lesions. Spontaneous confabulations could represent patients' descriptions of visual images generated internally.

M. DIXON, D. BUB, & M. ARGUIN. The Influence of Semantics on Shape Identification in Category Specific Agnosia.
Laboratory studies of agnosia typically use line drawing identification ability to demarcate recognizable from unrecognizable objects. This is problematic because shape primitives of line drawings are unknown, and semantics are inextricably linked to the forms. By using blobs with known primitives we demonstrated that a category specific agnosic (CSA) patient could always identify blobs if they differed along a single dimension (e.g., curvature). With blobs that differed in two dimensions (e.g., eccentricity, curvature), identification capability depended on the semantic relations among blobs. For example, ELM could not identify four multidimensional blobs playing different types of birdsong, but identified identical blobs playing recordings of four unrelated sounds. This paradigm allows the unprecedented ability to look at semantics in CSA independent of structural processes.

Paper Session 3

CHILDHOOD DISEASE

E. SHAPIRO, M. BALTHAZOR, L. LOCKMAN, & W. KRIVIT. Neuropsychological Outcomes of Bone Marrow Transplantation in Hurler's Syndrome.
Children with Hurler's syndrome (MPS I) whose baseline Bayley MDI was over 70 were studied as part of a multi-center study of the effectiveness of bone marrow transplantation (BMT) on preventing the dementia associated with neurodegenerative storage diseases of childhood. Of 17 untransplanted children studied, those evaluated between 1 and 2 years of age had a mean MDI of 81 while those between ages 2 and 3 had a mean MDI or Stanford Binet IQ of 61. Seventeen children transplanted at less than two years of age with at least 10 months of follow-up had a mean MDI/IQ decrement of 3.86 points indicating stability in development. Seven children transplanted between the ages of 2 and 3 had a mean IQ decrement of 6.88 points. IQ falling below 50 was significantly more common in the older group ($p < .01$). We conclude that BMT prevents deterioration of cognitive function and that higher IQs are more commonly found in children transplanted earlier. Supportive MRI data, language, and behavioral data will be presented.

V. ANDERSON, C. CATROPPA, L. BOND, K. GRUNWOOD, E. KEIR, & T. NOLAN. Childhood Bacterial Meningitis: Relationships Between Age at Illness and Cognitive and Educational Sequelae.
Bacterial meningitis is a common paediatric interaction occurring mostly in pre-school children. It acts upon the immature brain, possibly disrupting cerebral and cognitive development. This study prospectively compared 130 meningitis survivors and 130 healthy controls, matched for gender, age and SES. Evaluation occurred 6 years post-meningitis, and included measures of intelligence, educational ability, language, visual-motor skills and memory. Results showed poorer performances on all tasks for the post-meningitic group. Within group analysis indicated that presence of medical complications and younger age at illness were associated with poorest outcome. Language difficulties were particularly common, and showed a strong relationship to educational deficits, which were also frequently identified. Findings are discussed in relation to the notion of critical periods of development, from both neurological or neuropsychological perspectives.

M. CROSSLEY, R. CASEY, & C. VOLL. Reversible Dementia With Betaine Therapy in Adolescent-Onset Homocystinuria: A Case History.
A 22 year-old caucasian male who presented with a 8-mo history of deteriorating academic performance, apathy, lower limb weakness and spasticity, and visual changes was found to have homocystinuria due to 5,10-methylene tetrahydrofolate reductase deficiency. Neuropsychological assessment prior to betaine therapy revealed marked bradyphrenia and bradykinesia, impaired visual perception and scanning and poor constructional skills. Memory, language, and conceptual functions were average. Six mo after treatment-onset, FSIQ had increased 32 points to superior range, and memory and language were above average. Perception, praxis, and hand dexterity had returned to normal range, and speeded visuomotor processing, although mildly impaired, was greatly improved. In summary, six mo after starting betaine therapy, this young man displayed a remarkable recovery in higher brain functions.

D. SCHRETLEN, J.C. HARRIS, D.F. WONG, & M.A. DiCARLO. A Preliminary Study of Cognition in Lesch-Nyhan Disease.
Lesch-Nyhan disease (LND) is a rare condition that involves the inborn deficiency of an enzyme (HPRT) that is essential for purine metabolism. In its most extreme form, HPRT deficiency gives rise to an extraordinary behavioral syndrome that includes choreoathetoid cerebral palsy and severe, compulsive self-injury. Although mental retardation also is considered a defining feature of LND, no systematic neuropsychological study of this condition has been reported previously. The present descriptive study of 5 adult LND patients demonstrates that cognitive assessment is feasible despite their multiple disabilities. Mental retardation may be a common but not essential feature of the syndrome, and there is some evidence that patients with LND may show selective rather than pervasive cognitive deficits.

K.O. YEATES, B. ENRILE, N. LOSS, E. BLUMENSTEIN, & D.C. DELIS. Verbal Learning and Memory in Children With Myelomeningocele.
Examined verbal learning and memory in children with myelomeningocele using the California Verbal Learning Test. Participants included 41 children with myelomeningocele, from 8 to 15 years of age, 32 of whom had a history of shunted hydrocephalus, and 41 controls matched for age, gender, race, and WISC-III Vocabulary subtest standard score. Children with myelomeningocele performed worse than controls, especially when they had a history of hydrocephalus. They recalled as many words as controls on the first learning trial, but had a slower learning curve across trials, so that their overall recall was lower. They demonstrated less consistency and significant recency effects on learning trials, but did not differ in semantic or serial clustering, or in repetitions or intrusions. They displayed more retroactive interference after presentation of a second word list. Their delayed recall of the original list was worse than controls, but not their recognition. Overall, myelomeningocele is associated with significant deficits in retrieval, particularly when accompanied by hydrocephalus.

Paper Session 4

AGING

T. GLEASON, D. DeLEONARDIS, J. PHILIPSON, & S. DOPKINS. Spatial Memory in Young and Older Subjects.
During the acquisition phase of each trial, old and young subjects saw a display consisting of a landmark object and a test object. During the test phase, subjects tried to place the test object in the correct position

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relative to the landmark object. On some trials, the display was rotated between the acquisition and the test phase. The older subjects were less accurate than the young subjects on both rotated and unrotated trials, but no more inaccurate on the rotated trials. Inaccuracy in locating the object was decomposed into inaccuracy in specifying its orientation relative to the landmark and inaccuracy in specifying its distance from the landmark. For unrotated trials, the older subjects were disproportionately more inaccurate in specifying orientation than in specifying distance.

G. SMITH, R. PETERSEN, R. IVNIK, & J. MALEC. Subjective Memory Complaints, Psychological Distress and Longitudinal Change in Objective Memory Performance.
Past studies comparing subjective complaint to objective memory performance have largely been cross-sectional, precluding comparison to actual *change* in memory performance. In 1992–1993, we obtained subjective memory reports, objective memory performance and psychological distress data for 300 to 397 (75.6%) participants originally assessed in a normative study between 1988 and 1990. All participants were between 55–97 years old at entry. The Memory Functioning Questionnaire General Frequency of Forgetting Scale (MFQ-GEN), the SCL-90-R General Severity Index (SCL-GSI) and Mayo Cognitive Factor Scale Scores (MCFS) were obtained for each person. In multiple regression modelling, the SCL-GSI, MCFS-Learning absolute scores and the MCFS-Retention change scores contributed 20%, 3% and 1% respectively to MFQ-GEN variance. Emotional factors appear to be a better predictor of subjective ratings than either absolute objective performance or objective longitudinal change.

J.F. MALEC, G.E. SMITH, & R.J. IVNIK. Clusters of "Impaired" Normal Elderly Do Not Decline Cognitively in 3–5 Years.
The power of clusters based on psychometric data to predict cognitive decline on psychometric re-assessment 3 to 5 years later was examined. Cluster analysis using Ward's method of age- and education-corrected Mayo Cognitive Factor Scale (MCFS) scores for 376 normal elderly subjects revealed 4 of 16 cluster profiles that were predicted to be "At-Risk" for future cognitive decline. 235 of the original sample completed reassessment. Membership in an At-Risk cluster did not powerfully predict subsequent medical evaluation of cognitive or psychiatric disorder or status as lost to follow-up. Repeated-measures analyses of variance of MCFS scores showed no differential decline in learning or memory between Normal and At-Risk clusters. Thus, in a nonclinical sample, relative cognitive impairments are not powerfully predictive of future cognitive decline.

C.M. CULLUM, C.M. FILLEY, & E. KOZORA. Episodic Memory Functions in Advanced Aging and Early Alzheimer's Disease.
Normal aging and Alzheimer's disease (AD) share some common neuropathological and neuropsychological features, with many of the differences between age-matched groups being largely quantitative. Cognitively low-functioning but otherwise healthy individuals age 80–95 and younger patients (<85) in the early stages of AD were examined in order to reduce age effects per se on cognition. The groups did not differ on measures of global cognitive status, attention, or language. Deficient semantic processing as reflected by inefficient learning and recall styles characterized the AD group, with double-dissociations observed in terms of learning and recall patterns. Results suggest important qualitative and quantitative neuropsychological differences as well as overlap between these conditions and highlight some of the challenges in defining cognitive "normality" among the oldest segments of our population.

D. JACOBS, Y. STERN, B. TYCKO, G. MAESTRE, & R. MAYEUX. Apolipoprotein-E and Cognitive Function in Nondemented Older Adults.
An association between the apolipoprotein E type 4 allele (Apo-ε4) and Alzheimer's disease (AD) has been reported; however, there have been no investigations of the apolipoprotein-E polymorphisms and cognitive function in nondemented older adults. We examined potential associations between Apo-E genotype and neuropsychological test scores in 179 nondemented elders. Subjects homozygous for the ε4 allele (4/4) scored lower than subjects without an ε4 allele (−/−) on all 15 neuropsychological measures examined. Significant group differences were observed on tests of figure drawing and sentence repetition. Subjects heterozygous for the ε4 allele (4−) generally scored lower than −/− subjects, but not as low as 4/4 subjects, suggesting a dose-dependent relationship between ε4 and cognition. Results suggest that Apo-ε4 or a nearby susceptibility locus in linkage disequilibrium with Apo-ε4 impacts cognition in aging, even in the absence of clinically significant AD.

Symposium 1

THEORIES OF FRONTAL LOBE FUNCTION

A.P. SHIMAMURA. Theories of Frontal Lobe Function.
Patients with frontal lobe lesions exhibit a wide array of cognitive deficits, including impairment in planning, problem solving, working memory, and temporal memory. Some have viewed memory impairment as secondary to other cognitive disorders, such as deficits in attention, inferential reasoning, and problem solving. Others have viewed memory impairment as a primary deficit in frontal lobe mechanisms (e.g., working memory). This symposium presents theoretical views of frontal lobe function. The presenters describe how their theoretical framework provide insights concerning the role of the frontal lobes in cognitive behavior.

M. MOSCOVITCH. Frontal Lobes and Memory.
Evidence regarding frontal-lobe involvement in memory is presented from three sources: (1) studies on people with frontal-lobe lesions, (2) PET scan studies in normal people, (3) task interference studies in normal people. The evidence is used to evaluate a neuropsychological model of memory (Moscovitch, *J. Cog. Neuroscience*, 1992), in which the frontal lobes act as "working-with-memory" structures that organize input at encoding, initiate and implement retrieval strategies, and monitor and evaluate the information that is recovered from memory.

D.Y. KIMBERG & M.J. FARAH. A Unified Account of Cognitive Impairments Following Frontal Lobe Damage: The Role of Working Memory in Complex, Organized Behavior.
A computer model is presented that performs four tasks often impaired by frontal damage: motor sequencing, the Stroop task, the Wisconsin Card Sorting Test, and a context memory task. In each task, patterns of performance typical of frontal-damaged patients are shown to result from the same type of damage to the model. Specifically, the model simulates frontal damage by weakening associations among elements in working memory. The simulation shows how a single underlying type of damage could result in impairments on a variety of seemingly distinct tasks. Furthermore, the hypothesized damage affects the processing components that carry out the task rather than a distinct central executive.

A.P. SHIMAMURA. Prefrontal Cortex as a Dynamic Filtering Mechanism.
Patients with frontal lobe lesions exhibit numerous disorders that affect memory and cognition. Many aspects of frontal dysfunction suggest a failure to filter or inhibit irrelevant or extraneous information. During

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on-line cognitive tasks, a filtering problem may lead to problems in attention and planning (e.g., heightened Stroop effects). In memory, problems may result because of interference from previously activated memories (i.e., proactive interference). Based on this view, the variety of behavioral disorders that occur as a result of damage to the prefrontal cortex is not because various regions within the prefrontal cortex are performing different computations. Instead, prefrontal regions are performing the same computation—that is, filtering or gating information—but each region filters different kinds of information.

J. GRAFMAN. Evolution of the Structured Event Complex: Management Knowledge Units are Stored in Human Prefrontal Cortex.
Many researchers have suggested that the prefrontal cortex acts to maintain information over time in some sort of working memory buffer. An alternative to a "working memory" view of frontal lobe function is proposed. It is suggested that the prefrontal cortex serves to represent knowledge, but knowledge in the form of a structured event. This managerial knowledge unit (MKU) is hypothesized to be, in effect, a form of memory which would allow learning of thematic knowledge about a situation or plan. This script-like knowledge is bound to knowledge stored elsewhere. Its architecture is similar to that of other knowledge architectures (e.g., the lexicon). The MKU framework allows for cognitively-rich, hypothesis-driven research and also offers a clinically useful approach to prefrontal disorders.

A. DIAMOND. Frontal Lobe Involvement in Cognitive Changes During Early Development.
Evidence from developmental neuropsychology suggests that the dorsolateral prefrontal cortex is required for success on certain memory tasks, such as the "A not B" and delayed response tasks. These tasks require subjects to keep track of where a reward has been hidden in the absence of visible cues. The nature of the memory ability required for such tasks appears to mature during the first year of life. Findings from infants, brain-injured humans, and animal studies suggest that the dorsolateral prefrontal cortex plays a role in inhibitory control in reaching behavior. A theory of development is proposed which suggests that the child must not only acquire knowledge but must also inhibit reactions that interfere with the expression of knowledge that is already present.

Poster Session 2

PSYCHOPATHOLOGY, EPILEPSY, MEDICAL ILLNESS, HIV

I.C. SMET, R.S. GOLDMAN, J. BARTOK, L. DECKER, R. TANDOM, & S. BERENT. Stability of Neuropsychological Functioning Across an Acute Schizophrenic Episode.
The purpose of the present study was to determine to what extent specific cognitive abilities change with the diminution of acute psychotic symtomatology in schizophrenia. We utilized a repeated measures design to assess neuropsychological functioning and clinical symptoms in a sample of 22 research-diagnosed inpatient schizophrenics, who were assessed upon admission and re-assessed shortly before discharge. In addition to significant clinical improvement, we observed significant improvement in aspects of attention, executive function, memory, and general mentation. Furthermore, improvement on neuropsychological tasks was associated with the degree of clinical change. These findings imply that neuropsychological deficits in schizophrenia, to some degree, are transient in nature and are associated with symptomatic fluctuations.

A.V. DAVIS, J.S. PAULSEN, R.K. HEATON, & D.V. JESTE. An Assessment of the Semantic Network in Chronic Schizophrenia.
It is well documented that schizophrenic (SZ) patients display language impairments (Gruzelier et al., 1988; Silverberg-Shalev, 1981). The underlying mechanisms of these impairments, however, remain unclear. Thirty-six early-onset SZ (EOS) subjects, 20 age-, education-, and IQ-matched late-onset SZ (LOS) subjects, and 28 age- and education-matched normal comparison (NC) subjects were administered the animal fluency task. The EOS and LOS subjects generated significantly fewer words than NC subjects. Multidimensional scaling analyses suggested that the semantic networks of NC and LOS subjects were similar. Both NC and LOS subjects demonstrated a clear division between wild and domestic dimensions. In contrast, the EOS network was disorganized and not as clearly defined. Furthermore, pathfinder analysis demonstrated that the EOS similarity index was significantly different from the NC and LOS. The NC and LOS indices were the same. These results suggest that verbal fluency deficits in SZ patients may vary with illness chronicity. Whereas general fluency impairments in SZ may be due to difficulties in initiating systematic search/retrieval strategies, specific impairments in chronic SZ patients may be the result of a breakdown in the structure of semantic knowledge.

R.N. MAHR, P.J. MOBERG, L.M. HARPER MOZLEY, R.E. GUR, & M. GIBNEY. Categorization and Comparison of Naming Errors: Elderly Schizophrenia and Alzheimer's Patients.
Previous studies have indicated deficits in confrontation naming and semantic language processing in schizophrenia. Twenty-one elderly patients with schizophrenia (SZ), 16 Alzheimer's patients (AD), and 17 matched controls were administered a test of visual confrontation naming as part of a comprehensive neuropsychological battery. The relative incidence of semantic, perceptual, lexical, and phonological errors did not differ between the three groups. The preponderance of anomic errors were semantic. More unrelated-type errors were made by elderly SZ patients than by AD patients. Since the pattern of semantic errors made by the two patient groups was similar, with the exception of unrelated-type errors, a random triggering mechanism may be involved in this error type. The similarity in pattern of anomic errors in the patient groups is consistent with neuropathological findings showing overlap in sites of pathology between AD and SZ.

P.J. MOBERG, R. MAHR, M. GIBNEY, S.E. ARNOLD, R. SHAPIRO, A. KUMAR, G. GOTTLIEB, & R.E. GUR. Neuropsychological Functioning in Elderly Patients With Schizophrenia and Alzheimer's Disease.
Elderly patients with schizophrenia (SZ), probable Alzheimer's disease (AD), and normal controls were compared using the CERAD neuropsychological battery. Both SZ and AD patients demonstrated marked impairment relative to controls, with the profile of neuropsychological deficits in both disorders appearing very similar. Only verbal delayed recall and rate of forgetting significantly differentiated between the two groups, with AD patients showing poorer recall and more rapid forgetting of verbal information over delay. Within group analysis indicated that, along with general cognitive impairment, SZ patients had significantly greater deficit in confrontation naming and semantic word-list generation relative to other tests. Neuropathological studies have noted abnormalities in specific subfields of the hippocampal formation in SZ that are also severely affected in AD. Though the specific histopathology of the two disorders differ, abnormalities in the common sites may underline the common neuropsychological profile.

S. BERNS, J. JAEGER, & E. DOUGLAS. Executive Deficits Predict Role Functioning in Psychiatric Outpatients.
Neuropsychological deficits, particularly executive deficits, have been widely documented in psychiatric patients. However, their functional significance remains unclear. This study examines the predictive value of executive functioning as measured by the Wisconsin Card Sorting Test (WCST) for role functioning (RF) three and six months following dis-

charge from a psychiatric rehabilitation program. Multiple regressions revealed that WCST perseverative errors at baseline predicted RF three months following discharge ($p < .021$) while diagnosis, BPRS and WAIS-R subtests had no predictive value. However, six months following discharge, the WCST was not significantly associated with RF. These results indicate that WCST performance may be useful for predicting RF in the short term. Data is presented that suggest longer term prediction may be hampered by a lack of stability in WCST performance.

G.D. RAINS, K. SAUER, & C. KANT. Cognitive Impairment Consistent With Left Fronto-Temporal Abnormality in Schizophrenic Patients.
In an effort to explore further the nature of the cognitive impairment associated with schizophrenia, fourteen patients who met either RDC or DSM III-R criteria for schizophrenia and ten control subjects were administered neuropsychological tests sensitive to specific domains of cognitive functioning. These included measures of general intelligence, attention, verbal and nonverbal episodic memory, semantic memory, word fluency, design fluency and cognitive flexibility (Wisconsin Card Sorting). Patients with schizophrenia, although impaired on the measure of general intelligence, were found to have unimpaired attention. These patients were impaired on all four measures of verbal memory but not on measures of nonverbal memory or semantic memory. The schizophrenic group also showed an impairment in word fluency and on the Wisconsin Card Sorting Test but not on Design Fluency. Taken together, these findings represent a pattern of cognitive impairment consistent with the presence of left fronto-temporal abnormality.

D.A. KAREKEN, P.J. MOBERG, & R.C. GUR. Schizophrenia and Interference in Verbal Memory.
Compared to other cognitive functions, evidence suggests that verbal memory is particularly impaired in schizophrenia. This study examined proactive interference and other measures of semantic processing in verbal memory with the California Verbal Learning Test in 29 schizophrenic patients and 29 healthy controls. Patients showed significantly less proactive interference, but also did not organize (cluster) their recall according to semantic category. Controls and patients demonstrated small retroactive interference effects regardless of semantic content. Although both groups made similar types of intrusion errors, patients committed more phonemic and nonshared errors on item recognition. Results suggest errant semantic processing as one underlying mechanism of defective memory in schizophrenia and underline the importance of research in temporal lobe anatomy, physiology, and cognitive function.

I.J. TORRES, L.A. FLASHMAN, D.S. O'LEARY, & N.C. ANDREASEN. The Effects of Proactive and Retroactive Interference on List Learning in Schizophrenia.
Schizophrenia spectrum patients ($n = 143$) and healthy controls ($n = 160$) were administered the Rey Auditory Verbal Learning Test (RAVLT) to investigate learning rates and the effects of proactive interference (P.I.) and retroactive interference (R.I.) on learning. The hypothesis that schizophrenia resembles a mild form of amnesia and that learning rates should therefore be diminished in patients was supported, both before and after equalization for first trial performance. It was also hypothesized that one source of learning deficit in schizophrenia would be increased susceptibility to both R.I. and P.I., since both conditions require temporal discrimination of alternate word lists. Results indicated that patients show increased susceptibility to R.I., but not P.I. This difference may be due to the frontally-mediated set shifting component which distinguishes R.I. from P.I.

F.R. FERRARO & M. OKERLUND. Failure to Inhibit Irrelevant Information in Schizotypic Individuals: Negative Priming.
Nineteen Low Schizotypic individuals and 13 High Schizotypic individuals participated in a negative priming experiment to substantiate claims that part of the cognitive performance deficiency in schizotypic individuals results from their inability to inhibit irrelevant information. Subjects were given 2-letter displays (A-b) and indicated which letter was in uppercase. In the A-b example, the A is relevant while the b is irrelevant. On control trials the next display might be f-J. On critical trials the next display might be B-e. That is, the lowercase b (previously irrelevant) now becomes relevant (B). There were 168 trials (68 control, 68 critical). Low schizotypic individuals displayed the standard negative priming effect (slower reaction times on Critical trials). High schizotypic individuals were actually slower on control trials. This outcome was supported by a 2 (Group) × 2 (Trial Type) interaction, $F(1, 30) = 49.07$, $p = .0000$. These results support the idea that high schizotypic individuals are deficient in their ability to adequately inhibit irrelevant information, suggesting that this failure may be a general characteristic.

J. TRACY, J. DE LEON, R. DOONAN, R. MUSCIENTE, & R. JOSIASSEN. Clock Drawing Deficits in Schizophrenia.
Empirically-based characterizations of cognitive impairment in schizophrenia with comparisons to data on dementia patients are needed to determine if cognitive decline in schizophrenia can be understood with current models of dementia. The Clock Drawing Test, widely used with dementia patients, was administered to schizophrenia patients ($N = 27$) in a repeated measures design. Two global measures of Clock Drawing performance determined the magnitude and stability of Clock Drawing impairment. A qualitative scoring system identified the specific nature of Clock Drawing errors. When compared to the literature on dementia, results suggested schizophrenia performance: (1) can be differentiated from Alzheimer's and Huntington's, (2) revealed deficits at a magnitude between that of dementia patients and elderly normal controls, (3) involved errors consistent with fronto-striatal dysfunction and not an executive function syndrome.

C.K. WESTERGAARD. Prediction and Quantification of Dyskinesia in Schizophrenia.
Motor abnormalities in schizophrenia (SZ) have been documented since the turn of the century, long before the advent of antipsychotic medication, but without objective, empirical assessment. The goal of the present study was to develop a quantitative neurobehavioral measure of dyskinesia that would be both sensitive to severe psychopathology and specific to SZ. A 3 (tension level) × 3 (group) design was employed, using psychiatrically normal ($n = 10$), bipolar ($n = 11$), and SZ ($n = 11$) adults. Independent measures included demographic and clinical variables (positive and negative symptoms, chronicity, and neuroleptic exposure). Dependent measures included: time off target, number of times off target, response and recovery time, motor steadiness, and quantitative measures of idiopathic motor behavior. Quantified measures provided both a sensitive and specific neurobehavioral measure of dyskinesia in SZ. SZs were unable to sustain appropriate muscle activation, and exhibited a diverse set of abnormal motor behaviors.

D.T. CRANDALL, J.A. BATES, R.M. BILDER, & J.A. LIEBERMAN. Methylphenidate Effects on Redundant Responding in First Episode Schizophrenia.
This study assessed effects of the dopamine agonist Methylphenidate (MET) on redundant responding in patients participating in a study of first episode schizophrenia. Patients and normal controls were asked to perform a two-choice guessing task both before and after an infusion of MET. Both patients and normal controls showed increased redundant responding after receiving the MET infusion. Patients' redundant guessing responses were characterized by switching back and forth (alternating) between choices, while control subjects revealed a tendency toward repeating only one choice (perseverating). The results suggest that the dopamine agonist MET may increase redundant responding in both patients and normal controls, and different patterns of nonrandom behavior may be associated with clinical status.

M.L. PROHASKA, R.A. STERN, G.A. MASON, C.T. NEVELS, & A.J. PRANGE, JR. Thyroid Hormone and Lithium-Related Neuropsychological Deficits: A Preliminary Test of the Lithium-Thyroid Interactive Hypothesis.

The "lithium-thyroid interactive hypothesis" postulates that neuropsychological deficits caused by lithium may be attributable to its antithyroid effects. This study addressed two related questions: (1) do subclinically hypothyroid (SCH) lithium-treated patients perform worse neuropsychologically than euthyroid (EUTH) counterparts? and (2) does neuropsychological performance in lithium-treated patients improve following thyroid hormone treatment? Sixteen outpatients participated in a double-blind, cross-over treatment study. SCH subjects performed significantly worse on measures of verbal learning and memory at baseline and performance on these variables was more highly correlated with TSH levels than lithium levels. Liothyronine treatment yielded improvement on measures of information processing and motor speed, regardless of initial thyroid status. In summary, although these data partially support the lithium-thyroid interactive hypothesis, additional studies with larger sample sizes and longer treatment trials are needed.

R.A. COHEN & I. LOHR. The Influence of Effort on Impairments of Attention Associated With Major Affective Disorders.

We investigated how effortful task demands affect attentional performance in patients with major affective disorders. Inpatients with both unipolar and bipolar affective illness were compared with normal control subjects on measures of different attention functions; on a low- and high-effort version of each task. Attentional impairments correlated highly with severity of affective disturbance (IDD). While affective disorder patients exhibited impairments on most of the tasks regardless of level of task effort, requirements for higher effort produced greater decrements in performance relative to control subjects. The effect of task effort was noted on certain attentional tasks (e.g., Symbol Coding, Continuous Performance), but not on other tasks (e.g., Visual Letter Search). While various attentional processes were affected, greatest impairments occurred on tasks requiring sustained and focused attention, under conditions of high effortful task demand.

J.L. HAYDEN, N.L. BURDICK, R.S. KERN, M.J. ROBERTSON, K.S. KEE, & M.F. GREEN. The Relationship Between Cognitive Functioning and Ambiguous Handedness in the Chronically Mentally Ill.

Atypical handedness (e.g., ambiguous handedness) is considered a marker for abnormalities in neurodevelopment. Ambiguous handedness has been associated with cognitive impairments in developmentally disabled populations. Studies to date have not examined the relationship between cognitive impairments and ambiguous handedness in the chronically mentally ill. The present study included 42 chronically mentally ill inpatients who were divided into two groups based on handedness. Measures of memory and learning, motor functioning, and executive functioning were administered. Ambiguous handers had significantly poorer memory compared with nonambiguous handers.

P.J. SNYDER & L.J. HARRIS. The Intracarotid Amobarbital Procedure (IAP): Its Past, Present, and Future.

The IAP is currently regarded as the best method for determining hemispheric specialization for speech, and it is universally relied on as a prognostic test for medically refractory epilepsy patients who are surgical candidates. Since its initial development, the IAP also has been adapted for assessing lateralized mesiotemporal contributions to memory functioning, and it is now widely used for both basic and applied research on the neuropsychological bases of language, memory, visuospatial functions, emotion, attention, and consciousness. Despite its wide range of applications, few clinicians who use the IAP are familiar with its historical foundations and development. Our intent is to explore this history, as well as to discuss current clinical and basic research uses of the IAP, its limitations, and its likely future use in epilepsy surgery programs.

G. RISSE, M. FANGMAN, A. HEMPEL, K. MERCER, & J. GATES. Dominant Hemisphere Superiority for Recognition Memory in Patients Undergoing the Intracarotid Amobarbital Procedure (IAP).

Recognition memory performance of each hemisphere was evaluated in IAP for 88 epilepsy patients who were candidates for unilateral cortical resection. Total memory scores were significantly higher in the left- (or right-) language-dominant hemisphere, while patients with bilateral language did not show a hemispheric advantage in memory performance. Review of material-specific items separately revealed a consistent dominant hemisphere advantage for verbal material regardless of lesion side, while the only nondominant hemisphere advantage noted was for recognition of abstract designs in patients with left hemisphere lesions. These findings are consistent with a global "hemispheric memory dominance" and suggest that the demonstration of "adequate" recognition memory in the nondominant hemisphere may not provide sufficient neuropsychological justification for dominant mesial temporal resection.

D.W. LORING, B.P. HERMANN, K. PERRINE, P.M. PLENGER, G.P. LEE, M.E. NICHOLS, & K.J. MEADOR. Memory for Real Objects is Superior to Line Drawing Recognition in Discriminating Lateralized Temporal Lobe Impairment During the Wada Test.

Wada memory asymmetries are increasingly employed as measures of lateralized temporal lobe dysfunction in patients who are being evaluated for anterior temporal lobectomy (ATL). Since the Wada test is not standardized, it is difficult to determine to what degree method variance is contributing to the differences in the reported results. We compared real objects to line drawing representations of real objects in their ability to discriminate lateralized temporal impairment in ATL candidates, all of whom have subsequently undergone surgery. Although both real object and line drawing memory asymmetries (ipsilateral–contralateral memory difference scores) significantly discriminated laterality of seizure onset, objects were superior to line drawings in making this differentiation. Type of memory stimuli is one factor affecting memory results during the Wada test.

P.M. PLENGER & A. SANDER. Clinical Prediction of Temporal Lobe Dysfunction: Usefulness of the Visual Versus the Verbal Memory Dichotomy.

The usefulness of memory measures for determining lateralized temporal lobe dysfunction was analyzed. Epilepsy patients were categorized as dominant or nondominant temporal dysfunction (EEG/MRI). Patients obtaining results within normal limits on all verbal memory measures, but who had at least one measure in the impaired range on nonverbal memory were classified as nondominant temporal dysfunction. The reverse was used for dominant temporal classification. A moderately good hit rate was noted for verbal memory measures and dominant temporal dysfunction. However, a high false positive rate was achieved using this technique for predicting nondominant temporal lesions. These results support cautious use of verbal memory measures, but seriously questions predictions based on the results of nonverbal memory measures.

J. WILLIAMS, M. GRIEBEL, & G. SHARP. A Standardized Protocol for the Intracarotid Amobarbital Procedure (IAP) in Children.

With increased surgery for childhood epilepsy, questions have been raised about the feasibility of performing the IAP with children to determine language and memory function. Research is needed concerning the effects of IQ, age, dose level of amobarbital, and gender on a child's ability to complete the test. In addition, reliability of IAP memory results in children needs to be established. In order to facilitate this research, a standardized IAP protocol is proposed which would facilitate research across surgical centers. This protocol includes assessment of expressive speech, receptive language, memory for objects and pictures, and recall of verbal information. Quantification of results requires 67% correct retention for passing the memory component. An alternative protocol is recommended for children with language disorders or decreased intelligence.

R.F. ASARNOW, C. LoPRESTI, & D. SHIELDS. Developmental Outcomes in Children Receiving Surgery for Medically Intractable Infantile Spasms.
Developmental outcomes were assessed at two years post-surgery in 26 children with infantile spasms which were refractory to medical treatment. The children were between three months and four years of age at the time of surgery. Each child's developmental level and degree of seizure control was assessed immediately prior to surgery, and at yearly intervals thereafter using the communication, motor and adaptive behavior domains of the Vineland Adaptive Behavior Scales. The major effect of surgery was to reduce the proportion of children with "catastrophic outcomes" (developmental quotients < 36), in communication, motor and adaptive behavior domains. Prior follow-ups of children with infantile spasms indicate that more than 40% of the children had IQ's less than 36. In contrast, only 8% of the children in the current series have developmental quotients less than 36.

C.M. BISHOP, J. NANSON, & C.E. PANIAK. Cognitive Integrity Following Early Acquired Lesion, Intractable Seizures and Hemispherectomy.
Neuropsychological evidence suggests that the right hemisphere may possess considerable linguistic competence (Ogden, 1988). Sodium amytal studies cite evidence for atypical speech representation in individuals with left hemisphere injury accompanied by epilepsy (Woods et al., 1988). Neuronal plasticity has been implicated in compensation of language, and other, functional loss due to cerebral damage in young children (Kinsbourne & Hiscock, 1977). Cognitive decline associated with epilepsy variables has also been described (Trimble, 1988). A 16-yr-old male and a 12-yr history of intractable seizures post-ruptured AVM, who underwent sodium amytal procedure and subsequent surgical interventions, demonstrated post-AVM developmental history consistent with right language representation and progressive cognitive deterioration associated with seizure activity and prophylaxis.

C. GECKLER & J. SCHUSTER. Cognitive and Behavioral Status in Children With Intractable Epilepsy: Pre and Postoperative Comparisons.
The literature suggests that childhood epilepsy is often associated with cognitive impairments, emotional dysfunction, and behavioral disorders (Kim, 1991; Sillanpaa, 1992). This study examined 22 children (10 females, 12 males, mean age 10 yr) with medically refractory seizures and compared postsurgical outcome (6 month s/p) with presurgical performance in the areas of intellectual functioning and emotional behavioral status, derived from the PIC. Results indicate VIQ and FSIQ remained constant, PIQ reflected a modest 4 point gain. Nine subjects with pre- and post-PIC information demonstrated statistically significant improvements in compliance, self control, and somatic comfort, placing scores in the nonclinical range. Trends toward improved academic achievement and social competence were also evident. Very modest correlations existed between intellectual functioning and emotional-behavioral status. Possible bases of results and treatment implications are discussed.

B. KLEIN, B.E. LEVIN, M. LLABRE, & M. DUCHOWNY. Anticonvulsant Medications and Behavioral Correlates in Children with Epilepsy.
Few studies of childhood epilepsy have examined medication effects and psychosocial functioning while controlling for seizure-related variables. This study examined the relationship between antiepileptic drugs (AEDs), seizure type, and psychosocial/behavioral functioning in 48 children with epilepsy (aged 6–13). For subjects with generalized seizures, no significant differences were found between monotherapy and polytherapy groups. However, subjects with partial seizures on monotherapy were less depressed compared to those on polytherapy. Subjects with partial seizures taking carbamazepine had higher self-esteem, less depression, and fewer behavioral problems than those taking sodium valproate. These results indicate an interaction between seizure type and AED, and underscore the need to address psychosocial concerns related to medication variables in clinical settings.

H.A. WISHART, V. WARMFLASH, W.B. BARR, & N. SCHAUL. A Moderating Effect of Age at Seizure Onset in Childhood on Relations Between Focus Site and Memory in Epilepsy Surgery Candidates.
On the basis of previous research (e.g., Strauss et al., 1993), we hypothesized that age at onset would moderate the relation between side of seizure origin and material-specific deficits in learning and memory. Subjects were adults with childhood onset of partial epilepsy of unilateral right ($n = 15$) or left ($n = 19$) temporal lobe origin, as determined using MRI and 24-h video/EEG monitoring. As expected, patients with early-onset LTL seizures showed poorer verbal memory than did patients with later LTL onset, who performed as well as or better than RTL patients ($F(1, 28) = 11.3$, $p < .005$). RTL patients showed poorer nonverbal memory than LTL patients regardless of age at onset ($F(1, 27) = 6.8$, $p < .01$). Clinical and empirical implications are discussed.

J. BORTZ & G.P. PRIGATANO. Evidence of a Negative Response Bias in Patients with Frontal Lobe Seizures.
Patients with frontal lobe seizures (FLS) are at high risk for misclassification as having nonepileptic seizures (NES). Clinical features of FLS are often bizarre, ictal EEG recordings frequently normal, and neuropsychological test findings may be unrevealing. We previously reported a unique negative response bias on the CVLT in 18 NES patients. This pilot study investigated response bias tendencies in patients with FLS versus NES and lateralized temporal seizure foci. FLS patients produced a mean response bias score indistinguishable from NES patients ($M = -.24$ and $-.16$, respectively). In replication of previous results, a positive response bias was documented in patients with left temporal seizure foci ($M = +.31$). Right temporal patients showed no consistent response tendency. Further studies are needed to clarify mechanisms underlying a negative response bias in patients with FLS.

A. PERRINE, B.P. HERMANN, M. SEIDENBERG, J. SCHOENFELD, & A. WYLER. Hippocampal Sclerosis and Recognition Memory for Verbal Material Following Left Anterior Temporal Lobectomy.
We examined recognition memory performance of left unilateral temporal lobe epilepsy (TLE) patients prior to and after anterior temporal lobectomy (ATL). Patients were divided into two groups (No/Mild hippocampal sclerosis, $n = 19$, and Moderate/Severe hippocampal sclerosis, $n = 23$). Patients without pathology experienced a greater decline in recognition memory than patients with pathology; decreased discriminability and increased false positives. In addition, only the no pathology group showed a significantly greater increase of false positives to novel semantic and phonemic distractors compared to the other distractor types. This pattern of performance suggests that resection of normal hippocampus impairs the specific and distinctive encoding of verbal material.

B.P. HERMANN, M. SEIDENBERG, J. CHRISTESON, M. MORAN, & A. WYLER. Serial Position Curve Following Anterior Temporal Lobectomy.
We examined changes in serial position effects in 85 anterior temporal lobectomy (ATL) patients (50 left and 35 right). Side of resection and degree of hippocampal sclerosis (none/mild, $n = 30$; moderate/severe, $n = 55$) were examined. Pre- to post-operative changes in recall for primacy, middle, and recency portions of the word list varied with laterality of ATL and degree of sclerosis. Left ATL subjects without hippocampal sclerosis demonstrated significant postoperative increase in recall from the recency, and decrease recall from the middle portion compared to left ATL patients with sclerosis. No effect was found for the right ATL group. Results show that the memory morbidity following left ATL is associated with the neuropathological substrate, and that hippocampal contributions to discrete memory phenomena can be demonstrated.

J. ANSLEY, C.S. GASS, M.C. BROWN, & B.E. LEVIN. Epileptic and Nonepileptic Seizure Disorder: A Comparison of MMPI-2 Profile Characteristics.
We described and contrasted personality and emotional features of epileptic (ES) and nonepileptic seizure (NES) patients using the MMPI-2.

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NES ($n = 47$) was associated with evidence of conversion symptoms and somatic preoccupations. ES patients ($n = 56$) had lower mean scores on scales Hs, Hy, and subscale Hy4 (Somatic Complaints). Clinical elevations ($T > 65$) on Hs and Hy occurred in 62% of the NES patients, in contrast with a lower incidence in ES patients (34% and 32%, respectively). MMPI-2 basic scale scores, entered into a stepwise regression analysis, collectively accounted for 24.8% of the variance in diagnosis (ES vs. NES), with major independent contributions from scales Hy and Sc. The diagnostic implications of these data are discussed.

D.S. DERRER, L.M. BINDER, & M.C. SALINSKY. Pseudoseizures or Epilepsy? A Step Closer to a Differential With the Unusual Experiences Scale.

A new structured interview, the Unusual Experiences Scale (UES), significantly differentiated patients with epileptic seizures (ES) from those with psychogenic seizures (PS). The UES total score discrimination was due to two items—anxiety attacks and past criminal convictions. Several UES items were combined in a logistic regression model with 3 MMPI scales and whether the patients were seeking disability. Two models were generated. The first contained the L scale, anxiety attacks, and disability seeking; it was 79.2% sensitive and 85.7% specific. The second model added the Hy scale and was less sensitive (75.0%) but more specific (88.1%). Clinical utility of these prediction models was discussed.

A.C. ROSEN & W.B. BARR. Visual Search in Epilepsy Surgery Candidates.

Performance on the Visual and Verbal Cancellation Tests of Mesulam and Weintraub (1985) was examined in a sample of 81 epilepsy surgery candidates [35 Right Temporal (RTL), 46 Left Temporal (LTL)]. When stroke patients are given these measures, it is typically found that left-hemisphere patients have difficulty searching for target letters and right hemisphere patients have difficulty scanning through unstructured arrays. In this sample there were no differences between the RTL and LTL groups' search for letter versus geometric targets. There was, however, a significant interaction between group and structure where RTL patients were found to search more slowly through unstructured versus structured arrays. The findings suggest that RTL patients have relative difficulties in imposing order during their search of novel and unstructured stimuli.

M.C. BROWN, R.A. KADERMAN, B.E. LEVIN, G.J. REY, & R.E. RAMSAY. Neuropsychological Evaluation of Subependymal Heterotopias.

We report the neuropsychological, MR, and EEG telemetry data of an adult female with bilateral subependymal heterotopias. Past reports of clinical data in cases of subependymal heterotopia are rare, and limited to the observation that cognitive deficits are mild or absent. Comprehensive neuropsychological testing in our patient revealed a select deficit in word retrieval, which correlated well with EEG telemetry studies demonstrating an epileptogenic lesion in the left-temporal lobe. This case demonstrates that cognitive deficits do result from subependymal heterotopias. However, the deficit resulting from this widespread, bilateral defect of neuronal migration was select and illustrated the need for careful test selection to elucidate cognitive deficits resulting from a focal lesion.

N.L. ADAMS, S. REDLINE, & I. BROWNER. Impact of Mild and Moderate Levels of Sleep Apnea on Neuropsychological Function and Mood.

We investigated the health impact on 31 middle-aged patients of mild to moderate levels of sleep apnea (between 5 and 30 episodes of obstructed breathing/h). Compared to 14 controls, apneics are sleepier (but not pathologically so), cannot focus attention as well, have slower choice reaction times, and complete fewer items on a complex symbol digit task. They also reported lower vigor and greater mood disturbances. Our ongoing work investigates whether these apneics will benefit from treatment.

L. RAVDIN, C. CLEMENTS, P. PRIMEAU, W. BARR, & E. HILTON. Memory Functioning in Neuroborreliosis.

Lyme borreliosis is a chronic infection which may result in multisystemic complications. Late neurologic manifestations, neuroborreliosis (NB), may include complaints of memory impairment, depressed mood, and fatigue. However, the latter are frequently reported in chronic disease populations, and may influence memory functioning. Verbal memory was evaluated in patients with NB ($n = 21$), other chronic infections ($n = 21$), and healthy controls ($n = 21$). Fatigue, but not depression, was significantly correlated with memory performance. NB patients show mild memory deficits relative to healthy controls, but there are no significant differences between the two patient groups. NB patients reported greater memory deficits, yet subjective reports were not correlated with objective performance.

D. EDWIN, S. NAIDU, D. HOFFMEYER, A.J. KUMAR, & H.W. MOSER. Cognitive Impairment and MRI Abnormality in Adult Males With Adrenoleukodystrophy.

Neuropsychological status was evaluated in 84 adult male patients with adrenoleukodystrophy-adrenomyeloneuropathy, and compared with brain MRI scored in a standardized fashion. Patients with cerebral involvement ($N = 33$) performed similarly to those with spinal involvement alone ($N = 51$) in studies of global intellect and verbal knowledge and skills, but demonstrated impairment in psychomotor speed, visual organization, recall and recognition memory, and executive functions. Patients with MRI evidence of severe cerebral disease had global and language impairment as well, and deficits in all areas were correlated with degree of brain MRI involvement. We are currently studying patterns of brain involvement and cognitive deficits, and following their course over time.

W.W. BEATTY, K.A. HAMES, C.R. BLANCO, R.H. PAUL, & S.L. WILBANKS. A Verbal Abstraction Deficit in Multiple Sclerosis.

Impairments on nonverbal tests of abstraction by patients with multiple sclerosis (MS) have been reported frequently, but findings on the verbal Similarities test from the WAIS are equivocal. To reexamine the status of verbal reasoning in comparison to nonverbal reasoning in MS we administered the Shipley Institute of Living Scale (SILS), the Wisconsin Card Sorting Test (WCST), and a shortened version of the Free Sorting part of the California Card Sorting Test (CCST) to 100 MS patients and 32 age- and education-equated control subjects. Patients performed more poorly on the WCST, CCST, and the Vocabulary Abstraction scales from the SILS, but because they also attained lower Conceptual Quotients, their poorer performance on the verbal abstraction cannot be attributed solely to lower verbal ability.

S. BEASON-HAZEN, J. LYNN, K.W. RAMMOHAN, & R.A. BORNSTEIN. Depressive Symptoms and Neuropsychological Performance in Chronic Progressive and Relapsing Remitting Multiple Sclerosis.

This study examined patterns of depressive symptoms and neuropsychological performance in probable or definite multiple sclerosis (MS) patients referred for routine neuropsychological testing at a tertiary care medical center. From a total sample of 84 subjects, 17 pairs of subjects were chosen, based on disease course [chronic progressive (CP) or relapsing remitting (RR)]. Subjects were matched for age, education, and disease severity as indicated by Expanded Disability Status Scale score. CP patients performed worse on measures of executive function and attention. RR patients did not perform worse than CP patients in any domain of cognitive function. RR patients endorsed more depressive symptomatology than did CP patients. These data suggest that cognitive dysfunction may occur as a primary clinical finding more frequently in CP patients, while depressive symptoms may be more common in RR patients.

E.N. KERR, M.T. SAMUELS, S.M. EDWORTHY, & C. VIOLATO. Attentional Capacity in Patients With Systemic Lupus Erythematosus (SLE).
The presence of cognitive deficits may represent a marker of CNS disease in SLE. Based on previous research and on patients' complaints, it was postulated that a limitation in attentional capacity is a fundamental cognitive deficit in patients with SLE, particularly those with CNS involvement. Auditory and visual attention were assessed under increasingly demanding conditions in order to examine effortful attention on a limited capacity system. Thirty-five SLE patients who met the American College of Rheumatology criteria for having SLE and who had had a recent medical were included. Twenty-three Rheumatoid Arthritis patients and 42 healthy adults served as control subjects. Performance was analyzed in relation to disease activity and severity, medications, depression level, and age. The results indicate that CNS involvement in SLE disproportionately reduces attentional capacity.

R. MURRAY & R.M. RUFF. Neuropsychological, Emotional, and Physical Sequelae of Eosinophilia Myalgia Syndrome.
Many who developed Eosinophilia Myalgia Syndrome (EMS) after the ingestion of contaminated L-tryptophan have complained of cognitive and emotional problems in addition to physical deficits. When the neuropsychological, emotional and physical functioning of a group diagnosed with EMS was compared with a comparison group, the EMS group was found to be more depressed, to have higher MMPI-2 T scale elevations, and more physical, cognitive and emotional complaints. Significant differences between groups in neuropsychological functioning were found, with the EMS group performing less well than the comparison group. Particularly affected were psychomotor speed, spatial construction and immediate and delayed memory for visuospatial information. Depression may have compounded these cognitive problems.

G.M. GRACE, M.A. BERG, & W. NIELSON. Assessment of Attention, Concentration, and Memory in Patients With Fibromyalgia.
In addition to widespread chronic pain, a highly frequent complaint among individuals with fibromyalgia (FM) is poor memory and concentration. In the present study, 15 patients with FM were matched to 15 normal control subjects on the basis of age, sex, and estimated intellectual level. Subjects were given a 90-min testing session involving objective cognitive measures and ratings of sleep quality. Results indicated that FM subjects scored significantly lower than control subjects in both general memory [$t(28) = -2.53$, $p < .01$] and sleep quality [$t(28) = 8.00$, $p < .001$]. These findings suggest that individuals with FM suffer from memory impairment (though not from impairment in attention/concentration). Furthermore, results suggested a potential relationship between memory and sleep quality in the FM patients. These results have implications for improving treatment programs for individuals with FM.

S.R. BEERS, L.A. MORROW, M.C. MORGAN, & S. MANZI. Cognitive Function in Systemic Lupus Erythematosus (SLE): Relationship to Mood State.
Cognitive changes noted in SLE patients have often been linked to reactive depression or to fatigue, a ubiquitous symptom of this disease. Learning and memory, attention and mental flexibility, conceptual functions, information processing, visuospatial ability, and psychomotor speed were evaluated in 28 patients with SLE and 32 normal controls of comparable age and education. Significant differences were found on a measure of visuospatial ability and one of psychomotor speed, although SLE scores were lower on all but 4 instruments. Other measures showed strong trends to significance. Test performance was not significantly correlated with current mood state (e.g., depression, tension, fatigue), suggesting that cognitive performance in SLE is not associated with current mood state.

P. MARSHALL. Effects of Chronic Fatigue Syndrome (CFS) on Cognitive Function.
This study evaluated the effect of CFS on: (1) speed of cognitive processing, (2) psychomotor speed, (3) ability to divide and sustain attention, (4) selective attention, (5) short term and recent verbal memory, and (6) working memory. Fourteen CFS patients were matched by sex, age, and IQ with control subjects. ANOVA indicates that the CFS patients exhibited slower psychomotor speed on simple and choice reaction time tests and the Stroop test, recalled fewer words after a one hour delay on a selective reminding test, and had much more difficulty on a working memory (reading span) test. CFS patients did not show deficits in selective, divided, or sustained attention or exhibit slowed speed of cognitive processing.

A. TUCKER. Memory and Learning Impairments in Non-Insulin Dependent Diabetes Mellitus.
The limited literature on the cognitive functioning of people with non-insulin dependent diabetes mellitus (NIDDM) suggests deficits in memory, learning and attention, particularly for older people with NIDDM. In this study 35 people (mean age 51 yr), carefully screened for confounding organic problems (diabetic and nondiabetic), were compared with a nondiabetic control group, matched on age and socioeconomic variables. Both groups were tested with Digit Span, Rey Figure, Rey Auditory Verbal Learning Test, Prose Passages (WMS), and Block Tapping (a test of immediate visual memory, after Corsi). Analysis of the data showed that the NIDDM group performed significantly worse on tests requiring immediate auditory memory and attention, auditory verbal learning and some aspects of executive functioning.

R. CLUYDTS, K. TERSAGO, B. KEYMEULEN, G. SOMERS, & A. BOSSUYT. Neuropsychological Function, Regional Cerebral Blood Flow and Hypoglycemia in Insulin-Dependent Diabetes.
Neuropsychological function in insulin-dependent diabetes patients was assessed before and after recovery from moderate insulin-induced hypoglycemia and related to basal regional cerebral blood flow (rCBF). At baseline the diabetic patients performed significantly worse than the healthy controls on motor function and frontal lobe tests as well as on a visuospatial comparison task. Furthermore, patients with hypoperfusion in frontal and parieto-occipital regions tended towards a worse visuospatial performance than other patients. Frontal lobe impairment is suggested to be more apparent in hypo- and normoperfused patients than in subjects with cerebral hyperperfusion. Following recovery from hypoglycemia, susceptibility for interference effects with increased in the diabetics, whereas the controls displayed slower movement times. Further exploration of the relationship between neuropsychological function and rCBF in insulin-dependent diabetics is indicated.

B. PALMER, K. BOONE, L. CHANG, A. LEE, & S. BLACK. Cognitive Deficits and Personality Patterns in Maternally or Paternally Inherited Myotonic Dystrophy.
Cognitive functioning was compared between myotonic dystrophy (MD) patients with maternal (mMD) versus paternal (pMD) inheritance, and normal controls. A standardized personality measure was also employed. Both MD groups evidenced slow Stroop performance relative to controls, but the pMD group had an otherwise normal neuropsychological profile. In contrast, the mMD group exhibited lower performance on measures of intelligence, visual-construction, and some, albeit not all, frontal measures. No significant differences were found on measures of memory or visual-perception. Neuropsychological results confirm the presence of distinct cognitive subgroups associated with MD inheritance pattern. Personality assessment revealed a relatively high incidence of dependent tendencies in both MD groups.

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D.C. THEBERGE, J.L. PICKETT, W.S. BROWN, S.V. SCHWEITZER, & A.R. NISSENSON. Cognitive Status, P300, and Hematocrit Levels in Hemodialysis Patients.
Twelve chronic hemodialysis (CHD) patients received recombinant human erythropoietin (EPO) to further increase their blood hematocrit (Hct) levels over current clinical guidelines. This study aimed to determine if increased levels of Hct in fact have any consequence for neurocognitive status. Event-related potentials (ERPs) of each subject were recorded across two trials of an auditory detection task—first at moderate, then at high Hct levels—which were then correlated with the P300 amplitudes and latencies. Hct levels in both trials were significantly negatively correlated with both target and nontarget P300 latencies, that is, increases in Hct were significantly correlated with decreases in P300 latencies. Since shorter P300 latencies are associated with faster cognitive processing speeds, these findings support the association between higher levels of Hct and the improved mental status of CHD patients being treated for anemia with EPO.

M. LEVAV, A.F. MIRSKY, & M.E. CRUZ. Neurocysticercosis and Performance on Neuropsychological Tests: A Community Study in Ecuador.
We studied a group of 123 subjects from a mountain community in Ecuador in which parasitic infection of the brain (neurocysticercosis) afflicts more than 14% of the population. The battery of neuropsychological tests evaluated language, attention and memory. CT scans and EEG examinations were performed as well. The results of statistical analyses yielded a model that discriminated infected from non-infected subjects with 72% accuracy; it included the following scores: Trail Making tests Part A, Compatible Reciprocal Motor Task, and impulsive, anticipatory errors on the AX task of the Continuous Performance test.

S.G. SILVA, R.A. STERN, N. CHAISSON, E.A. SINGER, V. GAVER, J.B. WATSON, R.N. GOLDEN, & D.L. EVANS. Evidence of Mild Visuoconstructive Impairments in HIV Infection Using the Boston Qualitative Scoring System for the Rey-Osterrieth Complex Figure.
The Boston Qualitative Scoring System and a quantitative scoring method for the Rey-Osterrieth Complex Figure were employed to assess visuoconstructive skills in HIV-seropositive gay men. Subjects were participants in a longitudinal study; all seropositives were asymptomatic at baseline. Three groups were compared: seropositives, asymptomatic (POSa); seropositives, who became symptomatic during the subsequent 24 mo (POSs), and seronegative controls (NEG). Relative to POSa and NEG, the POSs performed significantly worse on several qualitative measures gathered at baseline: copy presence, perserveration, and confabulation. POSa and NEG subjects did not differ on these measures. No group differences were detected using the quantitative system. The qualitative scoring results demonstrated subclinical visuoconstructive difficulties in seropositives who became symptomatic, suggesting that visuospatial impairments may preceed the onset of systemic symptoms in HIV infection.

S.A. JOHNSON, J.R. SADEK, N. BUTTERS, D.A. WHITE, K.I. TAYLOR, J.H. DeLAPENA, J.L. CHANDLER, I. GRANT, J.H. ATKINSON, D.P. SALMON, J.S. PAULSEN, M.R. SWENSON, & THE HNRC GROUP. Retrograde Amnesia in HIV Associated Dementia; Evidence for Subcortical Dysfunction.
An updated version of the remote memory battery was administered to fourteen HIV+ patients: seven patients presented with HIV associated dementia (HAD) and seven patients with signs of mild cognitive and motor impairments (MCM). Twelve patients with Alzheimer's disease (AD), 12 patients with Huntington's disease (HD), 23 elderly normal controls (ENC), and 17 young normal controls (YNC) were also tested. AD and HD patients performed as expected, with AD patients exhibiting a temporal gradient (i.e., memories from earlier decades better than recent decades) and HD patients performing the same across all decades. The MCM group did not differ from their control group in any decade, suggesting that remote memory is not affected in HIV+ patients with mild cognitive impairments. The HAD group was significantly impaired relative to controls for all decades and displayed no temporal gradient. Their performance did not differ from that of the HD patients. These findings are consistent with previous research suggesting that HAD is a result of subcortical dysfunction.

M.C. DIEHR, D.A. WHITE, R.K. HEATON, J.A. McCUTCHAN, M.R. WALLACE, I. GRANT, H. ATKINSON, & THE HNRC GROUP. Neuropsychological Profile of HIV-Associated Minor Cognitive Motor Disorder (MCMD).
The American Academy of Neurology AIDS Task Force (1991) established diagnostic criteria for HIV-Associated Minor Cognitive-Motor Disorder (MCMD). We analyzed the profile of Neuropsychological (NP) scores in subjects with and without MCMD. One-hundred ninety HIV+ men were given an Expanded Halstead-Reitan Battery and medical, psychiatric, and neurological examinations. NP status was clinically rated in eight ability areas: abstraction, attention, learning, memory, motor, psychomotor, sensory, and verbal. A team came to a consensus diagnosis of 'Normal' ($N = 148$) or 'MCMD' ($N = 42$) for each subject. Discriminant Function Analysis (DFA) predicted diagnosis based on the eight ability areas, age, education, and CD4 count. *T*-tests revealed group differences on all NP areas, age, CD4 count. DFA revealed that MCMD group membership was predicted best by learning, attention, abstraction, motor and memory scores.

R.S. DURVASULA, C.H. HINKIN, P. SATZ, & W.G. VAN GORP. The Relationship Between Psychomotor Speed and Pure Motor Speed in HIV Infection.
The relationship between psychomotor and pure motor speed was investigated in a sample of 204 HIV seropositive subjects. Subjects were administered a battery of neuropsychological measures assessing: (1) Psychomotor speed, (2) Pure Motor speed, (3) Motor-free speed. Significant correlations were found between all three groups of measures. Principal components analysis revealed the underlying factor structure to change as a function of disease severity with the motor and psychomotor variables loading together and distinct from the timed motor-free tasks. Finally, ANOVA using motor speed as the grouping factor revealed significant differences on measures of psychomotor tests, but not speeded motor-free tests. Although preliminary in nature, the results suggest that interpretations regarding psychomotor slowing in HIV disease should be interpreted in light of pure motor speed.

A.C. BRENN, E.M. EATON, M. CARLSON, & K.P. LOTT. Verbal Learning and Memory in Symptomatic HIV+ Males: Evidence of Subcortical Dysfunction.
Verbal learning and memory performances of 33 symptomatic HIV+ and 14 HIV− gay or bisexual males were compared using the California Verbal Learning Test (CVLT) and the Controlled Oral Word Association Test (COWA) to examine for subcortical deficit patterns. The HIV+ groups was expected to show reduced verbal fluency (COWA), poorer total free recall (CVLT), and disproportionately better performance on recognition than free recall (CVLT), but no differences in errors compared to the HIV− group. A MANCOVA (premorbid IQ; current mood state as covariates), revealed significant group differences in support of subcortical deficit patterns. The HIV+ group had significantly reduced total free recall and disproportionately higher recognition than free recall performance and (nonsignificantly) reduced verbal fluency. Group differences in errors were not found.

E.S. STROUP, M. HUNTER, & R.A. BORNSTEIN. Subtle Cognitive Deficit and Psychological Distress in Asymptomatic HIV Infection.
The presence of subtle neuropsychological deficit (primarily in verbal memory and psychomotor speed) associated with asymptomatic HIV infection has been documented in recent literature. As of yet, the pathophysiological mechanism responsible for these subtle deficits remains unclear. This paper examines the relationship between psychological distress and neuropsychological functioning in 132 asymptomatic HIV+

subjects and 82 HIV controls. Results indicate that HIV+ subjects were more impaired relative to HIV controls on tasks requiring attention/concentration and psychomotor speed/reaction time. Further analysis suggests that attention/concentration deficits in HIV+ subjects were primarily due to increased levels of psychological distress; however, slowed reaction times and psychomotor speed appeared to be unrelated to psychological distress (perhaps due instead to viral invasion of CNS).

Special Session

THE USE OF BRAIN IMAGING TECHNOLOGY IN COGNITIVE NEUROPSYCHOLOGY

M.I. Posner & F. Wood

THURSDAY AFTERNOON, FEBRUARY 9, 1995

Symposium 2

MULTICENTER INVESTIGATIONS IN EPILEPSY AND EPILEPSY SURGERY: THE BOZEMAN EPILEPSY CONSORTIUM

D.W. LORING & K.J. MEADOR. Multicenter Investigations in Epilepsy and Epilepsy Surgery: The Bozeman Epilepsy Consortium.
Neuropsychology of epilepsy and epilepsy surgery is of increasing interest to neuropsychologists, paralleling the growth in the number of institutions providing surgical treatment of intractable seizures. The majority of neuropsychology reports in this population, however, remains based on samples from single institutions. This limits the generalizability to other centers with different referral patterns, and relies more heavily on chance/sample-specific fluctuations. This symposium will present results from the Bozeman Epilepsy Consortium, an informal collaboration among 8 epilepsy surgery centers. Topics will include seizure outcome associated with level of intellectual function, non-verbal memory deficits in right TLE, biological vs. psychosocial determinants of depression in TLE, evolution of neuropsychological deficits in childhood epilepsies, confrontation naming patterns in lateralized TLE, and effects of early lesions on neuropsychological development.

E. STRAUSS & THE BOZEMAN EPILEPSY CONSORTIUM. Gender Effects on Cognitive Outcome in Epilepsy.
The literature suggests that functional outcome depends upon many factors, including age or maturational state of the organism at the time of insult, the specific functions assessed, and gender. Maturation proceeds more slowly in males than in females. Thus, damage at a particular age may have very different implications in males than in females since it would interfere with different stages of the developmental process. The subjects were seizure patients and included 609 men (296 with right-sided foci; 313 with left-sided foci) and 619 women (271 with right-sided foci; 348 with left-sided foci). The ANOVA (sex by focus by age at seizure onset) revealed main effects of age at seizure onset [$p < .01$] and focus [$p < .001$]. FSIQ increased with increasing age at seizure onset. In addition, overall intellectual level was poorer in patients with left as opposed to right hemisphere seizure origin. Finally, the sex by age at seizure onset interaction was significant [$p < .05$]. In males, FSIQ increased in a linear fashion from infancy to adulthood. Females demonstrated a flatter profile.

K. PERRINE & THE BOZEMAN EPILEPSY CONSORTIUM. Dysnomia in Lateralized Temporal Lobe Epilepsy.
Dysnomia is often found in patients with left temporal lobe epilepsy and may help lateralize the focus in preoperative evaluations. We examined differences in the Boston Naming Test between patients with left ($n = 212$) and right ($n = 208$) temporal lobe seizures undergoing preoperative neuropsychological evaluations at five epilepsy centers. Patients with a left temporal focus scored significantly lower ($p < .002$, mean = 42.4) than patients with a right temporal focus (mean = 47.6). Although better naming was found in patients with structural lesions ($p < .0001$) and later age at seizure onset ($p < .0001$), naming significantly predicted seizure laterality ($p < .0001$) after accounting for lesion presence and age at onset. Dysnomia appears to be predictive of a left temporal seizure focus.

M. WESTERVELD & THE BOZEMAN EPILEPSY CONSORTIUM. Neurodevelopmental Issues in Pediatric Epilepsy.
Surgical treatment of seizures in children is less common than in adults, and is most frequently performed when seizures are associated with a neoplastic or developmental lesion. A particular concern is the potential for neuropsychological morbidity. Temporal lobectomy in adults may be associated with deficient verbal learning following dominant hemisphere resection, and deficient nonverbal information processing following nondominant hemisphere resection. However, the extent to which this paradigm is applicable in younger patients is uncertain. We found no significant between group (right vs. left) or within group (VIQ vs. PIQ) differences in IQ scores prior to surgery. Following left temporal lobectomy, a significant improvement in PIQ was observed ($p < .05$). No other significant postoperative IQ changes were observed. We conclude that there is no increased risk of cognitive morbidity associated with temporal lobectomy in this group.

M.R. TRENERRY, B.P. HERMANN, & THE BOZEMAN EPILEPSY CONSORTIUM. Depression in Epilepsy: Laterality of Lesion Versus Attributional Style.
This project compared the effects of side of seizure onset versus patients' attributional style on multiple measures of psychometrically measured depression in 83 left and 85 right temporal lobectomy patients. Attributional style was measured with the MMPI pessimism/optimism scale (PSM) developed based on Seligman's model of attributional style. Depression was assessed using the Center for Epidemiologic Studies Depression scale (CES-D) and Beck Depression Inventory (BDI). Side of seizure onset was not associated with CES-D or BDI scores, or with PSM scores. Both CES-D and BDI scores were positively associated with pessimism/optimism (PSM). These data do not support the notion that depression is associated with lateralization of cerebral dysfunction. Instead, the data indicate that degree of depressive symptomology is based on attributional style.

W.B. BARR & THE BOZEMAN EPILEPSY CONSORTIUM. The Right Temporal Lobe and Memory: A Critical Reexamination.
The relationship between the left temporal lobe and verbal memory is well established. There is less evidence supporting the relationship between the right temporal lobe and "non-verbal" memory. Data from multiple centers was obtained for the WMS-R Visual Memory Index (351

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subjects), the Visual Reproduction subtests (535 subjects) and the Rey-Osterrieth Complex Figure (419 subjects). No differences were found in comparisons of mean scores from patients with right and left temporal lobe foci. Repeated measures ANOVA's showed no group by delay interactions. Analyses of receiver operating characteristic (ROC) curves found low sensitivity and specificity for all tests. The inability to find significant group differences in this large sample, as well as numerous theoretical points about right temporal lobe functioning, will be discussed.

G.J. CHELUNE & THE BOZEMAN EPILEPSY CONSORTIUM. Does Presurgical IQ Predict Seizure Outcome Following Temporal Lobectomy?

It has long been held that presurgical IQ is a significant prognostic indicator of surgical outcome following anterior temporal lobectomy (ATL). The purpose of this investigation was to test this hypothesis. A total of 872 ATL patients from 6 centers were categorized by surgical outcome (seizure-free, non-seizure-free), and the groups were compared according to mean WAIS-R Full Scale IQ, the proportion of seizure-free patients in discrete IQ groups, and the influence of patient and seizure factors (e.g., right hemisphere language, presence of a structural lesion) on outcome. Despite the presence of a statistically significant relationship, the magnitude of the group difference was only 3 points, with an effect size suggesting minimal clinical significance. In none of the additional analyses was IQ a meaningful predictor of outcome. We conclude that IQ should not be used to exclude patients from consideration of ATL.

Paper Session 5

EXECUTIVE FUNCTION

T.P. ROSS, S.R. MILLIS, & R.D. WHITMAN. Theoretical Models of Prefrontal Function: An Empirical Examination of Three Models of Executive Functioning Using Confirmatory Factor Analysis.

Three models of executive functioning were tested a priori using confirmatory factor analysis (CFA): two-factor and three-factor models proposed to be consistent with Fuster's (1989) and Goldman-Rakic's (1987) conceptualizations of prefrontal functioning, respectively; and an opposing unifactorial model. A comprehensive battery of executive measures was administered to a normal sample ($N = 160$). CFA resulted in a reasonable fit for the unifactorial model [$\chi^2(24) = 17.63$, $p = 0.82$] and for the two-factor [$\chi^2(23) = 17.28$, $p = .79$] and three-factor [$\chi^2(22) = 18.43$, $p = .68$] models. For the present sample of neurologically intact individuals, a unidimensional view of executive abilities is favored because it is the most parsimonious among the models examined.

B. LEVINE, D.T. STUSS, & W.P. MILBERG. A Multiple Subgoal Test of Planning for Use in Clinical Assessment: Preliminary Data With Normal Elderly Patients and Patients With Frontal Lesions.

A task of supervisory abilities requiring strategy application in a relatively unstructured, multiple subgoal format was administered to 20 normal Ss in two age groups and 5 Ss with frontal lesions. Both elderly Ss and Ss with frontal lesions showed evidence of inefficiency in their approach, but these effects did not appear to be due to failure to recall the rules of the task, slowing, or item difficulty. The elderly group showed the greatest variability, reflecting a minority of Ss whose performance resembled that of the Ss with frontal lesions. As a group, however, the Ss with frontal lesions were inferior to the elderly Ss. The data suggested that Multiple Tasks holds promise in improving the specificity and sensitivity of executive functioning assessment.

J.H. RICKER & S.R. MILLIS. Executive Control Deficits in Lateralized Subcortical Infarction.

Executive functioning was studied in stroke patients with infarction in the striatum (left, $N = 8$; right, $N = 12$); frontal white matter (FWM; left, $N = 9$; right, $N = 12$); or thalamus (left, $N = 6$; right, $N = 10$). Groups were equivalent in age, days since onset, education, and level of dementia. Group, laterality, and group × laterality effects were observed for phonemic and categorical word-list generation tasks, with left thalamic infarction resulting in lowest performance. Group effects were observed on sequential set-alternation and problem-solving task components, with striatal and FWM subjects performing at lower levels; no laterality or interaction effects were noted. Results support previous research suggesting subcortical lesions, particularly striatal-frontal lesions, can disrupt executive functions. Results also indicate that language-based executive functions are more disrupted by left-sided lesions, but other executive control domains are equally impaired regardless of subcortical lesion laterality.

J.S. RUBINSTEIN, J.E. EVANS, & D.E. MEYER. Task Switching in Patients With Prefrontal and Parietal Cortex Damage.

Prefrontal cortex has been implicated in the executive control of behavior. This research focuses on task switching, an executive process that allows simple actions to be combined in novel ways. Two experiments examined task-switching performance and interference effects in patients with single, focal brain lesions. Subjects alternated between two simple matching tasks. Switching times were measured by comparing response times for trials in alternation and non-alternation blocks. Dorsolateral prefrontal cortex (DLPFC) and left temporal/parietal cortex (LTPC) subjects produced abnormally long switching times. This implicates both cortical areas in the control of task switching. Only DLPFC subjects, however, produced reduced switching times when interfering stimuli were removed, suggesting that DLPFC and LTPC play different roles in the central-executive control of task switching.

P.J. ESLINGER, K. BIDDLE, & L.M. GRATTAN. Prospective Study of Altered Cognitive Development After Right Dorsolateral Frontal Lobe Lesion in Childhood.

We report a prospective study of cognitive and social development in a boy who sustained focal lesion to the right dorsolateral frontal lobe at seven years of age. During a 4-yr follow-up period, standardized and experimental measures indicated above average range of measured intellect, but significant impairments in visual-spatial working memory, temporal-spatial organization, planning and visual search strategies in problem solving tasks and sequential processing. Nonfrontal cognitive measures were within normal limits. Behavioral assessment indicated no emergence of significant social impairment or affective symptoms at this age. The findings suggest altered cognitive architecture soon after early right dorsolateral frontal lobe lesion in visual-spatial aspects of executive control and self-regulatory processes.

M.L. GOUROVITCH, B. KIRKBY, J. GOLD, G. ESPOSITO, J. VAN DORN, J. OSTREM, T. GOLDBERG, D.R. WEINBERGER, & K. BERMAN. A Comparison of Letter and Category Fluency: Cerebral Activation With Positron Emission Tomography.

Word generation during category versus letter cues has been shown to be differentially impaired following cortical lesions. To evaluate the functional anatomy of these tasks, 10 normal controls were studied using

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the O^{15}PET water method. There were three counterbalanced conditions including letter fluency, category fluency, and a control condition where subjects generated week days and months. Frequency was controlled by having the subject produce words following 3.5 s cues. rCBF data were normalized as a percentage of the whole brain mean. Regions of interest were drawn on co-planar MRI's and applied to the individual PET studies to obtain mean regional values. As expected, letter and category tasks activated several similar brain regions including the left anterior cingulate, frontal cortex, and thalamus. There were also significant deactivations in the parietal and temporal regions. Category fluency uniquely activated the right thalamus. Few areas differed between the two tasks. Activity was greater in the right frontal gyrus for letter cues, while category cues elicited less deactivation in the left temporal gyrus. These results suggest that there are only subtle differences in the neural pathways *normally* recruited to complete letter versus category fluency.

Paper Session 6

EPILEPSY

K. MEADOR, D. LORING, E. MOORE, M. NICHOLS, & W. THOMPSON. Cognitive Effects of Phenobarbital, Phenytoin, and Valproate.

Differential cognitive effects of anti-epileptic drugs (AEDs) are debated. We compared the cognitive effects of phenobarbital, phenytoin, and valproate in 59 healthy adults using a randomized, double-blind, incomplete block, crossover design. Cognitive assessments were conducted at baseline, after one month on each drug, and at 2 repeat baselines 11 wk after each AED treatment. The neuropsychological battery included 12 tests (yielding 22 variables): Choice Reaction Time, P3 Potential, Finger Tapping, Grooved Pegboard, Selective Reminding Test, Paragraph Memory, Complex Figures, Symbol Digit Modalities Test, Stroop, Visual Serial Addition Test, Hopkins Symptom Checklist, and Profile of Mood States. Over half of the variables exhibited AED effects compared to nondrug baselines. All three AEDs produced some untoward effects, but AED differences were almost entirely due to phenobarbital.

S.J. SWANSON, T.A. HAMMEKE, J.R. BINDER, M. FISCHER, G.L. MORRIS, & W.M. MUELLER. Language Lateralization Ratios with Functional Magnetic Resonance Imaging and Wada Testing: A Preliminary Report.

Language lateralization with Wada testing has been criticized for poor standardization yielding widely disparate estimates of bilateral language representation. It has been recommended that Wada results be validated using brain mapping techniques. In the present study we compare alternate methods of scoring and interpreting Wada language data with language lateralization quotients (LQ) obtained with functional magnetic resonance imaging (FMRI), a new noninvasive technique for localizing function. Nine intractable epilepsy patients were studied with both FMRI and Wada. Significant correlations ($r = .89$-$.95$, $p < .001$) were obtained between all Wada language calculation methods and FMRI LQs. There was a trend for higher correlations when ratings of paraphasic errors were included and interruption of counting was excluded in Wada calculations.

G.K. DEUTSCH, G. GLOSSER, J. CORWIN, A.J. SAYKIN, M.R. SPERLING, & M.J. O'CONNOR. Lateralization of Memory Discrimination and Response Bias During the Intracarotid Amobarbital Test (IAT).

Material-specific recognition memory was evaluated during IAT in 80 left-hemisphere language-dominant epilepsy patients who subsequently underwent anterior temporal lobectomy. Discrimination (Pr) and response bias (Br) were calculated according to two-high threshold theory. Expected lateralization of material-specific discrimination was found. Pr decreased for words following left-hemisphere (LH) injection and for designs following right-hemisphere (RH) injection. Response bias lateralization followed a different pattern. Br was more liberal with LH injection regardless of material type. Findings suggest that discrimination and response bias may be dissociable. Lateralized differences in discrimination are a function of material type (verbal vs. visuospatial), whereas response bias seems to be a function of whether memory representations are discrete or distributed.

P. FEDIO, A. AUGUST, S. SATO, & C. KUFTA. Reversed Hemispheric Dominance for Verbal and Visuospatial Functions.

To escape early left brain insult, language may be reassigned to the right brain and "crowd" resident visuospatial skills. This hypothesis was examined with six left-handed patients with temporal lobe epilepsy [three left (LTE); three right (RTE)]. Electrical stimulation over left temporoparietal cortical sites disrupted pattern discrimination, not naming; stimulation of the right brain elicited only anomia. The psychometric and intracarotid amytal profiles of the patients also suggested reversed laterality. It is likely that the late onset RTE patients presented reversed laterality at birth. Early left brain injury [LTE] may promote interhemispheric transfer of functions, and honor the developmental priority of language whereas spatial functions may be assigned to the damaged brain. These results challenge the crowding hypothesis.

K. PERRINE, J. BUCHWALD, S. PACIA, W. DOYLE, M. DOGALI, & O. DEVINSKY. Language Outcome Following Multiple Subpial Transection Surgery for Epilepsy.

Multiple subpial transections (MST) disrupt horizontal fibers to inhibit discharge propagation while sparing vertically oriented columns mediating higher functions, and are used when seizures arise from cortex not amenable to resection. We compared postoperative language functioning in 11 patients undergoing left MST in language cortex to 22 patients undergoing left resective surgery. The two groups did not differ on age, IQ, and preoperative language functioning. Repeated measures ANOVA revealed significantly poorer postoperative language in the MST group for naming, fluency, and reading. Although MST may be used in sensorimotor cortex without significant sequelae, transecting horizontal fibers in language association cortex produces some morbidity, presumably due to the greater need for interconnections in association cortex. However, seizure control may take precedence over dysphasia.

W. BARR, V. WARMFLASH, G. NEY, & N. SCHAUL. Receiver Operating Characteristic (ROC) Graph Analysis of Verbal Test Scores in Classifying Patients with Right and Left Temporal Lobe Seizures.

Receiver operating characteristic (ROC) graphs were used to examine the classification accuracy of verbal indices in 76 patients with chronic temporal lobe seizures. Individual scores were treated as separate cutoffs to classify patients with right or left temporal lobe seizures. Sensitivity and specificity values from every observed score were calculated and plotted as ROC graphs. Optimal cutoff scores were chosen to meet the criteria of specificity greater than 80% and maximal sensitivity. The greatest combined sensitivity and specificity was obtained from Boston Naming Test scores (sensitivity, 47%; specificity, 82%). No other verbal measure exhibited a sensitivity greater than 30%. The results indicate that the sensitivity and accuracy of single verbal indices is rather weak. The use of ROC analyses in neuropsychological assessment of epilepsy surgery candidates will be discussed.

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Paper Session 7

NEGLECT

F.S. LEIBOVITCH, C. CALDWELL, & S.E. BLACK. A Neural Network Approach to Brain-Behaviour Correlations in Hemispatial Neglect.
Hemispatial neglect is hypothesized to result from damage to an integrated cortical network for directed attention involving the frontal, parietal, and cingulate cortices and subcortical reticular pathways (Mesulam, 1981). We assessed the ability of Neuralyst, a computational neural network, to predict the presence or absence of left hemispatial neglect in 58 stroke patients using right/left ratios of cortical and subcortical segments on SPECT. The network was able to predict neglect with an accuracy of 80 ± 5%. The parietal, temporal, and sensorimotor cortical regions were important predictors in both conventional stepwise regression and by computational modelling, but the cingulate cortex emerged only in the neural network. We conclude that the neural network approach can be a useful way to test neuroanatomical hypotheses for complex behaviours such as hemispatial neglect.

J.C. ADAIR, D.J. WILLIAMSON, D.H. JACOBS, D.L. NA, & K.M. HEILMAN. Far Radial-Superior Vertical Neglect: Identification of a Viewer-Centered Reference Frame.
Neglect from bilateral brain injury can disrupt responses along hemispace defined by the vertical and radial axes. Though the neglected space can be referenced to environment-centered (EC) or viewer-centered (VC) coordinate systems, the frames of reference for vertical and radial neglect remain largely undefined. We segregated VC and EC reference frames in a patient with combined far radial-superior vertical neglect through performance of radial line bisections above and below eye level. To separate reference frames for vertical space, bisections were performed while lying sideways. Results suggest this patient's far and superior neglect respected a retinotopic VC reference frame.

L. SPEEDIE, E. WERTMAN, M. VERFAELLIE, N. ZILBERMAN, M. LICHTENSTEIN, & K.M. HEILMAN. Contralateral Neglect and Reading Directionality.
Right-left hemispheric asymmetries of neglect may be related to learned attentional scanning asymmetries or inborn asymmetries. We studied patients with unilateral stroke, documented by CT and clinical neurological examination. Only those patients who read a Semitic or a non-Semitic Indo-European language before the age of fifteen were chosen. Subjects who had hemispatial neglect on cancellation tests were excluded. Subjects bisected lines (26–30 cm) with either a right or left distractor in right, left, and center space. Following right hemisphere lesions, right-to-left readers bisected lines closer to center than left-to-right readers, particularly in mid space and when the distractor was on the right. There were no significant language-scanning differences of neglect following left hemisphere lesions. Findings suggest reading-related scanning may influence attentional or intentional biases.

A. CHATTERJEE & R.J. GAGE. Representational Shifts in Unilateral Spatial Neglect.
Neglect patients frequently form abnormal spatial representations. To determine if damage to right frontal versus temporal-parietal cortices affect such representations differently, two patients were tested on their ability to locate dots on horizontal lines, immediately after exposure and after a 10 s delay. The patient with posterior damage made similar rightward directional errors irrespective of hemispatial location or temporal delay, suggesting that the parietal lobes are critical for structuring coordinates of egocentric representational space. The patient with frontal damage made greater errors to the left in contralateral hemispace and after the delay, confirming the frontal cortices' role in sustaining memories of contralateral spatial locations. The surprising leftward errors suggest that previously reported "visual grasp" from frontal lesions also occurs at a representational level.

R. McGLINCHEY-BERROTH, W. MILBERG, M. VERFAELLIE, L. GRANDE, & M. ALEXANDER. Implicit Perceptual Processing in Hemispatial Neglect: Evidence From a Repetition Priming Task.
Visual perceptual processing was investigated in four hemispatial neglect patients. In a repetition priming task, subjects verbally identified target items preceded by lateralized picture primes that were either identical or different than the target. Alternatively, subjects were asked to name the picture prime. Results indicated preserved perceptual priming from repeated items from the neglected visual field in the absence of conscious awareness. This supports previous findings of implicit visual processing and suggests that visual form information is processed to a high level of specificity without the benefit of focal attention or conscious identification in hemispatial neglect.

L.J. BUXBAUM. Visual Attention to Objects and Space: Object-Centered Neglect or Location Focus?
Recent demonstrations of the role of perceptual objects in neglect suggest that for some patients, target detection should be influenced by the side of the object on which a target feature appears. The performance of neglect patients was investigated with a version of Treisman and Souther's (1985) "Q and O" visual search paradigm in which the task was detection of a circle intersected by a line segment ("Q") in an array of "O's" (preattentive task) or, conversely, an "O" in an array of "Q's" (attentive task). In the present experiment, the locations of line segments distinguishing "Q's" and "O's" were manipulated both with respect to the side of the circles as well as the side of the array. Critically, one group of patients demonstrated impaired detection of line segments on the left as compared to right of circles even on the "preattentive" task and independent of the location of the target circles in the array. These and other data are discussed in light of accounts of "object-centered" and spatial mechanisms of object-processing impairments in neglect.

Symposium 3

SINGLE VERSUS MULTIPLE MEMORY SYSTEMS IN THE HUMAN BRAIN

J. DELUCA. Single Versus Multiple Memory Systems in the Human Brain.
While much has been learned about the neuroanatomical substrates of human declarative memory during recent years, several theoretical issues remain unclear. The papers in this symposium are designed to address the following questions: Are there really different forms of amnesia, or does amnesia result from damage anywhere along a singular "memory circuit"? That is, are diencephalic, mesial-temporal, and basal forebrain amnesia simply variations of the same syndrome? Are these structures involved in the same basic memory processes or do they perform distinctly different processes? Each of the major neuroanatomical regions known to play a critical role in amnesia will be discussed individually. The discussant will attempt to summarize and integrate the presentations.

N. GRAFF-RADFORD. Diencephalic Amnesia.
Damage to both the mamillothalamic tract (MT) and the inferior thalamic peduncle (ITP) or their respective thalamic nuclei seems crucial

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in developing dense amnesia. Isolated fornix, mamillary bodies, anterior thalamic nuclei, and dorsomedial nuclei lesions have not caused as severe an amnesia. In temporal lobe, damage to the hippocampus can cause amnesia, but, a more dense amnesia occurs when the perirhinal and/or parahippocampal cortices, but not the amygdala, are also damaged. Similarly, for the diencephalon, we propose, that a dense and enduring amnesia occurs when both hippocampal-related structures (MT) plus perirhinal cortex pathways (ITP) are damaged. These patients have anterograde verbal and visual amnesia, and sometimes retrograde amnesia, retained skill learning, and normal priming. Diencephalic and temporal lobe amnesia have strong similarities.

P.J. ESLINGER. Basal Forebrain: Distinctive Contribution to a Common Neural Substrate for Learning and Memory.
The organizing question of this symposium, as applied to basal forebrain amnesia, will be addressed from three empirical perspectives. First, anatomy of key nuclei and pathways in the basal forebrain region emphasizes interrelationships with the medial temporal lobe and medial diencephalon, but also the orbital frontal lobe. Within this framework, the reported pathophysiology from clipping of ruptured anterior communicating artery aneurysms and other vascular lesions in this area highlights the marked heterogeneity among cases. Second, cognitive aspects of basal forebrain amnesia focuses on level and characteristics of learning and memory, including temporal organization, temporal judgment, cueing effects and forgetting. Finally, comparative patterns of recovery are related to pathophysiology. Although distinctive, the basal forebrain contributes to a larger neural substrate for learning and memory.

K.A. WELSH, M.E. QUIG, M. HELMS, B.L. PLASSMAN, & J.C.S. BREITNER. The Memory Impairment(s) of Early Alzheimer's Disease?
The relative importance of immediate and delayed memory measures in detecting early stage Alzheimer's disease (AD) is controversial. Current investigations within our laboratory and in others attempt to clarify the issue. We examined the performance of very mild AD patients ($n = 29$) and elderly controls ($n = 35$) on two different verbal memory tests used in previous reports (narrative recall, word list memory). The results showed that for each test, the delayed recall measures were more sensitive than the immediate recall tasks. However, when the two tests were considered together, narrative recall (even immediate recall) had higher discriminative capacity than did word list memory (immediate and delayed). These findings highlight important differences in task demands. A model positing a solitary impairment in the long-term maintenance of new information can explain the observed memory deficits of early AD.

Poster Session 3

DEMENTIA, APRAXIA, & REHABILITATION

M.L. BOON & M.D. FRANZEN. Reliability of Assessment Instruments Designed for Use With Elderly Patients.
The Kendrick Dementia Battery and the Fuld Object-Memory Evaluation have been designed to assess cognitive functioning in elderly samples. Since these tests were designed for serial evaluations, their reliability should be evaluated. The current study examined the performance of 29 healthy elderly ($M = 78$ yr) subjects who were residents at a retirement home. Tests were administered on two occasions in counterbalanced order. To test temporal stability, results of two Kendrick tasks and four Fuld summary indices were analyzed with Pearson product moment correlations across the two administrations. All correlations were statistically significant. Modified Bonferroni-corrected t tests revealed no significant differences between the two administrations. These tests demonstrated good temporal stability, and may be useful for use with elderly patients who cannot tolerate more comprehensive batteries.

D. MARSON, K. HERFKENS, A. BROOKS, K. INGRAM, & L. HARRELL. Relevance of Dementia Screening Instruments to Physician Competency Judgments in Alzheimer's Disease.
This study represents an initial effort to demonstrate the relevance of neuropsychological instruments to the evaluation of competency. Seven subjects with varying levels of Alzheimer's disease (AD) and one normal older control were videotaped undergoing a structured competency interview (SCI) designed to evaluate a specific competency (subject capacity to make a medical treatment decision). The SCI was comprised of clinical history questions, the Mini-Mental State Exam (MMS), and a clinical vignette. Interview subjects were also independently administered (off videotape) the Dementia Rating Scale (DRS). Twelve physicians with experience assessing competency in dementia individually viewed the SCI videotapes and made competency decisions. Using Pearson r, physician competency outcomes were then correlated with subject scores on the MMS, the DRS, and the five DRS subscales. DRS Total Score was significantly associated with competency outcome ($r = .79$, $p < .05$), as was DRS Perseveration/Initiation ($r = .90$, $p < .002$) and DRS Memory ($r = .80$, $p < .05$). MMS was also very strongly associated with competency outcome ($r = .93$, $p < .001$), although the MMS in this study was not a truly independent dementia measure. Preliminary results thus indicated that subject competency status is strongly related to subject level of dementia, and that capacities for executive function, verbal fluency, and short term verbal memory are associated with subject performance on competency assessment measures. Dementia screening instruments like the DRS and MMS appear relevant and useful to clinical competency assessment.

B.R. REED, E.M. MARTIN, S.L. SCARBOROUGH, & W.J. JAGUST. Neuropsychological Patterns in Early and Late Onset Alzheimer's Disease.
Memory, expressive language (EL), receptive language (RL), and visuospatial (VS) performance was compared in two groups of 31 patients each, one with presenile onset Alzheimer's disease (AD) and other with senile onset AD. The groups were matched closely on education, estimated premorbid IQ, sex, handedness, and race and also on overall dementia severity as measured by functional disability. Presenile onset performed worse than senile onset on EL and VS, but better on a word list learning measure of recall. However, when the memory scores were age corrected, the direction of differences (still significant) reversed so that preseniles' recall was worse relative to their peers than was senile patients'. This suggests that the descriptively accurate observation that senile onset patients have poorer recall than presenile onset patients results from a combination of age and AD effects.

F.M. McCARTHY, W. BURNS, & J. CHEHEBAR-VALDES. Comparison of Three Reading Tests as Premorbid IQ Estimators.
The validity of predicting premorbid IQ using the NART-R, WRAT-R, WRAT3, and the Barona Index was evaluated with 30 normal subjects and 50 patients suffering from Alzheimer's disease (AD) classified as mild and moderate based on their MMSE scores. For normals, the Barona IQ and the NART-R were similar to obtained WAIS-R FSIQ. For AD patients, the NART-R was found to be the best of the three reading tests for estimating premorbid IQ based on the Barona Index. In general, the WRAT-R was comparable to the WRAT3 and both underestimated WAIS-R FSIQ. All four premorbid estimators were found to be highly accurate in predicting group membership. However, the WRAT3 was the best with a hit rate of 91% and a false positive rate

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of 10%. Results support the utility of the NART-R as a good premorbid estimator of IQ for mild and moderate levels of AD.

L.M. CARSWELL, R.E. GRAVES, W.G. SNOW, & M.C. TIERNEY. The Effectiveness of Premorbid IQ Estimates at Postdicting Verbal IQ Estimates in Normal Elderly Subjects.

A regression equation was developed utilizing predictive estimates of premorbid IQ including demographics, National Adult Reading Test (NART) errors and age-scaled Wechsler Adult Intelligence Scale-Revised (WAIS-R) Vocabulary scores to postdict WAIS-R Verbal IQ scores (VIQ) obtained five years earlier for a sample of 49 elderly normals (mean age = 71 yr). Stepwise multiple regression revealed that Vocabulary, sex and NART errors contributed significantly to the postdiction of WAIS-R VIQs and accounted for 66% of the variance in VIQ scores. The new regression equation demonstrated significant potential usefulness as a predictor of premorbid IQ as it accounted for 36% more of the variance in WAIS-R VIQs than the NART alone.

L.M. CARSWELL, R.E. GRAVES, & W.G. SNOW. Quantitative Evaluation of the Sensitivity of Premorbid IQ Estimates.

The present study was conducted to quantitatively evaluate the clinical sensitivity of several measures of premorbid IQ. Selected studies were reviewed that reported the correlation between various IQ predictors (such as the National Adult Reading Test and demographic equations) and Wechsler Adult Intelligence Scale/Revised (WAIS/WAIS-R) IQs for normal subjects. The error in prediction of WAIS/WAIS-R IQ was calculated for these predictors. Results indicated that, depending on the measure, a discrepancy between obtained and predicted IQ would have to be at least 14 points (and in some cases as much as 22 points) to be reliable. This analysis raises questions about the practical utility of such measures for predicting premorbid IQ.

E.D. RICHARDSON & J.D. NADLER. Cognitive Correlates of the Capacity for Self-Monitoring in Early Dementia.

The relationship between neuropsychologic functions and the ability to make subjective judgments about daily living abilities was examined. It was hypothesized that executive and visuospatial functions would be the cognitive domains impaired in dementing individuals who show either poor self-awareness of ADL disability or failure to benefit from feedback on performance. Subjects were 38 geriatric patients referred for a dementia evaluation. Tests of cognitive function and performance tests of ADLs were administered to the subjects. Subjects were first asked to predict their performance on each of the ADL tasks. After task performance, subjects were then asked to rate their performance level. Between group comparisons between "poor self-monitors" and "good self-monitors" revealed significant differences on tasks of executive function (effect size = .25) and visuospatial processing (effect size = .20) and modest differences in verbal memory functions (effect size = .13).

E.D. RICHARDSON & J.D. NADLER. Incremental Analyses of Specific Cognitive Domains in the Prediction of ADL Performance in Geriatric Patients.

The incremental value of specific domains of cognitive function in determining ADL ability in geriatric patients was examined. It was hypothesized that visuospatial abilities and executive function would be the most important cognitive domains required to perform ADL tasks. Subjects were 83 geriatric outpatients referred for a dementia evaluation. Tests of cognitive function and three performance tests of gender-independent ADLs were administered to the subjects. Results of hierarchical regression analyses revealed significant associations between specific cognitive domains and each of the three ADL tasks. Executive function added the most variance in the prediction equations beyond that accounted for by visuospatial ability. Memory added statistically significant, but not clinically meaningful, variance to the prediction of ADL.

E.D. RICHARDSON, J.D. NADLER, C. JORDAN, & J. BORTZ. Caregiver Burden and Unawareness of ADL Function in Dementing Patients.

The relation between lack of awareness of function ability in dementia and caregiver burden was examined. It was hypothesized that caregivers would report higher levels of subjective burden in the group of patients with low awareness of ADL deficits. Subjects were 35 geriatric patients referred for a dementia evaluation and their caregivers. Subjects were asked to predict their performance on ADL tasks prior to actually performing the tasks. The discrepancy between prediction and actual performance was calculated for each subject. Subjects with large discrepancies were labeled as having "low awareness," and subjects with small discrepancies were labeled as having "high awareness." Between group comparisons for level of awareness revealed significant differences in subjective burden reported by the caregivers, with low awareness groups having greater burden.

C.M. GHOSH, J.T. OLIN, & L.S. SCHNEIDER. Caregivers' Ability to Assess Cognitive Impairment and Longitudinal Change in Impairment in Alzheimer's Disease Patients.

The Relative's Assessment of Global Symptomatology-Elderly (Raskin & Crook, 1988; RAGS-E) was used to determine whether Alzheimer's disease (AD) caregivers can reliably assess cognitive impairment and changes in impairment. Patients were administered the Alzheimer's Disease Assessment Scale, cognitive subscale (ADASc; Rosen et al., 1984). Factor analyses of the RAGS-E ($n = 131$) revealed 3 factors (accounting for 49.5% of the variance) corresponding to three scales: cognitive functioning, mood disturbance, and odd or unusual behavior. Only the cognitive scale correlated significantly with the ADASc. One year change scores on the cognitive scale and ADASc were significantly correlated ($r = .47$, $p < .01$). These findings suggest that caregivers can detect impairment and change in impairment to a similar extent as other measures used in clinical trials.

K. WILD, J. LEAR, & J. KAYE. The Severely Impaired Alzheimer Disease Patient: Can Rates of Cognitive Change be Assessed?

Longitudinal assessment of cognitive change in Alzheimer's disease (AD) has relied primarily on evaluation of mildly to moderately impaired patients. However to describe possible subtypes or to evaluate efficacy of interventions, patients along the entire range of dementia severity must be followed. The present study describes changes in cognitive function in patients who are typically excluded from longitudinal studies due to their inability to complete most standardized neuropsychological batteries. Twenty-six outpatients with severe dementia were evaluated. Assessment instruments at two points in time included the Severe Impairment Battery, MMSE, CDR, ADL and IADL. Mean changes in SIB and other study variables are reported. Change in cognitive status as described by SIB scores was correlated only with initial IADL scores. Factors complicating longitudinal assessment are considered.

T.M. SCOTT, K. DUFF, N. MOCZYNSKI, J. NORTON, & D.A. GANSLER. The Utility of the Dementia Version of the California Verbal Learning Test (CVLT-D) in Discriminating Between Demented and Non-Demented Groups.

The Dementia Version of the CVLT is a 9-word list learning task designed for assessing learning and memory in patients with moderate to severe memory disorder. While the CVLT-D's procedures and indices are identical to the 16-word CVLT from which it was derived, there are no published studies validating its sensitivity in demented patients. The purpose of this study was to determine whether the CVLT-D is sensitive to the memory impairments in these patients. A group of demented patients was compared with age matched controls. Significant between-group differences were found for all learning and memory factors obtained. This suggests that the CVLT-D is sensitive to the memory deficits associated with dementia, and may be a viable alternative to the CVLT for more severely impaired patients.

D.S. DERRER, D.B. HOWIESON, J.A. KAYE, R. CAMICIOLI, & G. SEXTON. Memory Measures in Mild Dementia: Predictions from Logistic Regression Models.
Analysis of nine widely used memory measures (CERAD Word List Acquisition and Recall, WMS-R Visual Reproduction I and II, WMS-R Logical Memory I and II, the memory measures of the Neurobehavioral Cognitive Status Exam and the Mini-Mental State Exam and the latter's total score) showed each to have moderate predictive power in differentiating between patients with mild dementia and healthy normal controls. When these instruments were combined in a logistic regression analysis, three of them had substantial predictive power. Together the CERAD Word List Acquisition test, WMS-R Logical Memory II and WMS-R Visual Reproduction II were 97.3% accurate, 100% sensitive, and 94.6% specific in distinguishing these two groups. Clinical utility of these predictive instruments was discussed.

K.A. NOLAN, K.A. WELSH, A. HEYMAN, L.A. BURTON, & R.C. MOHS. Changes in Recognition Memory Over the Course of Alzheimer's Disease: A CERAD Study.
Recognition memory was examined in 430 probable Alzheimer's disease (AD) patients and 352 controls enrolled in the Consortium to Establish a Registry for Alzheimer's Disease (CERAD). Patients were observed for at least two years. AD patients differed from controls on all four recognition measures analyzed: correct "hits," false alarms, overall response accuracy, and response bias. Stratification by Clinical Dementia Rating and Mini-Mental State Examination scores demonstrated significant reductions in hits and overall accuracy with increased disease severity. However, there were no significant differences in response bias among AD stratified by severity and only the mild vs. severe comparison was significant for false alarms. While recognition accuracy is *progressively* diminished in AD, false positive response tendencies may be a characteristic, relatively immutable feature of AD dementia.

A.W. KASZNIAK & G.D. CHRISTENSON. One-Year Longitudinal Changes in the Metamemory Impairment of Alzheimer's Disease.
Twenty-one Alzheimer's disease (AD) patients and their caregivers completed a questionnaire [modified Gilewski, Zelinski, & Schaie (1990) Memory Functioning Questionnaire], rating patients' memory and other cognitive difficulties, and made predictions concerning each other's performance on various memory tasks. AD patients underestimated (in comparison to caregiver ratings) both the frequency and seriousness of their memory and other cognitive deficits. Analyses of performance prediction accuracy data supported the conclusion that patient–caregiver discrepancies reflected patients' impaired awareness of deficits rather than any general patient or caregiver response bias. One-year reassessment showed increased patient–caregiver discrepancies for the questionnaire, but not for the performance prediction accuracy measures. Results are discussed within the context of hypothetically different aspects of deficit unawareness that are assessed by different measurement approaches.

B.A. OBER & J.E. BRUSTROM. Source Memory for Actions in Alzheimer's Disease.
A source memory task, using everyday objects in actions performed either by the subject or the experimenter, was given to probable Alzheimer's disease (AD) and elderly control subjects. Our goal of obtaining a performance level from the AD subjects which was not at floor, and of obtaining a performance level from the control subjects which was not at ceiling was met by using 10-min delay for the AD subjects and a one-week delay for the elderly controls. Both AD and control subjects were much less likely to mistake New test items for Old items, than to mistake experimenter-as-source for subject-as-source items; however, there were a number of interesting differences in the proportions of response types (Experimenter, Subject, New), depending on source types (Experimenter, Subject, New).

W.P. GOLDMAN. Flashbulb Memories in Patients With Alzheimer's Disease.
The present study was conducted to determine if there are conditions in which remote autobiographical memory is spared in Alzheimer's disease (AD). Sixteen patients with AD and 16 elderly controls recalled the circumstances in which they were informed about emotional news events: bombing of Pearl Harbor, assassination of President Kennedy, explosion of the Space Shuttle. Such memories are typically referred to as "flashbulb memories" and have been shown to be vivid and long lasting in normal controls. AD patients recalled less in terms of the quality and quantity of information provided. Thus, flashbulb memories are not immune to the dementing process. However, some AD patients were able to provide flashbulb memories. This indicates some sparing of remote memory in the earliest stages of AD.

V.J. ROBERTS, F.C. GOLDSTEIN, & M. LAMAR. Activity Memory in Patients With Alzheimer's Disease.
The purpose of the present study was to examine immediate and delayed recall in a five trial learning task of categorizable subject performed tasks (SPT's) and word lists in Alzheimer's disease (AD) patients and healthy elderly controls. Motor retrieval was required following motor encoding of SPT's and verbal retrieval was employed following verbal encoding of words. Analyses revealed that free and cued delayed motor retrieval was significantly better than free and cued delayed verbal retrieval in both AD patients and controls. In contrast, immediate recall under both conditions was comparable. These findings suggest that deterioration of learning and recall for action may be spared relatively later in the course of AD. Therapeutic implications will be discussed.

J.O.W. GREENE & J.R. HODGES. Public Memory in Alzheimer's Disease.
To study whether public memory is consistently impaired in patients with very early Alzheimer's disease, we compared 32 patients with either minimal (MMSE OVER23) or mild (MMSE 17–23) disease and 30 matched controls. Even minimal DAT patients were impaired on all tests of public memory except for famous face recognition. There was also evidence of a gentle temporal gradient for remote memory in DAT. In contrast to the uniform and severe impairment of anterograde memory seen in DAT patients, there was considerable heterogeneity in performance on remote memory. The deficit in face and name processing in DAT patients was at identification and naming, rather than recognition. This would suggest that the deficit primarily involves semantic knowledge of famous persons and post-semantic processing. However, famous face and name identification correlated poorly with general semantic tasks, suggesting that person and knowledge and general semantic knowledge may be separate.

P.J. MASSMAN & R.S. DOODY. Sex Differences Involving Naming in Alzheimer's Disease: Stronger Relationships With Left Hemisphere Functioning in Men.
Confrontation naming ability may be less lateralized in women than in men, so women with Alzheimer's disease (AD) may exhibit greater naming impairment than men with AD. This proposition was examined by analyzing the relationships between Boston Naming Test (BNT) scores and other neuropsychological measures in 48 men and 50 women with probable AD. The groups did not differ in age, years of education, or MMSE scores. The AD men and women did not obtain significantly different BNT scores, but the associations between BNT scores and other measures thought to tap left-hemisphere functioning (e.g., right-hand tapping speed) were higher in men than in women. Correlations between BNT scores and memory or "right-hemisphere" measures (with MMSE partialed out) were not significant in men or women. Interestingly, the correlation between BNT performance and years of education was much higher in men ($r = .46$) than in women ($r = -.01$).

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L. McFADDEN & L. FREEDMAN. Spatial Memory in Cortical and Subcortical Dementia.
Although visuospatial deficits are frequently a component in the neuropsychological profile of subcortical neurodegenerative diseases such as Parkinson's disease, Progressive Supranuclear Palsy, and Huntington's disease, these are thought to be the result of executive function dyscontrol, and not primarily a deficit in visuoperceptual skills per se. To address this concept, a spatial memory test was administered to two patient groups: one with Dementia of the Alzheimer's Type (DAT), and a second with subcortical degenerative diseases (SUB). The groups were matched for age, education, Full Scale IQ, and visuospatial analytical reasoning ability. The Alzheimer group showed a marked mnestic deficit for spatial stimuli, whereas the Subcortical group demonstrated significant levels of learning over multiple trials, and stronger retention after delay, in comparison to the cortical group. The results are discussed in terms of retained memory function and spatial skill in subcortical and cortical degenerative processes.

M.M. CHERRIER & A.I. TRÖSTER. Performance of Alzheimer's Disease Patients and Normal Elderly on Verbal and Figural Fluency Measures.
In this study, we examine the pattern of performance between twenty mild to moderately impaired Alzheimer's disease (AD) patients and twenty age- and education-matched healthy elderly controls (NC) on verbal and figural fluency tasks. Using a category verbal fluency task and the Ruff Figural Fluency Test (RFFT), we found that the NC group performed significantly better than the AD group on both verbal and figural fluency tasks. Verbal and figural fluency were strongly, positively correlated in the AD group but not in the NC group. Visuoconstructive ability was not significantly different between the two groups. Findings suggest that cognitive flexibility and the ability to create novel, nonverbal responses are deficient in AD patients, even in mild to moderate stages of decline.

Y. KIM, S.P. CERCY, M. ASHTARI, & J. ZITO. Neuropsychological Correlates of Limbic MRI Volumetry in Dementia of the Alzheimer Type.
This study examined the relationship between impairments of specific cognitive domains in patients with probable dementia of the Alzheimer type (DAT) and regional atrophy as measured by MRI in three limbic structures, the amygdala, hippocampus, and mammillary bodies. DAT patients showed significant atrophy bilaterally in the amygdala and mammillary bodies, but not the hippocampus, compared to controls. For all subjects, hippocampus and mammillary body volume correlated significantly with orientation and memory, while amygdala volume correlated with all cognitive domains examined: intelligence, orientation, memory, motor, and executive functions. Multiple regression analyses indicated that amygdala volume was a better predictor of memory and global cognitive functioning than either hippocampus or mammillary body volume. The role of the amygdala and its relationship to other limbic structures in mediating memory functions is discussed.

C.H. HINKIN, D.L. SULTZER, M.E. MAHLER, M.A. MANDELKERN, J.L. CUMMINGS, W.G. VAN GORP, R. DURVASULA, J.R. ROPCHAN, & W.H. BLAHD. Frontal Hypometabolism and Executive Dysfunction in Alzheimer's Disease.
Although positron emission tomography (PET) characteristically demonstrates biparietal and bitemporal hypometabolism, some but not all individuals with AD evidence bifrontal metabolic abnormalities. The present study investigated the relationship between frontal lobe hypometabolism and performance on neuropsychological (NP) measures of executive function. Twenty-one subjects with probable AD received resting state PET scans using ^{18}F-fluorodeoxyglucose and NP testing. Results showed: (1) principal components analysis revealed a frontal/limbic factor; (2) cluster analysis revealed a frontal/limbic subtype; (3) frontal hypometabolism was strongly associated with performance on NP measures of executive function. These findings suggest that cerebral metabolic dysfunction in AD is heterogeneous and that NP impairment on measures of executive function is regionally specific and associated with frontal metabolic abnormality.

S. MURTHA, H. CHERTKOW, G. WATERS, & H. BERGMAN. Working Memory (WM) Impairment in Dementia of the Alheimer's Type (DAT): Evidence Against a Single Central Executive (CE).
Considerable evidence has emerged that DAT patients have a specific impairment affecting the CE component of WM. This has been demonstrated through dual task experiments involving recall of consonant trigrams [Brown/Peterson (B-P)], or visual pursuit tracking (tracking) during concurrent performance of secondary distractor tasks. It is not clear whether DAT patients who are claimed to have a CE deficit on the basis of one task would also show impaired performance on another. Seven elderly controls and 10 DAT subjects were assessed on two different WM experiments which used the dual task paradigm (B-P and tracking). The DAT subjects performed significantly worse than the controls on both experiments. Their performance, however, was even more impaired when concurrent performance of increasingly demanding secondary tasks placed further demands on processing resources, confirming previous findings of a WM deficit in DAT. Analysis of the correlations between the two tasks did not reach significance. While differing non-WM demands on the two tasks might be responsible, a reasonable alternate hypothesis is that the two tasks reflect the deterioration of separate CE stores.

R. HENDRICKSON & A.W. KASZNIAK. Variability of Memory Awareness in Alzheimer's Disease.
The effect of dementia on "metamemory" remains poorly understood. We examined metamemory judgements on Wechsler Memory Scale-Revised tasks in three groups of subjects: 8 higher functioning Alzheimer's disease (AD) patients, 8 lower functioning AD patients, and the 16 AD caregivers. Both AD groups generally overestimated their performance, as compared to their caregivers' predictions of the patients' abilities, on four memory tasks. In contrast to prior studies, the three AD patients who displayed the most accurate metamemory abilities were all in the lower functioning group, suggesting that metamemory functioning may be quite variable in AD. Research did not support the hypothesis that performance on frontal lobe-related tasks is associated with impairments in metamemory judgements in AD.

J. ANDRIKOPOULOS. Anosognosia in Alzheimer's Disease and Visuocognitive Performance.
Anosognosia in Alzheimer's disease (AD) is said to be related to disproportionate right hemisphere involvement. Thirty four patients with a probable diagnosis of AD were categorized as being either aware (N = 17) or unaware (N = 17) of their memory deficits. Both groups were equated for duration of illness, education, subtests from the Wechsler Adult Intelligence Scale-Revised and subtests from the Multilingual Aphasia Examination. Visuospatial, visuoperceptual and visuoconstructional abilities were assessed by Judgment of Line Orientation, the Facial Recognition Test and Block Design, respectively. There was no significant difference between the groups on any of the visuocognitive tests. It is argued that the level of dementia most likely explains the anosognosia rather than disproportionate right hemisphere dysfunction.

J. NADLER, M. COHEN, R. HODDER, & N. RELKIN. Unawareness of Cognitive Functioning in Dementia.
This study further examined unawareness of cognitive functioning in dementia. Using a performance-based measure of awareness (a modification of the Awareness Interview; Anderson & Tranel, 1989), degree of awareness of cognitive functioning was compared between demented (n = 56) and nondemented (n = 63) subjects, with level of cognitive status statistically controlled. Awareness was examined across five domains of cognitive functioning. Comparisons of mean discrepancy scores between groups revealed significantly greater unawareness of functioning and deficits in dementia. Greater unawareness was specifically seen

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for the cognitive domains of orientation, language, and memory. The results suggest that awareness deficiencies are present in dementia, that they are not merely an artifact of global cognitive impairment, and that there are varying degrees of unawareness across cognitive domains.

J.J. VASTERLING, B. SELTZER, & J.W. FOSS. Impaired Awareness of Memory Deficit in Alzheimer's Disease: Relationships to Behavioral Ratings and Dementia.
Despite increasing documentation of impaired awareness of memory deficit among patients afflicted with Alzheimer's disease (AD), controversy exists regarding the relationship of impairment of awareness to other disease correlates. The purpose of this study was to examine possible associations of dementia stage, cognitive performance, and patient, clinician, and caregiver ratings of patient depression, anxiety, and irritability with awareness of deficit, measured by patient-caregiver discrepancies in ratings of patient memory impairment among 36 AD-diagnosed patients. Results of a stepwise multiple regression analysis suggested that greater impairment of awareness is associated with greater cognitive impairment, less clinician-rated depression, and greater caregiver-rated irritability.

P.K. SHEAR, E.V. SULLIVAN, J. JOHNSON, M. STEIN, J.A. YESAVAGE, J.R. TINKLENBERG, & A. PFEFFERBAUM. Simple and Complex Motor Movements in Alzheimer's Disease and Parkinson's Disease.
Disability in complex motor functioning is common to Alzheimer's disease (AD) and ideopathic Parkinson's disease (PD) but the deficits may occur for different reasons in each disease. In this study, AD patients were found to have motor performances superior to PD patients on tests of simple motor functions (whether unimanual or bimanual). By contrast, the PD patients performed significantly better than the AD patients on complex motor tests. Additionally, patient age was found to be differentially related to the integrity of complex motor functioning in the 2 groups, with younger AD patients performing more poorly than older AD patients and no significant age relationship in the PD group.

D.H. JACOBS, D.L. NA, J.E. CIBULA, J.C. ADAIR, D.J.G. WILLIAMSON, J. SHUREN, M. GOLD, A. FOUNDAS, & K.M. HEILMAN. Apraxia Score Does Not Predict Motor Learning Performance in Alzheimer's Disease (AD).
Patients with Alzheimer's disease (AD) reportedly have normal motor procedural learning. However, these reports did not include information about whether or not the patients with AD were apraxic. We tested the hypothesis that apraxia in AD might predict poor performance on a motor learning task. Twelve patients with Alzheimer's disease were graded for praxis performance and then given 20 trials on a rotor pursuit. ANCOVA covarying for the initial performance showed that praxis score did not predict performance on the rotor pursuit task. The results suggest that motor learning may not depend upon stored movement engrams that are thought to be damaged in AD.

J. NEILS, J. SHUREN, & D.P. ROELTGEN. Impairment of the Graphic Motor Code in Alzheimer's Disease.
This study reports the writing performance of a dysgraphic patient with Alzheimer's disease (AD) and moderate dementia who frequently perseverated on strokes and letters. Letter formation errors were also frequently produced. Oral spelling was superior to written spelling and upper case print was superior to cursive writing. This patient demonstrated an apraxic dysgraphia and a spatial dysgraphia with relatively preserved central (linguistic) spelling processes. We suggest that damage to the peripheral orthographic mechanism may cause deficits in writing in at least some patients with AD. The bilateral damage associated with AD may result in characteristics of apraxic dysgraphia associated with left-hemispheric damage and spatial dysgraphia associated with right-hemispheric damage.

S. REDIESS & R. SATRAN. Corticobasal Degeneration: Serial Neuropsychological Examination of a Case.
Four years after the evacuation of a subdural hematoma, patient C.C. presented with degenerative brain disease characterized by apraxia of the right hand evolving into alien hand and leg, gait instability progressing to rigidity, akathisia, gaze palsy, involuntary movements of the face, arms, legs, and trunk, and mild cognitive decline. Three neuropsychological exams performed up to 3 yr before symptom onset demonstrated stable cognitive deficit consistent with the location of his initial SDH. Examinations after disease onset demonstrated progressive deterioration in praxis, motor sequencing and executive functions, relative preservation of memory, and well-preserved general intellect. CT and MRI scans showed progressive cerebral atrophy greater in left frontoparietal region and mild cerebellar atrophy. Neurologic, neuropsychologic, and neuroradiologic features of this disease are consistent with CBD.

L. LALAMI, E.S. ANDERSEN, D. KEMPLER, & M.S. SEIDENBERG. Loss of Perceptual Knowledge in AD.
This study investigates the nature of the dissociation between natural kinds and artifacts in Alzheimer's disease (AD). The study examines the error patterns of AD subjects as well as normal controls on naming and knowledge probe task. The data indicate that AD subjects make significantly more errors on natural kinds than on artifacts in the naming task. This pattern is also observed in the knowledge probes task. These results replicate earlier findings that AD subjects are relatively more impaired in naming natural kinds than artifacts. Moreover, they indicate that this pattern is associated with degraded conceptual knowledge. Finally, AD subjects make significantly more errors on perceptual than on functional probes, which is compatible with Warrington and Shallice's (1984) proposal that, in impairments of natural kinds, perceptual knowledge is disrupted.

G. GLOSSER, M.J. WILEY, E.J. BARNOSKI, & D.J. LIBON. Gestural Communication in Alzheimer's Disease.
Communicative hand-arm gestures were assessed in Alzheimer's disease (AD) patients and healthy elderly. Based on the notion that speech and gestures arise from common semantic-conceptual representations, qualitatively similar linguistic and gestural communication impairments were expected when access to or organization of semantic memory representations becomes disrupted in AD. Groups demonstrated equal gesturing rate during conversation and did not differ in rates of production of "deictic" gestures that have no specific semantic content and "beats" that serve primarily syntactic functions. For semantic content-bearing "iconic" and "metaphoric" gestures, AD patients produced proportionately more referentially unclear gestures. Impaired gestural clarity correlated with severity of linguistic/cognitive impairments. Findings support the general hypothesis that AD patients' referential communications are similarly disrupted in linguistic and gestural channels.

A.M. RAYMER, L.J.G. ROTHI, & K.M. HEILMAN. Nonsemantic Activation of Lexical and Praxis Output Systems in Alzheimer's Subjects.
Based on models of lexical/praxis processing incorporating direct nonsemantic access to lexical and praxis output systems, we predicted that Alzheimer's disease (AD) subjects, who presumably have semantic impairment, would be better in naming and gesturing to viewed tools than to tool descriptions. To test this prediction, AD and control subjects performed four lexical and praxis tasks. Controls performed at high levels in all tasks. The AD group performed significantly better for naming viewed tools than for naming to descriptions, whereas the difference between gesturing to viewed tools and gesturing to descriptions was not significant. Three AD subjects did demonstrate significantly better gestural performance to viewed tools than to described tools. These findings support lexical/praxis models which include direct nonsemantic access to lexical and praxis output systems.

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K.I. TAYLOR, D.P. SALMON, V.A. RICE, N. BUTTERS, & L.R. HILL. The Validity of the American National Adult Reading Test (AMNART) in Dementia of the Alzheimer Type (DAT): A Longitudinal Analysis.

The American National Adult Reading Test (AMNART) is thought to provide a valid and stable estimate of premorbid verbal IQ (VIQ) in demented patients by assessing familiarity with "irregular" words (e.g., naive) through the ability to correctly pronounce them. To assess its validity, the AMNART was administered to 40 dementia of the Alzheimer type (DAT) patients and 40 normal control (NC) subjects at three annual evaluations. DAT patients' AMNART estimated VIQs were significantly lower than demographically matched NC subjects' and declined significantly over time as dementia progressed. These results suggest that the AMNART does not provide valid and stable estimates of premorbid VIQ in DAT patients. However, a statistically derived correction factor based on DAT patients' rate of cognitive decline significantly improves the tests' performance.

L.P. ALTMANN, E.S. ANDERSEN, & D. KEMPLER. Open and Closed Class Speech Errors in Alzheimer's Disease.

Semantic impairment is a hallmark of Alzheimer's disease (AD). In modular theories of speech production, semantic impairment should affect open but not closed class words. We investigated spontaneous speech errors and found that AD patients made errors on both word classes, in the same proportions at mild and moderate stages of disease. These errors provide a challenge for modular theories of speech production in which open and closed class words are accessed by different mechanisms. We argue for a theory in which both open and closed class items have distributed representations and are activated by similar mechanisms, the main difference between the two being semantic content.

J.B. RICH & L.E. KENWORTHY. A Qualitative Analysis of Drawing Errors in Alzheimer's Disease Patients and Elderly Control Subjects.

Drawings on the Beery Developmental Test of Visual-Motor Integration (VMI) were compared in 44 moderately demented (M MMSE = 16.0) Alzheimer's disease (AD) patients and 32 normal control (NC) subjects equated for age and education. As expected, the NC group had significantly higher VMI scores ($M = 42.5$) than did the patients ($M = 14.3$). We used an original scoring system to assess the quality of drawings across 16 dimensions. Neglect, perseveration, and line thickening (a concrete replication of the stimulus model) were observed among AD patients only and are considered markers of brain damage. The AD group also made significantly more errors involving crowding or shifting toward the stimulus, rotations, angle distortions, extraneous additions, simplifications, and several measures of figural relations. The developmental nature of the VMI minimizes floor effects, which allows assessment of even severely demented individuals. This qualitative scoring system supplements the standard Beery score by characterizing the nature of drawing errors in both patient and normal populations.

F.W. BYLSMA, D.X. RASMUSSON, & S. STARKSTEIN. MRI and EEG Correlates of Neurological and Cognitive Impairment in Huntington's Disease.

The inter-relationship of MRI, EEG, neurological, and cognitive measures of disease was assessed in 13 Huntington's disease patients. Cognitive impairment correlated with sylvian cistern size on MRI, and with abnormal Theta and Alpha band power at frontal and temporal EEG recording sites. Neurological impairment correlated with putamen area on MRI, and with increased temporal Beta and lower frontal Theta frequencies in the EEG. Abnormal Alpha and Theta band power and slower frontal Theta frequency correlated with reduced cingulate gyrus area on MRI. EEG measures, reflecting cortical activity, and cortical measures from MRI scans were more highly correlated with cognitive impairment than were subcortical MRI measures. MRI measures of subcortical atrophy, specifically putamen area, correlated with severity of neurological impairment as indexed by the chorea subscale score of the QNE.

M.J. ROMAN, D.C. DELIS, J.V. FILOTEO, T.L. DEMADURA, J. PAULSEN, M. SWENSON, & N. SWERDLOW. Performance in Patients With Huntington's Disease on a Global-Local Directed Attention Task.

Visual attention and perception in patients with Huntington's disease (HD) were investigated using a global-local directed attention task. Stimuli consisted of a large number (global level) composed of smaller numbers (local level); stimuli were either "consistent" (same number at both global and local levels), or "inconsistent" (different numbers at the two levels). In one block of trials, subjects were asked to identify the number at one level of the stimuli; in another block of trials, they identified the number at the other level. In terms of accuracy, HD patients were selectively impaired relative to controls in responding to inconsistent stimuli but not to consistent stimuli, suggesting a specific vulnerability to perceptual interference. HD patients' perceptual accuracy was related to their speed of responding but not to their level of dementia. Results overall suggest that increased vulnerability to perceptual interference may in part underlie the spatial impairment associated with HD.

D.H. JACOBS, J. SHUREN, D.L. NA, J.C. ADAIR, & K.M. HEILMAN. Superior Vertical and Far Radial Neglect in a Patient With Huntington's Disease: Evidence That the Neglect is a Motor-Intentional Disorder.

Of four patients with Huntington's disease that were tested for neglect, one demonstrated right superior extinction on a double simultaneous stimulation task. On line bisection tasks performed in 3 dimensions (horizontal, vertical, and radial lines), he neglected superior and far radial space. We attempted to dissociate the attentional and motor-intentional components of neglect on vertical bisections by asking the patient to bisect lines viewed through a video monitor that had been rotated 180°. Results suggested an intentional type of neglect. We suggest the caudate may be important for integrating visual attention and motor intention in the vertical plane.

E.B. MONTGOMERY, JR., W.C. KOLLER, M.C. NEWMAN, T.J.K. LAMANTIA, E.F. SWANSON-HYLAND, & A.W. KASZNIAK. Objective Test to Confirm Parkinson's Disease.

We are developing a battery of tests to provide an objective confirmation of idiopathic Parkinson's disease (iPD). In preliminary studies, this battery distinguishes between normal subjects ($n = 18$) and patients with early mild iPD ($n = 18$) with 95% sensitivity, 94% specificity, and the area under the receiver-operator curve (ROC) of 0.98. The battery incorporates tests of motor function, olfaction, and affective state. When additional normal subjects were studied in a prospective manner, the test battery correctly identified 44 of 48 NC subjects. This test battery could help insure appropriate care. This test battery could allow early or pre-clinical detection that, coupled with neuro-protective therapies, could further reduce health costs and disability. Such a test also could prove useful in investigating possible genetic and/or environmental causes of iPD.

R.S. KERN, C.J. WALLACE, L.M. WOMACK, S.G. HELLMAN, & M.F. GREEN. An Effective and Durable Training Procedure for Remediating Deficits on the WCST: The Effects of Error on Learning.

Although a number of studies have demonstrated the feasibility of remediating deficits on the WCST, performance gains have been relatively short-lived. The present study tested the effectiveness and durability of an intensive training procedure, one based on errorless learning principles, and sought to determine the effect of previously committed errors on performance during and after training. Twenty-eight psychiatric inpatients were assigned to a High or Low Error group. The High Error group received two standard administrations of the WCST prior to training. All subjects received training on the WCST followed by immediate, one-, two-, and four-week post-tests. Results supported the effectiveness and durability of the training procedures, and indicated that error history may influence performance during but not after training.

V. FRAÏLE & H. COHEN. Prosody in Parkinson's Disease: Relations Among Duration, Intensity and Fundamental Frequency Range.
Prosodic abnormalities have been described in neurologically impaired populations including patients with Parkinson's disease (PD), a neurodegenerative disease mostly affecting the basal ganglia. In this study, we investigated the prosodic patterns of accentuation in PD by evaluating the relations between three basic prosodic features: duration, intensity and F_0 range (Delta F_0). Measures were extracted from digitized repeated syllables produced under two Modes (unaccentuated, accentuated) by 8 mild and 11 moderate PD patients, and 14 control subjects matched for age and education. ANOVAs showed that accentuation leads to modifications of all parameters and that these changes are present in both PD and control subjects. Correlational analyses revealed however that, in accentuated syllables, the relational pattern among these parameters is altered, even at early stages of PD. These results confirm a striatal involvement in the control of complex motor acts needed to coordinate the acoustical patterns that convey prosodic information.

P.R. DALBY, A.W. KASZNIAK, J.E. OBRZUT, G.E. SCHWARTZ, E.G. MONTGOMERY, & L.M. ALEAMONI. Facial EMG and the Subjective Experience of Emotion in Idiopathic Parkinson's Disease.
Nineteen nondemented, nondepressed patients with idiopathic Parkinson's disease (PD) and 19 demographically-matched controls rated valence and arousal experienced in response to emotionally laden slides (International Affective Picture System slides of Lang and colleagues). During slide viewing, bilateral zygomatic and corrugator EMG activity was recorded. Results show the PD patients to experience similar emotional valence and arousal to that of normal controls. However, PD patients display significantly less facial muscular activity in the zygomatic region, in response to positive valence slides, and a trend toward less activity in the corrugator region, in response to negative slides. PD patients showed no significant difference between levodopa drug "on" and "off" conditions. Results are discussed in relation to peripheral feedback versus central mediation theories of emotional experience.

K.G. NICHOLSON & D. KIMURA. Sex Differences in Articulation.
Both speech development and the prevalence and nature of CNS speech disturbances varies with sex. Thus, sex differences might exist in the speech performance of normal adults. Young, right-handed men (n = 20) and women (n = 18) were compared on both a uni- (/ba/ and /ga/) and multisyllabic (/ba/ /da/ /ga/) speeded repetition tasks. There was a significant interaction between sex and syllabic type [$F(1,36) = 9.51$, $p = .004$]. Men were faster than women at unisyllabic repetition (no. syllables/20 s), which may result from greater force produced by stronger muscle contractions. In contrast, women were faster at multisyllabic repetition, which may reflect more efficient coordination of speech motor sequences. Preliminary data on manual tasks show similar effects.

M.F. SCHWARTZ, E.J. FITZPATRICK DESALME, & T.G. GIOVANNETTI. The Multiple Objects Test for Ideational Apraxia: Etiology and Task Effects on Error Profiles.
The Multiple Objects Test (MOT) requires the subject to perform conventional actions involving combined use of more than one object (e.g., wrap a present). Eleven TBI and four CVA patients, selected for errors in everyday action, performed the MOT in a manner consistent with previous description of ideational apraxia, that is, they failed to use objects appropriately and to realize the logical organization of the task. Error profiles were similar for the TBI and CVA groups but varied considerably from task to task. These results cast doubt on the localizing significance of IA; moreover, they caution against inferring underlying causes from the profile of errors on the MOT, without an accompanying analysis of task demands.

A.M. RAYMER, J.C. ADAIR, L.J.G. ROTHI, & K.M. HEILMAN. Another Case of Conduction Apraxia and Its Theoretical Implications.
We describe a patient whose gesture impairment can be termed conduction apraxia in that, although gesture was abnormal across tasks, gesture imitation was particularly impaired. Unlike the prior case of conduction apraxia that was attributed to a dissociation between the input and output action lexicons, we attribute our patient's deficit to the impairment of the innervatory pattern system involved in translating space-time representations of skilled movement into motor programs. We propose that interactions between the action output lexicon and the innervatory pattern system may provide an advantage in tasks in which stored knowledge can constrain gesture responses (gesture to command and to viewed objects). The lesion locus in this case implicates temporal-parietal structures in the neurological representation of the innervatory pattern system.

C. OCHIPA, L.M. MAHER, & L.J.G. ROTHI. Treatment of Ideomotor Limb Apraxia.
We report the results of a gesture treatment program in a patient with chronic ideomotor limb apraxia. A single subject multiple baseline design across behaviors was used. Separate treatments were designed to address the patient's three dominant error types in praxis performance. Results suggested considerable improvement in gesture production. Treatment effects were specific in that a given error type did not decrease to criterion until it was targeted in treatment, and generalization to non-treated items did not occur. Post-treatment scores revealed that gains in gesture performance for treated items were maintained after treatment was discontinued.

J. THOMSON. Rehabilitation of High School-Aged Individuals With Traumatic Brain Injury Through Utilization of an Attention Training Program.
Attention problems, along with poor memory, are reported to be among the most common post-traumatic brain injury (TBI) symptoms. The purpose of this research was to evaluate the effectiveness of an attention training program in high school-aged individuals who have sustained TBI. Utilization of a multiple baseline across subjects design revealed that notable gains in many attention and academic tasks were demonstrated with the initiation of attention training. However, generalization of this training to other settings was not remarkable. In addition, training tasks (validated with an adult population) were not sufficiently engaging and reinforcing for utilization in this younger population. Further work will include incorporation of a direct generalization training component and modification of materials for children.

M. McCUE. Ecologically Valid Assessment of Problem Solving Ability: The American Multiple Errands Test.
Data is presented on the American Multiple Errands Test (AMET), an executive problem solving simulation conducted in a naturalistic setting (urban shopping area). Results indicated that performance on the simulation discriminates individuals without neurological, learning or psychiatric disorders (n = 14) from individuals with neurological (n = 12) and learning disabilities (n = 21). With the exception of the Paced Auditory Serial Addition test, results are not significantly related to performance on standard psychological tests of problem solving. Significant correlations do exist between AMET performance and reports of everyday cognitive problems on the Patient Competency Rating Scale. Preliminary reliability data and implications for rehabilitation are presented.

S.M. AUGUST, L.M. GRATTAN, P.J. ESLINGER, D. RIGAMONTI, & E.F. ALDRICH. Coping Strategies and Positive Outcome in Frontal Lobe Lesion Patients.
Although coping efforts account for outcome differences in normal populations, the relative effectiveness of different coping strategies used by patients on cerebrally impaired patients is minimally known. This study investigates the types of coping strategies used by patients with focal frontal and nonfrontal lesions and their relationship to outcome. The COPE, a standardized multidimensional coping measure was administered. Results indicate that as a group, both frontal lesion patients, as well as those who were identified as positive outcomes, used diverse cop-

ing strategies, predominately problem focused. Those patients identified as having negative outcome tended to use more emotion-focused strategies which were also related to increased distress.

S. RASKIN & M. SOHLBERG. Training of Prospective Memory Performance.
Two single-subject experiments are presented in which the span of prospective memory was increased after systematic training. Both subjects sustained traumatic brain injury with subsequent severe impairment in prospective memory performance. In both cases, improvement was observed with prospective memory training, as compared to baseline testing, and no improvement was observed in a control condition. After training, both individuals demonstrated improved performance on neuropsychological measures and on a measure of prospective memory functioning in their daily life.

G. GOLDSTEIN, S. BEERS, & S. LONGMORE. Teaching Severely Amnesic Patients to Use a Memory Assistive Device.
Based on studies identifying an intact procedural memory system in densely amnesic patients with Korsakoff's syndrome, this study proposed to teach four patients with organic amnesic disorder to use a portable prosthetic memory device that stored information crucial to activities of daily living. The training goal was to teach Ss to pick up, turn on, and read the LED display screen on a small box when asked a question. Learning and generalization phases of training were completed, along with one week and one month follow-up assessment. Results were evaluated using a single case design. All Ss successfully completed the training, maintaining 90% of their gains at follow up. Results indicated that densely amnesic patients learned to use the prosthetic device to access functionally relevant information in a short period of time. This learning generalized across examiner and location and remained stable for up to 1 mo after training. Implications for directing rehabilitation interventions and improving the quality of life for amnesic patients are discussed.

Symposium 4

HORMONAL INFLUENCES ON SEX-TYPED COGNITIVE ABILITIES

S.A. BERENBAUM. Hormonal Influences on Sex-Typed Cognitive Abilities.
There is now considerable evidence that gonadal hormones affect cognitive abilities that show sex differences, including spatial ability, fluent production, motor skills, and memory. The participants in this symposium will review the evidence for organizational and activational effects on several aspects of cognition, and present data from their own studies. Thus, data will be presented to show that exposure to androgen in the prenatal and neonatal periods affects the development of visual discrimination in primates and spatial ability in people, and that high levels of circulating estrogen facilitate motor skills and memory in women. Participants will also discuss the possible neural mechanisms underlying these hormonal effects on cognition.

C. HAGGER. Reversal of Sex Differences in Learning Abilities Following Neonatal Androgen Manipulations.
In infant monkeys, the ability to perform on a concurrent visual discrimination task with 24-h intertrial intervals develops earlier in females than in males. This sex difference is related to the presence of perinatal androgens: male monkeys with neonatal orchiectomy (reduced testosterone levels) performed similarly to normal females; neonatally ovariectomized female monkeys treated with dihydrotestosterone (DHT), but not testosterone propionate (TP), showed slower learning than normal females (similar to normal males). Androgen effects on learning were independent of effects on external genitalia, because TP virilized female genitalia more than DHT. Thus, the presence of androgens during the critical period of brain differentiation affects the development of both primary sexual characteristics and learning abilities.

S.A. BERENBAUM. Early Androgen Effects on Cognitive Abilities in Children and Adults.
Recent studies addressing the causes of sex differences in human cognitive abilities indicate that high levels of androgen during early development result in enhanced spatial ability. This evidence, which will be reviewed in this presentation, comes from several sources, including individuals with unusual early exposure to hormones because of genetic disease [e.g., congenital adrenal hyperplasia (CAH)] and normal individuals with varying levels of measured or inferred hormones (e.g., girls with variations in measured amniotic testosterone, female twins). For example, CAH females have substantially higher spatial ability than their unaffected female relatives. Androgen effects on spatial ability appear to be independent of androgen effects on early activities. These results will be discussed with respect to the nature, timing and mechanism of androgen action on the brain.

E. HAMPSON. Effects of Natural and Synthetic Estrogens on Fine Motor and Articulatory Skills in Women.
Tests of manual speed and coordination and tests of speed and accuracy on articulation are often used in neuropsychological assessment. In women, differences in estrogen status may be one factor that contributes to the normal variance in scores on these tests. Evidence for an association between circulating estrogen levels in adult women, and performance on finger-tapping, Purdue Pegboard, and Manual Sequence Box scores will be described, using data from several recent studies by ourselves and others. Data from selected tests of articulatory speed will also be presented. In general, results suggest that higher levels of estrogen may be associated with a facilitative effect on certain motor skills. Some limits to this generalization will also be discussed.

S.M. RESNICK. Effects of Estrogen Replacement Therapy on Cognitive Aging.
Several investigations have shown that estrogens influence cognitive functioning and that hormone replacement therapy has beneficial effects in surgically post-menopausal women. Data on hormonal status and memory function were collected as part of the Baltimore Longitudinal Study of Aging (BLSA), allowing further examination of the effects of estrogen replacement therapy (ERT) on cognitive aging in post-menopausal women. Forty-two women who reported that they were receiving hormone therapy during a cognitive assessment were compared with 161 women who never received ERT. Preliminary analysis indicated that ERT was associated with better performance on the Benton Visual Retention Test, a measure of short-term visual memory. The potential protective effect of estrogen on memory has important implications for cognitive aging in elderly women and suggests an additional benefit of ERT.

Presidential Address

THE CHALLENGE OF NEUROPSYCHOLOGY: A SLICE OF LIFE AND HOW TO MEASURE IT

Donald T. Stuss

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FRIDAY MORNING, FEBRUARY 10, 1995

Symposium 5

AAMI, AGE-RELATED COGNITIVE DECLINE, AND MILD COGNITIVE IMPAIRMENT: DEFINING AND CHARACTERIZING COGNITIVE CHANGES WITH AGE

S. REDIESS. AAMI, Age-Related Cognitive Decline, and Mild Cognitive Impairment: Defining and Characterizing Cognitive Changes With Age.
The NIMH Work Group's proposed research diagnostic criteria for AAMI (Crook et al., 1986) generated both empirical study and strong opinion. DSM-IV includes new designations relevant to aging and cognition; however, the authors rejected the proposal to include Age Associated Memory Impairment as a diagnostic category. Papers in this symposium will address the controversy regarding the AAMI criteria and the reasoning behind changes in DSM-IV relevant to aging and cognition. Empirical evidence relevant to the AAMI construct and Mild Cognitive Impairment will be presented. The symposium will also discuss neurobiological correlates of memory impairment in healthy elderly and issues pertaining to pharmacological intervention.

S. REDIESS & E.D. CAINE. Aging, Cognition and DSM-IV.
The NIMH Work Group's research diagnostic criteria for AAMI (Crook et al., 1986) established objective criteria for identifying older adults with normal age-related memory changes. These criteria stimulated study into the stability of cognitive inefficiencies in healthy elderly and into the efficacy of intervention approaches. However, AAMI was not incorporated into DSM-IV due to concerns over applying a medical diagnosis in the absence of disease and the limitations of specific criteria. DSM-IV includes two new designations that, along with dementia, present aging related cognitive changes on a continuum. This paper will discuss some of the criticisms of AAMI, review Age-Related Cognitive Decline and Mild Neurocognitive Disorder, and present the rationale behind these changes in DSM-IV.

G.J. LARRABEE. Age-Associated Memory Impairment: Definition and Psychometric Characteristics.
Until recently, there have been no specific criteria for describing older persons who have experienced memory loss but who are clearly not demented. Previously descriptive terms such as "benign senescent forgetfulness" have been applied to these persons, however there were no clearly-defined performance characteristics for identifying BSF or other nonpathologic age-associated memory decline. The original NIMH Workgroup criteria for AAMI are reviewed (Crook et al., 1986). Quantification of memory complaint and performance is discussed, as well as cluster analyses providing empirical support for AAMI, and statistical data on the discrimination of AAMI from Alzheimer-type dementia. Lastly, data are presented on the prevalence and longitudinal stability of AAMI.

A. LA RUE, G. SMALL, S. McPHERSON, & S. KUOMO. Subjective Memory Loss in AAMI: Family History, Neuropsychological, and Positron Emission Tomography (PET) Correlate Correlates.
Self-reports of memory problems were examined in 67 healthy relatives of patients with Alzheimer-type dementia (AD) and 44 matched controls without a family history of dementia, all of whom met modified criteria for AAMI. The most robust predictor of everyday forgetting was self-reported depressive symptoms ($b = 5.20$, $SE = 0.79$, $p < .0001$) despite low levels of such symptoms. Performance on objective memory tests was not predictive of subjective memory ratings. Among AD relatives, age at onset of illness in the affected family member was related to subjective seriousness of forgetting ($b = 14.67$, $SE = 5.32$, $p < .008$). In subsample of 29 AD relatives and 14 controls, more frequent mnemonics usage was associated with lower left frontal ($r = 0.50$, $p < .001$) and right frontal ($r = 0.52$, $p < .0005$) metabolic ratios on PET (FDG). This may reflect greater efficiency of memory processing due to mnemonics usage, or it may suggest that mnemonics are being used to compensate for subtle frontal dysfunction.

G. SMITH, R. PETERSEN, & R. IVNIK. Definition, Course and Predictors of Outcome of Mild Cognitive Impairment.
The Mayo Clinic Alzheimer's Disease Center has attempted to study the boundaries between normal aging and early dementia. We have previously reported concerns regarding AAMI diagnostic unreliability and the broad application of the label of "memory impairment." Recently, we have explored the bias inherent in using subjective memory complaints to identify objective memory problems. We are now studying approximately 80 mild cognitive impairment (MCI) patients who have impairments in memory function but do not meet dementia criteria. At follow-up, the percentage of this cohort progressing to meeting dementia criteria has increased from 0% at initial evaluation to roughly 25% at 1.5 yr and nearly 50% at 3 yr. A major focus of this presentation will be on the clinical definition, longitudinal course, predictors of outcome and neuropathological features of this "boundary" group.

Paper Session 8

APHASIA

D.S. O'LEARY, N.C. ANDREASEN, & R.R. HURTIG. The Role of Broca's Area in Language Processing: Evidence From Positron Emission Tomography (PET) Studies.
We review the findings from specific conditions of three PET studies performed by our group that assessed regional cerebral blood flow (rCBF) in normal controls during language tasks. In different conditions subjects listened to speech sounds and words, read words, recalled verbal lists, stories, and personal episodes, and generated words that begin with a specified letter (verbal fluency). Bilateral increases in rCBF were observed in Heschl's gyrus and the planum temporale in all conditions, and regions of the cerebellum and motor strip had increased rCBF during all tasks requiring verbal output. Broca's area was activated only during the verbal fluency task. These results, along with PET findings from other centers, suggest the need to reevaluate views of Broca's area that are based upon lesion analysis.

A.L. FOUNDAS, S. DANIELS, & J. VASTERLING. Anomia: Case Studies With Lesion Localization.
In a case of anomic aphasia after a unilateral left hemispheric stroke with a discrete lesion in Area 37, Foundas et al. (1991) and Raymer et al. (1991) proposed that Brodmann's Area 37 may be crucial for allowing the semantic system access to stored lexical information. Based on a modular system for word retrieval, we proposed that lesions downstream from Area 37 may produce similar deficits suggesting a semantic egress disorder. We replicated and expanded on Raymer's findings by demonstrating that Case 1, who had a lesion in Area 37, and Case 2, with a

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lesion in inferior-lateral portions of Area 6, were anomic due to deficits in lexical retrieval with semantics relatively spared.

K. BAYNES, D. BRENTARI, & J.A. KEGL. Chronic Language Impairment Following Landau-Kleffner Syndrome: A Case Study.
Landau-Kleffner's syndrome is a language-specific disorder of childhood that occurs secondary to epileptic activity. Close to 200 childhood cases have been reported, but limited adult follow-up is available. Manual communication has been used as an intervention in severe cases, with varying degrees of success. We report a 26-yr-old right-handed female who, at age 4, was diagnosed with Landau-Kleffner's syndrome. She was taught to use PSE and exposed to ASL and sign remains her preferred form of communication, despite limited morpho-syntactic development. Both comprehension and production of spoken English is profoundly limited. By investigating both her signed and spoken language deficits, we gain insight into the nature of the disorder that may accompany bilateral temporal lobe dysfunction.

L. GONNERMAN, J.T. DEVLIN, M.S. SEIDENBERG, & E.S. ANDERSEN. "Morphological" Priming Without a Morphological Level of Representation.
Aphasic patients demonstrating morphological paraphasias have been taken as implicating a morphological level of representation within the mental lexicon. Marslen-Wilson et al. (1994) present a theory of the organization of morphology based on a series of priming experiments with normal subjects. They find that the morphological relationship between prime and target words plays a crucial role in eliciting priming. We demonstrate that a connectionist model can exhibit the critical findings of Marslen-Wilson et al. without an explicit morphological level of representation. The effects arise from an interaction of semantic and phonological similarity. These results call into question the interpretation of morphological deficits, suggesting that these behaviors may arise solely from damage to the phonological or semantic systems rather than a distinct morphological level.

N.F. DRONKERS, Y. YAMASAKI, G.W. ROSS, & L. WHITE. Patterns of Language Impairment in 12 Cases of Japanese-American Multilingual Aphasic Patients Residing in Hawaii.
Twelve multilingual aphasic patients of Japanese-American descent were evaluated in both Japanese and English on a series of language tasks to determine if their brain injury had differentially affected their languages. Nearly all were Hawaiian-born of Japanese immigrants and were schooled in both languages. All had been followed medically for the past 28 yr as participants of the Honolulu Heart Program which also collected information on their language and cultural background. Ten patients showed no difference in the degree to which the aphasia affected their languages. Two others showed more severe deficits in one language over the other. Details of the cases and reasons for this discrepancy in language performance will be presented as well as issues of language assessment in the multicultural environment of Hawaii.

Symposium 6

RETROGRADE AMNESIA

M. VERFAELLIE. Retrograde Amnesia.
Recent neuropsychological studies of amnesia have suggested that retrograde memory loss is not a unitary phenomenon. Rather, the etiology of amnesia, specific lesion site and techniques used to assess remote information, all influence the pattern of deficits observed. By examining patterns of retrograde amnesia across a variety of remote memory tasks and patient groups, this symposium examines the cognitive and neural mechanisms underlying different forms of retrograde amnesia. Potential mechanisms for long-term shortage of mnemonic information are discussed in light of recent evidence from work in humans as well as animals.

M. O'CONNOR, M. WALBRIDGE, M. D'ESPOSITO, R. McGLINCHEY-BERROTH, & M. ALEXANDER. An Investigation of the Remote Memory Abilities of Patients With Rupture and Surgical Repair of ACoA Aneurysms.
The current study focused on whether ACoA patients demonstrated retrograde amnesia (RA) on four different measures of RA. Seventeen ACoA patients were compared to 10 amnesic control (AC) patients and 15 normal control (NC) patients. Remote memory was probed with tests of factual knowledge and autobiographical questionnaires. One-way ANOVA's revealed that ACoA patients were impaired on all RA tasks relative to NC's. Whereas ACoA patients performed better than AC patients on public events tests, patient groups were equally impaired on measures of personal memory. These data suggest that distinct classes of information exist in remote memory and that these are differentially disrupted by neurological events.

M. VERFAELLIE & L. REISS. Memory for Premorbidly Acquired Vocabulary in Amnesia.
To assess if amnesics have intact remote memory for semantic information, we examined memory for vocabulary words with known dates of entry into the language between 1955 and 1989, using both a recall and recognition test. Patients with acute onset amnesia performed normally on both tasks. Korsakoff patients, in contrast, were impaired at all time intervals and performed significantly worse for "remote" words than for "recent" words. The improvement associated with recognition compared to recall was larger for Korsakoff patients than controls and correlated significantly with performance on frontal tests. Implications of the differential performance of these two patient groups for theories of retrograde amnesia are discussed.

M. KOPELMAN. Focal Brain Lesions and Retrograde Amnesia.
Previous studies have indicated a role for pathology in both the temporal and frontal cortex in the genesis of extensive retrograde amnesia. Limbic-diencephalic pathology alone appears to produce only a brief or minimal retrograde loss. Previous studies have indicated poor correlations between retrograde and anterograde amnesia, an association between frontal dysfunction and remote memory loss, and disproportionate retrograde amnesia following anterior temporal pathology. A dissociation between the effects of left and right hemisphere damage may occur. In the present study, patients with frontal lobe lesions and patients with left- and/or right-temporal lesions were studied using MRI and PET neuroimaging, and various tests of retrograde amnesia were administered. Characteristics of remote memory impairment are compared after controlling for the severity of anterograde amnesia.

S. ZOLA-MORGAN. The Medial Temporal Lobe Memory System: Evidence for a Time-Limited Role in Memory Storage.
Clinical and experimental studies have shown that the hippocampal formation and related structures in the medial temporal lobe are important for the formation of long-term declarative memory. Several lines of evidence, including the finding that remote memory is often fully intact in amnesic patients and the finding of temporally graded retrograde amnesia in prospective studies of monkeys and rats with lesions involving the hippocampal region, suggest that memory depends on the medial temporal lobe system for only a limited period of time after learning. Thus, the medial temporal lobe is not the repository for permanent memory. During a lengthy period after learning, a slow-developing, more permanent memory is established elsewhere, presumably in neocortex.

Paper Session 9

PARKINSON'S DISEASE

B. LEVIN, B. KLEIN, M. LLABRE, J. BEAN, L. FLEMING, J. CORDLE, & G. REY. Ascertainment Bias in Longitudinal Studies of Parkinsonian Dementia.
Estimates of dementia in Parkinson's disease (PD) range from 10% to 80%. This variability may reflect an ascertainment bias in studies utilizing clinic based samples. We studied 248 PD subjects drawn from a neurology clinic with a comprehensive battery of cognitive tests. Subjects who returned for annual follow-up testing were compared with subjects who declined to return. On the initial visit, non-returnees were older and exhibited more cognitive deficits compared to returnees. No differences were noted on age of disease onset, disease duration, depression or PD motor signs. These findings suggest that cognitive impairment, rather than motor disability or depression, results in an ascertainment bias which distorts estimates of the prevalence of PD dementia and calls into question the generalizability of clinic based data.

B.L. ROPER, B. GIORDANI, S. BERENT, C.C. PERSAD, L.A. BIELIAUSKAS, K. HOLLERAN, N.L. FOSTER, & S. GILMAN. Relationship of Cognitive Impairment and Depression to Motor Disabilities in Parkinson's Disease.
Aspects of neuropsychological performance may be differentially associated with motor and mobility-related impairments in Parkinson's disease (PD). In this study, 74 medicated PD patients were seen for a structured motor examination and a brief neuropsychological screening battery. Ratings of posture/gait and bradykinesia were associated with decreased memory and language scores and increased symptoms of depression. Rigidity was directly related to depressive symptoms, though tremor ratings were not associated with any of the neuropsychological measures. Overall, postural and gait disturbance was more strongly and consistently related to cognition and affect than were other motor symptoms. Study of the distinct interrelationships between neuropsychological performance and mobility deficits in PD will assist in understanding the interaction of the dopaminergic and non-dopaminergic neurochemical deficiencies underlying this disorder.

A.I. TRÖSTER, A.M. PAOLO, S.L. GLATT, K.E. LYONS, & W.C. KOLLER. Depression and Cognitive Impairment in Parkinson's Disease.
Conflicting findings about the effect of depression on cognition in Parkinson's disease (PD) are difficult to reconcile given prior studies' small sample sizes and the confounding of depression with disease variables. We compared the DRS performance of 45 nondepressed (PD) and 45 depressed PD (PD-D) patients matched for age, education, gender, disease severity, disease duration, and age at onset, to that of 45 age-, education-, and gender-matched controls. In addition, we compared the DRS performance of a subset of 22 PD-D and 22 Alzheimer's disease (AD) patients matched for age, education, gender, and overall severity of cognitive impairment. Overall, results suggest that depression affects predominantly quantity rather than quality of cognitive impairment in PD, and that the PD-D "subcortical" pattern of cognitive impairment stands in contrast to the AD "cortical" cognitive impairment pattern.

S. O'BRIEN, D.L. HARRINGTON, K.Y. HAALAND, & N. HERMANOWICZ. Perceptual-Motor Learning Deficits in Parkinson's Disease.
Controversy exists about what aspects of procedural learning are impaired in individuals with basal ganglia dysfunction. This study examined the reasons for discrepant findings concerning perceptual-motor learning in Parkinson's disease (PD). It was hypothesized that learning deficits in PD would be most evident when performance was more dependent upon preprogramming [i.e., a fast rotation speed (RPM)] and when the learning context increased the potential for subjects to engage in multiple processing strategies (i.e., a random presentation of RPMs). PD and normal control (NC) subjects performed a rotary pursuit task at three RPMs (15, 45, 60). Half of the subjects received the RPM conditions in a blocked order and half received them in a random order. The NC group learned more rapidly than the PD group in the random, but not the blocked condition. The results suggest PD patients can develop an effective motor program, regardless of the speed of the movement, when there is no contextual interference from other RPM conditions. Their learning is impaired, however, when the context increases the potential for eliciting multiple processing strategies. This may be due to problems with flexibly switching among motor programs or deficits in strategic processing.

J. GREEN, J.L. WOODARD, B.E. SIROCKMAN, G.O. ZAKERS, C. MAIER, R.C. GREEN, & R.L. WATTS. Event-Related Potential Amplitude Change in Mildly-Affected Parkinson's Disease Patients Without Neuropsychological Deficit.
The study examined whether the P3 component of the event-related potential (ERP) is abnormal in mildly-affected, unmedicated patients with Parkinson's disease (PD). Patients included 20 mildly-affected PD patients, and age and education-matched controls. The auditory oddball ERP was elicited, and neuropsychological measures were obtained. Patients had larger P3 amplitude than controls, and increases in amplitude correlated significantly with improved performance on neuropsychological measures that were more attention-demanding. P3 latency was not prolonged among patients, and older age did not differentially affect patient measures. Increased P3 amplitude among unmedicated, mildly-affected PD patients is hypothesized to reflect brain dysfunction necessitating allocation of greater attentional resources in order to achieve effective task performance.

Poster Session 4

CHILD, VISUAL PROCESSING, NEGLECT, & AWARENESS

P.A. PRATHER, N. SARMENTO, & A. ALEXANDER. Development of Vigilance in Preschoolers.
While there has been extensive examination of attention disorders in school age children, research with preschoolers has been sparse. The present study focused on examining the development of sustained attention in a normative sample of children ages 3-6 yr towards establishing a baseline for identifying when a child is showing age-referenced difficulty with that aspect of attention. Based on performance on auditory and visual measures of vigilance, children under age 5 show notable difficulty sustaining attention for more than brief periods of time to other-directed tasks. In that sense, it is quite "normal" for preschoolers to have difficulty sustaining attention. At least until age 5, vigilance is not likely to be a discriminating factor in identifying attention delays in preschoolers. Rather, focus on impulse control, which seems to develop earlier, may be a more relevant variable in studying preschool attention delays.

M. CIRILLO, A. SILVERMAN, & D. TUCKER. The Relationship Between a Continuous Performance Task, Neuropsychological Tests, and Inattention Versus Hyperactive/Impulsive Symptoms in Children Referred for Learning and Behavioral Problems.
This study examines how omissions and commissions on a continuous performance task (CPT) are related to parent ratings of inattention and

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hyperactivity/impulsivity when intelligence, academic achievement, and memory are accounted for. The Gordon Diagnostic System (GDS), WISC, WRAT, and Story Recall from the Denman Memory Scale were administered to 61 children referred for attentional problems. Results indicate that omissions and commissions on the Vigilance subtest of the GDS do predict parent ratings. The clinical implications of these findings as well as the relevance to the forthcoming DSM-IV diagnostic criteria are discussed.

J.S. CAROSELLI, M. HISCOCK, & L.E. KIMBALL. Modality-Specific Interference on the Paced Auditory Serial Addition Task.
A recent study suggests that auditory interference contributes to the difficulty of the Paced Auditory Serial Addition Task (PASAT). Alternatively, the finding may reflect an inherent advantage of digit codes over word codes. We describe an experiment in which a PASAT with written responses is compared to the standard (oral-response) PASAT. With presentation rates equated, normal adults performed better when writing their responses than when making oral responses. This outcome reinforces the inference of modality-specific interference. However, the advantage associated with written responses was reversed readily by accelerating stimulus presentation. Thus, despite the evidence for modality-specific interference, general processing capacity seems to be the principal performance-limiting factor.

K.M. CHRISTENSEN & M. JOSCHKO. Construct Validity of a Test of Attention for Children.
Tests that purport to measure attention generally also assess other cognitive abilities. The Seidel Continuous Attention Test (SCAT) is a new, computerized continuous performance test, designed to measure sustained attention in children. This study evaluated the SCAT's construct validity, in terms of convergent and discriminant validity. Discriminant validity was more strongly supported than convergent validity. Overall, the SCAT was uncorrelated with theoretically unrelated abilities, such as intelligence and short-term memory (discriminant validity); the SCAT did not correlate with other attention-related tests (convergent validity). Results may indicate that, as face validity suggests, the SCAT provides a more pure measure of sustained attention than do some traditional tests.

A. MORGAN, G.W. HYND, & C.A. RICCIO. Neuropsychological Differentiation of DSM-IV Attention Deficit Hyperactivity Disorder Combined and Predominantly Inattentive Types.
Research has revealed that DSM-II ADD/H and ADD/WO subtypes differ on neuropsychological variables. These diagnoses correspond respectively with DSM-IV ADHD Combined and Predominantly Inattentive Type diagnoses. This study compared children diagnosed as the Combined ($n = 29$) or Predominantly Inattentive ($n = 29$) Type on measures of cognitive ability, receptive and expressive language, visual/spatial constructional ability, visual perceptual ability, and executive functioning. The groups were found to differ only on receptive language abilities with the Predominantly Inattentive Type children having a higher mean PPVT-R score. Implications of the limited neuropsychological differentiation between the DSM-IV subtypes will be discussed.

M. BUNNER & D. TUCKER. Central Auditory Processing Deficits in a Sample of Children With Attention Deficits.
The relative incidence of auditory processing deficits in an unselected group of children referred for attentional and/or learning problems was examined. Auditory processing deficits were seen in 55.6% of the children. When children with low IQs or learning disabilities were excluded, 46.1% of children displayed impaired auditory processing. Preliminary analyses were conducted on groups of children with attentional difficulties and with and without comorbid auditory processing deficits. The groups did not differ in IQ or age. They differed significantly on a measure of cognitive impulsivity and spelling of nonwords. The results of the present study indicate that a significant proportion of children with attention deficits also have comorbid deficits in auditory processing. Directions for future research were discussed.

C.A. LEAVELL, J.D. ACKERSON, & R.F. FISCHER. Procedural Learning Difficulties in Children With Attention and/or Overactivity: Is It Motor Skill or Motor Acquisition?
Children with attentional problems with and without hyperactivity who were previously (Leavell et al., 1993) found to have deficits in procedural learning were compared with controls on a motor skill learning test [Rotary Pursuit (RPT)] and a variety of neuropsychological tasks tapping visual, motor and visual-motor attention, speed and integration. Results indicated an association between the initial acquisition of motor skills (first RPT trial) and neuropsychological tasks (Cancellations, Block Design and ROCF), suggesting that success on this trial may be related to visual/motor attention and integration. However, none of the other procedural learning variables were related to the neuropsychological tasks, nor did they differentiate between groups. Therefore, problems in procedural learning cannot alone be accounted for by the motor problems often described in these children.

F.L. COOLIDGE & B.J. REILMAN. Executive Function in ADHD, Reading Disabled, and Comorbid Children: Testing the Double Dissociation Hypothesis.
The double dissociation hypothesis was tested that ADHD children without reading disabilities would show executive dysfunction (EDF) while those who had reading disabilities with or without ADHD would not. Four groups of children ($N = 32$, ADHD alone; $N = 30$, comorbid; $N = 7$, reading problems alone; $N = 45$, controls) were identified. Executive functions (EF) were assessed through an 11-item scale (reliability = .86; two-factor structure, planning and decision-making). ANOVA revealed that the ADHD and comorbid groups scored significantly worse than the reading problems and the control groups. Findings argue against the double dissociation hypothesis and against the argument that EDF in comorbid children will be secondary to reading problems.

N. NABORS. Attention Deficits in Children With Sickle Cell Disease.
Twelve children with sickle cell disease (Hb SS) with a prior history of stroke, 14 children with sickle cell disease (Hb SS) without evidence of stroke, and 13 similar-aged siblings were compared on measures of attention, intellectual, achievement and adaptive functioning. The Hb SS children with evidence of stroke exhibited a trend towards impairment on measures of response time, mental processing speed and achievement compared to Hb SS children without evidence of stroke. The Hb SS children without evidence of stroke displayed a trend towards impairment on measures of response time and mental processing speed compared to healthy siblings. The Hb SS children with evidence of stroke were impaired compared to healthy siblings on measures of attention, intellectual and achievement functioning. Implications for these results and for future research were discussed.

G.V.A. MYLVAGANAM, K. TINGUS, E.L. TENG, & D. POWARS. Long Term Neuropsychological Effects of Sickle Cell Disease.
A study was conducted to determine the long-term effects of Sickle Cell disease (SCD) on the neuropsychological functioning of children and adolescents. The longitudinal study has currently accessed 41 patients from hospitals in Los Angeles County. Measures of cognitive functioning, mood, and fine motor and psychomotor speed were included in a comprehensive battery. Additionally primary caregivers were interviewed regarding the adaptive behavior of the patients. Preliminary findings showed a strong negative effect of age in several areas of functioning, including adaptive behavior. Mood significantly affected memory and psychomotor speed. The results are discussed in relation to the long term effects of SCD on neurological and social functioning. The findings provide a basis for different neuropsychological and clinical treatment plans tailored to fit patients diagnosed with SCD.

J. ROVET & M. ALVAREZ. Thyroid Hormone and Attention.
The discovery of a link between the gene for the syndrome of generalized resistance to thyroid hormone (GRTH) and ADHD has generated considerable interest in identifying the metabolic and genetic determinants of attentional dysfunction. Children with congenital hypothyroidism (CH) diagnosed by newborn screening provide a unique model to study the relations between thyroid hormone (TH) and attention. Eighty-four 7-yr-old children with CH had TH determinations and psychologic testing on the same day. Results revealed considerable variability in TH with 9.5% having a profile suggestive of GRTH. Four groups were compared: HH had high T4 and high TSH ($n = 8$); HN had high T4 and normal TSH ($n = 12$); HL had high T4 and low TSH ($n = 9$); and NV had normal T4 and varying TSH ($n = 55$). No group differences were observed in initial CH severity, age at start of therapy, parent IQ, SES, global IQ, achievement. However, HH scored lower in FFD ($p < .05$) but had fewer reported behavioral problems ($p < .05$). Subgrouping at 5 and 9 yr revealed the proportions of children and relations with FFD remained constant but children in the groups differed, supporting a hormonal model. The dissociation in the relations between TH and cognitive versus behavioral measures indices will be discussed in terms of ADHD.

S. MURPHY, S. HUNTER, F. ZELKO, & M. STEIN. Convergent and Divergent Validity of the WISC-III Symbol Search Subtest.
The Symbol Search subtest of the WISC-III reportedly measures different cognitive abilities than those assessed by the other twelve subtests. While it was designed to better distinguish abilities proposed to comprise the "Third Factor," it correlates highly with the Processing Speed Factor. While the abilities assessed by this new subtest have yet to be fully specified, the nature of the task suggests that processing speed may be only one of several skills necessary for effective performance. We used a multitrait/multimethod matrix to identify the common and unique factors underlying the Symbol Search subtest, given administration of a neuropsychological test battery to a mixed clinical sample of children referred for attentional and learning difficulties. Results supported our hypothesis that Symbol Search is strongly correlated with tasks indexing visual discrimination, graphomotor speed, sustained attention, concentration, and executive processes, although intellectual capacity appeared to mediate this relationship. These results provide evidence that this subtest may involve a cognitive agility component which requires the regulation and direction of a multistep problem-solving capacity not characteristic of other common processing speed tasks.

C. STERN & J. STILES. Visual Construction Performance in Children With Early Lateralized Brain Injury.
This study examined the effects of congenital stroke on children's visual construction abilities. Previous work has demonstrated differential patterns of spatial deficits in children with left- (LHD) and right-hemisphere (RHD) brain damage. These profiles are consistent with those observed in adult brain damaged patients. A block copying task was administered to children matched in age and intelligence with focal LHD or RHD and normal controls. The performance of children with LHD did not deviate from a younger normal group in either spatial strategy or accuracy. Children with RHD demonstrated disorganized spatial strategies and were significantly impaired in their ability to copy block models. Longitudinal data demonstrate that children with LHD and RHD show improvement on this task, suggesting behavioral plasticity of visual spatial functions.

L. SHARE, J.H. KRAMER, & J. LEONARD. A Developmental Analysis of Block Design Configural Errors in Children.
Process analysis of WAIS-R Block Design can be used to identify spared and impaired component cognitive processes. Prior studies suggest that configural errors in adults reflect a spatial processing style which de-emphasizes global aspects of the stimulus. The present study explores this phenomenon in children. Normal children were administered the WISC-III Block Design (with detailed recording of process) and a perceptual bias task in which they selected which of two hierarchically constructed comparison figures (global vs. local) more closely resembled a standard figure. More frequent configural errors on Block Design were predicted by younger age, lower overall Block Design score, and fewer "global" responses on the perceptual bias task. These results further support the idea that Block Design configural errors reflect a subordination of global features of a stimulus to local elements.

S. DAIGNEAULT, C.M.J. BRAUN, & G. WATTERS. Alexia Following a Perinatal Left Temporal Lesion: Evidence of a Module for Acquisition of Reading.
Developmental dyslexics typically have reduced hemispheric asymmetry of the posterior speech area both anatomically and functionally. They also typically have numerous other problems in the areas of visual perception, visual and/or auditory attention and short-term memory, phonological perception (discrimination or segmentation) and production, sequencing. Consequently, the notion of a reading acquisition module in the brain has come under criticism. SC1, a child with a perinatal left-hemisphere lesion localized at the tip of the temporal lobe, presented a pure alexia with average to high-average cognitive skills which are usually low average or deficient in developmental dyslexics. The only deficit was rote supra-span verbal memory. This atypical profile suggests the existence of a "reading acquisition module" at birth and that the layout of this module may differ from the systems identified as defective in developmental dyslexia.

M.J. COHEN, J. HALL, & C.A. RICCIO. Neuropsychological Profiles of Children Diagnosed as Specific Language Impaired With and Without Hyperlexia.
This study compared the neuropsychological profiles of 46 children with Specific Language Impairment (SLI) and 16 children with SLI and Hyperlexia (SLI+). The results indicated that as in previous studies (Cohen et al., 1989) the essential feature of Hyperlexia is Specific Language Impairment and not reading disability. Thus, Hyperlexia would be best conceptualized as a subgroup of Developmental Language Disorder (SLI). Further, it should be noted that both groups of children exhibited decreasing auditory/verbal memory as the language/semantic demands increase. However, the SLI+ group exhibited significantly better developed visual/spatial memory which appears to be the sole contributor to their elevated word recognition/spelling ability.

G. BEDI. Auditory and Visual Temporal Order Processing Deficits in Dyslexic Children.
The perceptual deficit hypothesis of dyslexia states that dyslexia is caused by impairment in perceptual processing. Most investigations of this hypothesis have focussed upon either auditory or visual processing. This study examined both auditory and visual processing in dyslexic children. Twenty-nine dyslexics, 49 chronologically age-matched normal readers and 17 younger normal readers who had the same absolute reading ability as the dyslexics were administered a battery of three auditory and three visual perception tests. The tests assessed discrimination, temporal order and closure in each modality. Dyslexics were not differentiated from either group of normal readers on the basis of their performance on auditory and/or visual processing tests. However, dyslexics were impaired in processing temporal order information, regardless of the modality of presentation.

J. KERSHNER & N. GRAHAM. Evidence for a Deficit and a Delay in Dyslexic Children's Poor Attentional Control Over Language Lateralization.
Children with dyslexia were compared to age and reading-level-matched nondisabled children in verbal dichotic listening using the forced attention methodology. Each ear was monitored selectively in counterbalanced order (LE first or RE first). In the LE first order, the dyslexics demonstrated a reduced REA in comparison to both control groups, suggesting a causal deficit; whereas in the RE first order the dyslexics were

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similar to the reading-matched group in demonstrating a greater REA than the older good readers, implicating a developmental delay. The results suggest that children with dyslexia may suffer from core attentional deficits in altering the REA. This implicates underlying difficulties of flexible verbal processing between hemispheres in response to the rapidly changing cognitive requirements of reading.

E. BLUMENSTEIN, S.D. GREWE, K.O. YEATES, L. QUEEN, & G. VASILOFF. Neuropsychology and Speech Pathology in Pediatric Rehabilitation: Are We Speaking the Same Language?
Examined agreement between neuropsychologists and speech pathologists in their assessment of specific language skills—that is, comprehension, repetition, and verbal formulation. Two sets of tests designed to measure these skills were administered by the respective disciplines to 36 children, ages 6–16 yr, who had sustained relatively severe closed-head injuries (CHI). Correlational analyses suggested that the tests all share some variance, but also demonstrated both convergent and divergent validity for certain specific skills, specifically comprehension and repetition. A profile analysis showed that both disciplines elicited a similar pattern of performance, which was consistent with the literature on pediatric CHI (i.e., expressive < receptive). Two unexpected findings were the lack of correlation between measures of verbal formulation and the consistently higher scores on neuropsychological measures. Overall, the study provides evidence that the tests administered by neuropsychology and speech pathology tap similar abilities and provide similar results.

B. BROOKSHIRE, J. FLETCHER, T. BOHAN, K. DAVIDSON, D. FRANCIS, & S. LANDRY. Verbal and Nonverbal Skill Discrepancies in Children With Hydrocephalus: A Five Year Longitudinal Follow-Up.
Children aged 60–72 mo with a history of shunted hydrocephalus (SH; $n = 33$), arrested hydrocephalus (AH; $n = 13$), and no hydrocephalus (NH; $n = 39$) received four longitudinal assessments of verbal and nonverbal cognitive skills over a 5-year period. Relative to the AH and NH groups, who showed no differences in verbal and nonverbal skills over time, the SH group demonstrated significantly lower performance on nonverbal measures relative to verbal measures at each of the four time points. There was no evidence that the nonverbal performance of the SH group was attributable to motor demands of the nonverbal tasks. Children in the SH group also demonstrated a trend for declines in both verbal and nonverbal scores over time, with nonverbal scores always lower. These results demonstrate that the pattern of poorer nonverbal than verbal cognitive skills in children with hydrocephalus is apparent throughout the 6–12 yr age range.

C.L. GROTE, J. HOEPPNER, & F. MORRELL. Nonverbal Abilities and EEG Patterns in Landau-Kleffner Syndrome.
It has been maintained, but not adequately demonstrated, that children with Landau-Kleffner Syndrome (LKS) exhibit a striking disparity between their impaired verbal skills and relatively preserved nonverbal abilities, and that this disparity can be useful in establishing the diagnosis of LKS. Forty-one children, with a reported history of normal language development until a subsequent and rapid loss of speech, were evaluated to determine whether their nonverbal abilities were age-appropriate, and if their EEG showed perisylvian epileptiform discharge during sleep, a cardinal feature of LKS. Results indicated very good agreement between these two variables (Fisher's exact test = .001), and that children whose language declined before age 3 yr are unlikely to have either intact nonverbal skills or to have an LKS-consistent EEG.

D.R. BLOOM, K. VERMEULEN, A. BOUDOUSQUIE, J.M. FLETCHER, H.S. LEVIN, & T. ENGLAND. Sensitivity of the CVLT-C and SRT to Memory Deficits During Recovery From Traumatic Brain Injury in Youth.
Memory impairment is often reported following TBI in children. The present study compared the verbal learning and memory performance of groups of mild, moderate, and severely injured TBI children at two time points in the recovery process on the Buschke Selective Reminding Test (SRT) and the California Verbal Learning Test-Children's Version (CVLT-C). Results indicated that both tests were sensitive to the effects of TBI on verbal memory functioning in children over the first six months postinjury. Performance on both tests rank ordered groups according to injury severity (Mild > Moderate > Severe) with mildly injured children consistently exceeding the performance of severely injured children at baseline and six month evaluations on both tests. These findings support the usefulness of the SRT and CVLT-C in evaluating recovery in verbal memory skills after TBI in youth.

G.A. STALLINGS, L. EWING-COBBS, D.J. FRANCIS, & J.M. FLETCHER. Achievement Test Scores in Head-Injured Children Before and After Injury.
To evaluate the impact of brain injury on group administered academic achievement tests, scores obtained two years prior to the injury through five years following the injury were examined. Subjects were 23 children and adolescents, ages 6–14 yr at injury, who had sustained mild-moderate ($N = 9$) or severe ($N = 14$) closed head injuries. Scores were reduced after injury in the following areas: reading comprehension, reading composite, and language composite. Injury severity was not related to achievement test scores. Comparison of the Wide Range Achievement Test and group administered achievement tests after injury indicated lower math scores on the WRAT. Results will be discussed in terms of the sensitivity of SAAT scores and the appropriateness of making placement decisions based on these scores. We will evaluate the accuracy of SAAT scores in predicting the placement needs of the present sample.

H.G. TAYLOR, K.O. YEATES, D. DROTAR, S. WADE, & T. STANCIN. Family Outcomes of Childhood Traumatic Brain Injury (TBI).
The present study was designed to explore the relevance of the family environment for recovery from TBI in children. The sample included 54 children with moderate-to-severe TBI and 42 children hospitalized for orthopedic injuries (OI). Results indicated that the TBI group had more behavior problems at a 6-mo follow-up than the OI group; and that the families of children with TBI had more injury-related family burden, parental psychological distress, and family disagreements. Parental distress and the family impact of injury predicted behavior outcomes at follow-up, even after controlling for pre-injury behavior status. Findings suggest an association between childhood sequelae of TBI and the post-injury family environment.

C.T. BARRY & H.G. TAYLOR. Post-Concussional Symptoms in Children: Relationship to Post-Injury Child and Family Status.
Postconcussional symptom ratings were obtained for 41 school-age children who sustained moderate-to-severe traumatic brain injuries (TBI) and in 40 children with orthopedic injuries (OI). Symptoms were evaluated soon after injury and at 6-mo follow-up. Measures of child outcome and postinjury family functioning also were administered. Children with TBI exhibited more postconcussional symptoms than children with OI at both evaluations. Within TBI group, number of postconcussional symptoms predicted child neurobehavioral findings, health outcomes, and family distress. Results support validity of postconcussional symptoms as signs of neurologic injury and as predictors of postinjury child and family functioning. Postconcussional symptoms therefore may be useful in screening children in need of more comprehensive assessments.

J.M. KINNEY, B.D. FANTIE, D.M. PASCUALVACA, D. RODRIGUEZ, & A.F. MIRSKY. The Comprehension of Affect in Children With Pervasive Developmental Disorders: Deficit in Matching Faces to Cartoon Situations.
We compared the performance of children with Pervasive Developmental Disorders (PDD) to that of two control groups; one matched by Verbal Mental age (VMC) and one by Performance Mental age (PMC) on tests designed to assess the perception of faces, facial expression, and

affective situations. Children with PDD had more difficulty selecting the appropriate facial expressions for cartoons depicting emotional situations than both control groups. The PDD group also differed from the PMC group, but not the VMC group, on some tests of matching facial expression, identity, and age group. We suggest that this deficit in matching faces to situations may be specific to interpreting events rather than either a general deficit in performance or in perceiving affect.

S. DAIGNEAULT, C.M.J. BRAUN, & J.L. MONTES. Pseudodepression and Mental Inertia in a Child With a Focal Left Frontal Lesion.
Only four pediatric cases with focal frontal lesions have been documented neuropsychiatrically. All were non-compliant, aggressive, remorseless and impulsive. A similar personality disorder frequently described in adults is termed "pseudopsychopathic" and is associated with orbitofrontal dysfunction. However, in adults, another personality disorder, termed "pseudodepressive," characterized by loss of initiative, excessive dependence, apathy, sluggishness and indifference, is associated with dorsolateral or frontomesial dysfunction, and involves cognitive inertia. No case of pseudodepression and cognitive inertia has yet been reported in a child. At age 3, SC2 had a large deep mesial left frontal cavernous hemangioma removed. At age 7, she is still a quiet, kind, obliging girl, with no behavior problems or dysphoria, but dependent, withdrawn and lacking in determination. Extensive cognitive and behavioral inertia were documented despite numerous normal test results. This case provides existence proof of a protracted frontal pseudodepressive-inert profile in the child, highly distinct from the pseudopsychopathic syndrome.

G. REITER, R.M. BILDER, P. FREYEISEN, L. BELL, & J.A. LIEBERMAN. Premorbid Achievement in First Episode Schizophrenia.
A follow-back study was conducted in the context of a larger study of first episode schizophrenia. The purpose of the study was to gather as much objective information as possible about the subjects' school functioning in order to determine if there were abnormalities in their developmental course. Academic standardized test results for 58 patients and 24 healthy controls were obtained for grades 1–12, when available. Grade level equivalents from standardized tests were used since they offered unbiased estimates of key functional abilities and were well normed. National percentile scores were also used to predict grade equivalent scores in cases where the latter were not available. ANOVA on the means of grade equivalent scores for each year, showed a significant main effect of group [$F(1, 2915) = 262$, $p < .000$], and of grade [$F(11, 2915) = 394$, $p < .000$], but no group by grade interaction. Post-hoc tests showed significant impairments in patients' scores relative to controls as early as the first grade. These results suggest that from the beginning, the patients' scores were significantly lower than the controls', and that levels of achievement increased over time throughout the grades for both groups. These findings are consistent with the hypothesis that patients with schizophrenia show early developmental deficits that can be observed in objective academic achievement test scores, long before the onset of symptoms.

B. GJAERUM & H. SOMMERSCHILD. Neuropsychological and Neuromotor Examination of a Child Psychiatric Sample. Validation of a New Method (NPM-X).
A method for neuropsychological and neuromotor examination (NPM-X) has been developed for developmentally disabled preschool children having a combination of disabilities and failing motivation, preventing them from cooperating with existing test batteries. The test-retest and inter-rater reliability has proved to be good. Psychological and psychiatric record (PPR) data for 35 children referred to two university clinics in child psychiatry were used for concurrent validation of NPM-X. Concurrent criteria were found for 89% of the NPM-X assessment of function normality/abnormality. The agreement level was high (average 80%, median 78%, mean and median Kappa .42). The PPR assessment led to remedial suggestion for 80% of the children, but more often global and partly specific, but rarely highly specific. The NPM-X assessment provided additional clinically relevant information. Details from the results will be presented.

E.B. FENNELL, T.B. FLYNN, S.P. KURY, L. DOTY, & J.P. MICKLE. Amnesia Secondary to Pericallosal Artery Aneurysms in a Child.
An 8-yr-old, right-handed male, at post-repair of a giant pericallosal arteriovenous malformation, was examined for neurobehavioral sequelae of his lesions. Approximately three fourths of the corpus callosum was affected by his hemorrhages and surgeries. Despite this trauma, an anterior callosal syndrome was not demonstrated. Instead, a profound memory disorder resembling diencephalic amnesia and anomia were evident at 6- and 12-mo follow-up. Significant impairments in reading and spelling were also observed. The behavioral anatomy of his disorder is discussed and compared to previous cases described in the world literature.

M.A. SCOTT, J.M. FLETCHER, B.L. BROOKSHIRE, K. DAVIDSON, D.J. FRANCIS, & T. BOHAN. Memory Functions in Children With Early Hydrocephalus.
This study evaluated the hypothesis that hydrocephalic children demonstrate more impairment on nonverbal memory measures than verbal memory measures, while recognition memory and memory for contextual information is relatively intact. Comparisons were made of 71 hydrocephalic children and 69 nonhydrocephalic children ages 6–12 yr. Four measures of memory were employed: Verbal Selective Reminding, Nonverbal Selective Reminding, McCarthy Verbal Memory II, and Continuous Recognition Memory. Results revealed group differences across serial learning tasks and on a measure of nonverbal recognition memory but not on prose recall. The hypothesis that the hydrocephalic group would be more impaired on measures of nonverbal memory was not supported. Results suggest that hydrocephalic children do poorly on recognition memory and serial learning tasks for verbal and nonverbal information, with lower storage and retrieval skills. This demonstrates a pattern of more pervasive memory disturbance.

T. HERSHEY, S. CRAFT, N. BHARGAVA, & N. WHITE. Memory and Insulin Dependent Diabetes Mellitus (IDDM): Effects of Age of Onset and Severe Hypoglycemia.
Investigations of IDDM patients' memory, attention, spatial and language functions have suggested that the two clinical factors of early age of onset and frequent, severe hypoglycemic episodes may discriminate between those patients with and without neuropsychological impairment (Ryan et al., 1988; Ryan, 1990; Richardson, 1990; Holmes, 1990). Although these factors have been studied extensively and shown to be associated with neuropsychological impairment, the nature of their relationship to cognitive functioning has not been precisely explicated. We hypothesized that the presence of both early age of onset and severe hypoglycemia would be a primary risk factor for neuropsychological impairment, particularly declarative memory. We examined the memory, language and other skills of patients with early-onset and late-onset IDDM, with and without a history of severe hypoglycemia and compared their performance with age- and education-matched normal controls. Our primary finding indicated that patients with early-onset IDDM and a history of hypoglycemia were significantly impaired on delayed verbal memory compared to all other groups. Thus, the interaction between age of onset and hypoglycemic history may be more important than each factor individually for understanding memory functioning in IDDM patients.

P.H. PAPERO, M.R. PRANZATELLI, L.J. MARGOLIS, L.A. WILSON, E. TATE, & P. GLASS. Neuropsychological and Psychosocial Functioning of Children With Opsoclonus-Myoclonus Syndrome.
Childhood Opsoclonus-Myoclonus Syndrome is a rare movement disorder which typically strikes in the early preschool years, resulting in sudden loss of milestones and increased behavioral irritability. This initial series of 13 cases (median age 5.4 yr), provides the first systematic evaluation of neuropsychological and psychosocial outcome. Subjects

demonstrated a range of preserved neurocognitive abilities, goal directedness, strong communicative effort, and social skills despite lowered measured intelligence (mean IQ = 61, *SD* = 8), severe speech and motor output problems, borderline elevation of behavior problems (Achenbach mean T-score = 65, *SD* = 6) and severe adaptive limitations (Vineland mean = 59, *SD* = 11). Results are discussed in reference to neurodevelopmental factors, relationship of age of injury to cognitive and adaptive outcome, and likelihood of subcortical localization.

B.D. MOORE, III & J. SLOPIS. Neuropsychological Significance of Areas of High Signal Intensity (Heterotopias) Seen on Brain MRI in Children With NF, Type I.

Neurofibromatosis (NF) is a common autosomal dominant genetic disorder with an incidence of approximately 1 in 3,500. Learning disabilities and ADHD occur much more frequently in children with NF than in the general population. Areas of increased signal intensity of T_2-weighted brain MRI are observed in as many as 50% to 60% and probably represent heterotopias. Most studies have reported that there is no association between the presence or number of these heterotopias and general measures of cognitive functioning. We examined MRI scans of 99 children, ages 6–16 yr, with NF for presence/absence of heterotopias. Neuropsychological performance was impaired in academic achievement and certain cognitive skills. Neuropsychological performance was not associated with the presence of heterotopias, in contrast to a recent report that they are. It is felt that more sophisticated MRI measurement techniques are needed to measure the exact location and volume of heterotopias so that this relationship can be determined.

A. HEFFELFINGER, S. CRAFT, & H. SIERLES. Prenatal Cocaine Exposure and the Development of Cognition and Language in Young Children.

Cocaine readily diffuses across the placenta and blocks the presynaptic reuptake of catecholamines. Therefore, prenatal exposure to cocaine could have a profound influence on the development of a fetus and a young child. We hypothesized that young children who were prenatally exposed to cocaine would have lower scores on cognitive and language tests than a group without prenatal exposure to drugs. Eighteen cocaine-exposed children (mean age = 19.5 mo) and 16 control subjects (mean age = 22 mo) were tested. The cocaine-exposed group scored significantly lower than the experimental group on cognitive and language tasks. Results supported the hypothesis that children prenatally exposed to cocaine would score lower on cognitive and language tasks.

C. OWENS, J. FISK, H. CHUGANI, & A. CANADY. Effects on Cognitive Development of Different Degrees of Intraventricular Hemorrhage: A Case Study of Twins.

This paper presents the results of neuropsychological investigation of a set of low birth weight, preterm, male fraternal twins. At the time of evaluations the subjects were 3 yr old. The twins were delivered via Caesarean section secondary to respiratory distress syndrome at 28 wk gestation. Twin A weighed 1330 g at birth with a Grade I intraventricular hemorrhage (IVH) and Twin B weighed 1415 g with a Grade III IVH. Neuropsychological/developmental evaluation revealed that Twin B was experiencing significantly greater impairment with respect to receptive and expressive language, motor and psychomotor skills, attention and concentration, problem solving ability, and social skill development as compared to Twin A. The results provide a dramatic demonstration that, all other things being equal, degree/extent of IVH is an important predictor of subsequent cognitive development in preterm infants. Further studies including PET scan will be presented. The results are discussed in the context of atypical development in high risk children.

J. HALL, G.W. HYND, M.J. COHEN, & C.A. RICCIO. Corpus Callosum Morphology and Behavioral Correlates in Children.

The present study identified brain-behavior correlates in a population of normal and clinic referred children. Subjects were administered neuropsychological tests which comprised five cognitive factors and MRI protocols designed to analyze regions of interest (ROI) of the corpus callosum. Analyses indicated a significant difference in which normal as well as female subjects demonstrated smaller callosal midbody measurements. Right handers correlated positively with the splenium. Limited support was provided that ROI area measurements are predictive of gender. No regions of the corpus callosum were predictive of cognitive functioning other than an inverse relationship of the isthmus with visual/spatial functioning.

L. STANFORD, E. FIELSTEIN, & T. BOLL. Neuropsychological Status of Children With Brain Tumors Following Resection With and Without Subsequent Chemotherapy and Radiation.

The present study compares both global and some specific neuropsychological factors between two groups of children with brain tumors: one group treated with tumor resection alone (n = 18) and the other receiving radiation and chemotherapy (n = 8) following resection. The two groups did not differ with regard to age at testing, age at diagnosis, time interval of testing, tumor location, and type of tumor. There were no significant differences between the two groups on any of the neuropsychological measures. On those measures thought to be more sensitive to diffuse organicity and disruption in higher level cognitive functioning normally associated with radiation and chemotherapy treatment, those children who had received this treatment performed better, although not significantly, than those who had been treated with tumor resection alone. Limitations and implications of the study are discussed.

R.W. BUTLER, N.V. CHEUNG, & J. EDDY. Increased Intellectual Functioning in Children With Neuroblastoma.

Neuroblastoma, a catecholamine-producing childhood tumor, originates in the neural crest cells and is well known for its genetic aberrations. We tested the hypothesis that it would be associated with developmental central nervous system involvement. Depending on subject age, the Wechsler Intelligence Scale for Children-Third Edition or the Stanford-Binet Intelligence Scale: Fourth Edition was administered. The Neuroblastoma group (n = 15) had a significantly higher (p = .003) mean IQ (M = 112.6 ± 12.5) than the control group (n = 14; M = 97.1 ± 13.3). For the subjects that completed the WISC-III (n = 22), six neuroblastoma subjects obtained a subtest scaled score of 19 while no control subject obtained a scaled score of 19 (p = .004). Neuroblastoma may be associated with a genetic predisposition for increased intelligence. Catecholamine overactivity may moderate this relationship.

D.E. TRAHAN. Visual Organization in Patients With Unilateral Stroke or Closed Head Injury.

This study examined visual organizational ability in patients suffering from unilateral stroke or severe closed head injury using the Hooper Visual Organization Test (VOT). The study examined rates of impairment in these groups as well as the relationship between VOT performance and measures of constructional and expressive language ability. Subjects were 50 patients with right-hemisphere stroke (RCVA), 21 patients with left-hemisphere stroke (LCVA), and 24 patients with closed head injury (CHI). Results revealed that RCVA and CHI patients performed significantly worse than LCVA patients on the VOT. Only 2 of 21 LCVA patients had scores in the impaired range. Results also suggested that the VOT is a complex test, correlating highly with measures of constructional ability and expressive language. While the VOT does appear more sensitive to right brain lesions, any lesion affecting expressive language or constructional abilities may also affect VOT performance.

E.J. CHOI, W. MITTENBERG, & F. McCARTHY. Depth Perception in Stroke Patients.

This study investigated the effects of stroke on stereopsis, that is, depth perception and examined the relationship between two types of stereopsis and lesion locations. A total of 50 stroke patients with radiographically documented unilateral lesions were included in the study with 25

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subjects each in the left-hemisphere (LH) and the right-hemisphere (RH) lesion group. RH had more impaired local stereopsis than the LH. Cortical lesion group had significantly more impaired stereopsis than the subcortical lesion group, regardless of the hemisphere. Global stereopsis was equally affected in all lesion groups. A greater local stereopsis impairment was noted in the posterior lesion group than in the anterior lesion group. Posterior lesion group also had more impaired global stereopsis than those with anterior lesions. Right hemisphere appears to be dominant for processing local stereopsis whereas both hemispheres appear to be involved in processing global stereopsis. This study offers evidence for the presence of separate anatomical structures to process local and global stereopsis.

V.W. MARK & N.G. WALLER. Spatial Behavioral Asymmetries in Aphasia.
Unilateral spatial neglect is usually considered by neuroscience researchers to be more severe, enduring, and frequent following right rather than left hemisphere damage. However, aphasia following left hemisphere damage may hinder the traditional assessment of neglect. In contrast, right neglect is frequently reported by therapists in aphasic patients on routine self-care activities. We assessed aphasic patients for neglect on functional activities and traditional neuropsychologic tests after extensive contact and repeated demonstration of task requirements. We found right neglect in all of our aphasic patients to a variable extent, more so in severe aphasia. The assessment of neglect in aphasia may require considerably more interaction with the patient than is standard in neuropsychologic research. Neglect in aphasia may be substantially underestimated by current research methods in neuropsychology.

S. NICHOLS, J. TOWNSEND, & B. WULFECK. Developmental Changes in Controlled Shifts of Covert Visual Attention.
Children have been found to use controlled, or strategic, processes differently than adults when executing shifts of attention. We have examined the development of these processes from ages 7–12 yr using two versions of the Posner covert attention paradigm. In one condition, attention is drawn automatically to a potential target location (the cue is valid 80% of the time). In the other condition, a symbolic cue is used. Two cue-target intervals were used. We found that children differ significantly by age in their overall response speed, as expected, and in the effect of cue validity on response time. However, they also differed in the interaction of cue type with cue validity and target delay in a manner that suggests increasing strategic processing across this age span.

C. DOOL & Y.M. ARCHIBALD. Autotopoagnosia in the Context of Cortical Basal Ganglionic Degeneration.
Autotopoagnosia, a bilateral impairment in pointing to one's *own* body parts, is indicative of left hemisphere dysfunction. We describe the case of a 77-yr-old woman in whom autotopoagnosia is a prominent feature, affecting not only test performance but everyday activities as well. In addition, this patient exhibits symptoms consistent with evolving cortical basal ganglionic degeneration (CBD). Cortical symptoms include marked ideational and ideomotor apraxia, alien hand phenomenon, visuospatial/constructional difficulties, mild dementia and mild expressive language difficulties. Subcortical symptoms include tremor, limb dystonia, and hyper-reflexia. Since autotopoagnosia has not previously been described in CBD, it is recommended that it be assessed whenever CBD is suspected.

D. HEINEMANN, A. SCHNIDER, & K. GUTBROD. Visual Interference in Simultanagnosia.
A patient suffered from a Balint's syndrome (ocular apraxia, optic ataxia, and simultanagnosia) after cardiac resuscitation following myocardial infarction. Visual recognition depended on stimulus complexity. Representations emphasizing the "Gestalt" were best recognized, independent of the size of the representation. Any kind of masking, particularly if it interfered with the object outline, was detrimental for recognition. In the perceptually difficult conditions, large designs were better recognized than small ones, implying that the patient was searching for significant (object-specific) details rather than building up an inner image of the object. Our results are compatible with the interpretation of simultanagnosia as an inability to suppress competing visual elements, that is, as an increased susceptibility to visual interference.

T. STANNARD & H. KAHN. To See or Not To See, That Is The Question: A Case Study of Visual Agnosia.
This case study examines a patient with severe deficits in visual recognition resulting from bilateral cerebellar infarcts and hemorrhage of the left posterior cerebral artery. Adequate primary visual function was established but the patient was reported to act as though he were blind. Testing eliminated a language based naming disorder but indicated visual agnosia. Results indicated apperceptive visual agnosia, possibly progressing to associative visual agnosia as spontaneous recovery occurred. Several features of this case appear to be unusual. First, the patient appeared to have particular difficulty integrating visual information into a whole visual representation. Second, the visual information presented appeared to confound the recognition process rather than facilitate it. This study offers evidence that may be helpful in contributing to current theory on visual agnosia.

L.E. TREXLER. Attentional Control of Homonymous Hemianopsia: A Case Study.
A 52-yr-old female 20 mo post-left-occipital-temporal infarct initially presented with evidence of a right homonymous hemianopsia. Neuro-ophthalmological and perimetry studies revealed that the patient had volitional control over the right lower quadrant of the visual field. The effortful control of the scotoma was found to be susceptible to competing cognitive tasks. MRI studies revealed that her lesion was confined to the geniculostriate visual pathways. PET images evidenced increases in blood flow in the left tempero-parietal and insular cortex and in the lateral convexity of right frontal lobe with effortful attention control of the right hemispatial field. These findings will be discussed in context of prevailing theories on recovery of function.

E. WERTMAN, L. SPEEDIE, R. TUTNAUER, N. ZILBERMAN, & K.M. HEILMAN. The Effects of Environment on Hemispatial Neglect.
We posited that because patients with hemispatial neglect have difficulty focusing their attention they would be more affected by the environment than would controls. To learn what effect the environment has on neglect, we studied a patient with left-hemispatial neglect from a right parietal lesion by having the patient bisect lines that were placed on the right, left, or center of a page and compared his performance to that of 12 controls. In all testing conditions, the center of the line was placed in the subject's midsagittal plane so that when the line was on the left of the page, the page was placed to right of the subject and vice versa. When compared to controls, our experimental subject demonstrated left-sided neglect. He also appeared to be affected by the line's position on the paper such that when the line was on the left side of the paper (and the paper was on the right), the patient's attempt at bisection deviated further toward the right. It appeared he was inadvertently also bisecting the paper. These results suggest a deficit in modulating attentional interactions between a peripheral reference frame and a target stimulus.

H.J. STORRIE-BAKER, S.J. SEGALOWITZ, S.E. BLACK, D.P. CROWNE, J.A. McLEAN, & N. SULLIVAN. EEG Support for the Arousal Hypothesis in Hemispatial Neglect Among 42 Unilateral Stroke Patients.
Hemispatial neglect is a striking impairment associated with focal damage from stroke. It is an inability to report, respond, or orient to contralesional stimuli, and is more frequent and severe after right hemisphere damage (RHD). A current hypothesis concerning the causal mechanisms of neglect is an increased disturbance to cortical arousal with RHD. To determine whether reduced cortical arousal is associated with neglect and

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RHD, we examined the correlation between stroke-related hypoarousal, neglect, and power spectra EEG in 42 unilateral stroke patients. Neglect was verified at the bedside, and arousal independently measured by RT scores and EEG desynchronization. Scalp EEG was recorded during a standard auditory oddball paradigm. We predicted enhanced slow and reduced fast frequency activity, and excess diffuse ipsilateral EEG slowing in neglect patients. We found relatively higher frequency activity associated with LHD and slower activity with RHD. Greater slowing was observed over the RH than the LH in neglect patients, regardless of hemisphere of damage. These data support the hypoarousal hypothesis.

M. MORRIS, T. LINEWEAVER, & N. KRAWIECKI. Hemispatial Neglect in Children With Brain Tumors.
This study assessed the incidence of hemispatial neglect in a large archival sample of children with brain tumors. Subjects who exhibited a 10% difference in performance accuracy between left and right hemispace on a letter cancellation task were compared to those without evidence of hemispatial inattention on developmental and medical variables. Thirty percent of the pediatric brain tumor sample exhibited neglect on this task. Both left and right sided neglect were observed with equal frequency. Neglect was significantly related to age at time of assessment and to tumor location, but not to tumor pathology or treatment regimen.

J.M. KEILLOR, G.M. GRIMSHAW, & M.P. BRYDEN. Lateral Biases in Line Bisection in Normals: A Perceptual or a Pre-Motor Phenomenon?
It is well documented that normal subjects will bisect a straight line to the left of the true midpoint. This phenomenon has been called pseudoneglect. Work with patients has demonstrated that both perceptual and pre-motor factors can account for line bisection errors. However, no studies have examined the relative contributions of perceptual and premotor factors to line bisection performance in normals. In the present experiment, we used a modified version of a pulley apparatus that Bisiach, Geminiani, Berti, and Rusconi (1990) used to dissociate perceptual and pre-motor factors in neglect patients. Results suggest that both perceptual and pre-motor factors contribute to line bisection errors, but only for short lines. Line bisection errors for longer lines appear to be perceptually mediated.

R.F. KAPLAN, D.D. PALOMO, J. LIEDERMAN, L. GORN, R.A. COHEN, K. WORKMAN, & S. SOKOL. Visual Monitoring of Eye Position During Line Bisection in Hemispatial Neglect.
We measured eye position in a patient with neglect from a right parietal lobe stroke while he guided a cursor on a computer screen to either the left end, right end or middle of a line. He was able to correctly place the cursor at both endpoints and move his eyes to the respective side of space. However, on bisection trials, he displaced the cursor to the right of center and his eyes rarely entered left hemispace. Bisection errors were greatest in left hemispace. We suggest that bisection errors were due to an attentional bias elicited only when the patient was required to use information from both sides of space.

D.L. NA, J.C. ADAIR, & K.M. HEILMAN. Lateral Hypometria in Progressive Supranuclear Palsy-A Case Study.
We report a patient with progressive supranuclear palsy (PSP) who demonstrated consistent failure to explore lateral peripersonal space on a tactile-mediated coin localization task. This behavior prompted us to perform an experiment in which blindfolded subjects (patient and controls) reproduced passive arm and hand movement in medial or lateral peripersonal space. When action took place in medial space, the patient reproduced medially and laterally perceived distances hypermetrically. However when action took place in lateral space, the same distance perceived medially resulted in hypometric movements. This hypometria in lateral peripersonal space suggests disruption of a motor-intentional system rather than a sensory-attentional system and this intentional deficit may account for this patient's restricted search.

J.H. BERNSTEIN & L. LEVISOHN. Denial of Hemiplegia: More Data From the Wada Procedure.
Gilmore, Heilman, Schmidt, Fennell and Quisling (1992) have described denial of hemiplegia in the context of the Wada procedure. They report denial of the contralateral hemiplegia with right, but not left, hemisphere injections by all 8 subjects in their sample. We have studied a series of 58 consecutively referred patients of whom 28 had complete bilateral procedures and were specifically asked as to their recollection of hemiplegia during the period of hemispheric inactivation. Twenty-six of the 28 patients denied hemiplegia bilaterally. Methodological differences between the two studies are examined. The implications of the comparison for the major current theories of anosognosia are considered.

J.D. ACKERSON, R.S. FISCHER, & J. ROSENBAUM. Measuring Awareness in Unilateral Right Hemisphere Stroke.
Lack of awareness of deficit is frequently associated with unilateral right hemisphere stroke, yet little empirical evidence exists to objectively measure patients' awareness of deficits and their impact on rehabilitation. In the present exploratory study we investigated deficits of awareness in 25 patients with unilateral right hemisphere stroke by comparing their self-ratings to expert ratings on 12 specific areas of competence. There were significant differences on 7 of the 12 specific areas of competence measured, indicating that awareness of deficit among unilateral right hemisphere stroke patients is differentially affected according to specified abilities. The difference scores generated from the self versus expert comparisons were then subjected to a factor analysis which yielded four functionally discrete factors: functional self-care, cognition, hemiparesis, and mood. We conclude that anosognosia following unilateral right hemisphere stroke should be viewed as a multidimensional phenomenon with the awareness of specific aspects of functioning being differentially affected across various cognitive and functional domains.

Paper Session 10

DEMENTIA I

D.A. CAHN, D.P. SALMON, N. BUTTERS, M.W. BONDI, S.A. JOHNSON, W.C. WIEDERHOLT, & E. BARRETT-CONNOR. Qualitative Features of Neuropsychological Test Performance in Individuals Who Are at Risk for Dementia of the Alzheimer Type.
The present study examined the hypothesis that subjects who are "at risk" (AR) for dementia of the Alzheimer type (DAT) due to very mild cognitive deficits in the absence of functional decline will produce a pattern of errors on neuropsychological tests of memory and language that is qualitatively similar to that of patients with DAT. Forty-two DAT patients, 238 normal elderly (NE) subjects, and 70 AR subjects were administered a battery of neuropsychological tests as part of an epidemiological study. Despite a high degree of overlap between AR and NE subjects on quantitative indices of performance, the AR subjects demonstrated a pattern of errors that was highly similar to that of DAT patients. AR and DAT patients did not differ in terms of perseverations and intrusions on tests of memory and fluency, and semantic and lexical errors on tests of confrontation naming. Furthermore, the AR subjects made significantly more of each error type than the NE subjects. These results suggest that assessment of qualitative aspects of performance may enhance diagnostic accuracy of very early DAT.

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D.B. HOWIESON, J.A. KAYE, R. CAMICIOLI, B.S. OKEN, & G. SEXTON. Evidence of Alzheimer's Disease at the Pre-symptomatic Stage in a Very Elderly Sample.
Elderly subjects who developed evidence of dementia during a longitudinal study of healthy aging were compared with matched controls who retained their nonimpaired status. Even in the presymptomatic stage those who would subsequently show signs of questionable dementia had a verbal memory impairment. Nonmemory measures did not differ between groups. We assume that most, if not all, subjects with Questionable Dementia will eventually show the full Alzheimer's syndrome. We hope to examine the alternative hypothesis that at least some in this group have "benign senile forgetfulness" by following these subjects for at least three more years.

J.A. BARTOK, C.S. WILSON, B. GIORDANI, B.A. KEYS, N.L. FOSTER, C.C. PERSAD, & S. BERENT. Patterns of Recall and Recognition Deficits Dependent on Alzheimer's Disease Severity.
The relationship between verbal recall and recognition impairments may depend on the severity of Alzheimer's disease (AD). In 202 patients with probable AD, we administered a 10-item, single-category work-list learning test using selective reminding procedures (SRT; Buschke & Fuld, 1974). Dementia severity was characterized with the Mini-Mental State Examination (range: 0-24). Statistical analyses were conducted on two parameters from the SRT: the total number of words correctly recalled and the recognition sensitivity index, d', measured at the end of the six learning trials. Although both SRT measures were impaired in comparison to control subjects, analyses of this single category SRT demonstrated that recall scores were more sensitive to dementia severity than were recognition measures, even among very impaired patients.

J.G. KEILP & I. PROHOVNIK. Estimated IQ Decline Related to the Severity of Parietotemporal Perfusion Deficit in Alzheimer's Disease (AD).
Current measures of dementia severity suffer from a variety of psychometric limitations that distort associations to pathophysiology. In this study, we attempted to address these limitations by characterizing severity as decline from premorbid functioning, using a demographic formula to estimate premorbid IQ in a sample of 27 AD patients who had received WAIS-R's. The resulting estimate of IQ decline was strongly associated ($r = .66$, $p = .0002$) with an index of AD-related parietotemporal perfusion deficit assessed from resting ^{133}Xe rCBF scans. This correlation exceeded those with current IQ, MMSE and BDRS, was independent of Mean Flow effects, and consistent within different educational strata. Findings suggest that estimated IQ decline is a noteworthy correlate of pathophysiological severity in AD, and that blood flow measures can be used to index disease-related intellectual deterioration.

S. CRAFT, J. NEWCOMER, S. KANNE, J. WEMSTROM, Y. SHELINE, J. LUBY, S. DAGOGO-JACK, & A. ALDERSON. Hormonal Effects on Hippocampal Function: Raising Plasma Insulin or Glucose Levels Enhances Declarative Memory in Patients With Alzheimer's Disease.
In a previous study, adults with very mild dementia of the Alzheimer type (DAT) showed memory facilitation and extreme plasma insulin levels when plasma glucose was raised to 225 mg/dl. The present study examined whether raising insulin levels while keeping glucose levels at baseline would also facilitate memory in adults with DAT. Thirteen normal adults and 19 adults with DAT were administered a cognitive battery during three metabolic conditions: elevated insulin, elevated glucose, and baseline insulin/glucose. Adults with DAT showed greater paragraph recall in the elevated insulin condition than in the other two conditions, and greater paragraph recall in the elevated glucose condition relative to baseline. These results support the hypothesis of disrupted glucose regulation in DAT and suggest that insulin plays an important role in this process.

J.C. STOUT, M.W. BONDI, T.L. JERNIGAN, S.L. ARCHIBALD, D.P. SALMON, & N. BUTTERS. Brain Morphometric Predictors of California Verbal Learning Test (CVLT) Performance in Alzheimer's Disease.
Probable Alzheimer's disease patients ($n = 27$) received magnetic resonance (MR) and neuropsychological evaluations. Multiple regression analyses were computed to predict CVLT performance using sets of cortical and subcortical gray matter and subcortical abnormal white matter measures from quantitative MR image analyses. A measure of general learning/immediate recall (total words recalled over 5 learning trials) was predicted by a pattern of relatively greater loss in limbic than non-limbic cortical gray matter. False positive errors on the recognition memory component of the CVLT was also predicted by the model. High abnormal white matter and low cortical gray matter volumes (both limbic and non-limbic) predicted high false positives. Results suggest that measures of general learning and recall from the CVLT are associated with disproportionate limbic damage, whereas recognition memory is associated with both increased abnormal white matter and a non-specific pattern of gray matter loss in either limbic or non-limbic cortical gray matter.

Paper Session 11

HIV

E.M. MARTIN, D.L. PITRAK, R.F. FARINPOUR, R.M. NOVAK, K.J. PURSELL, K.M. MULLANE, M.E. MENKEN, & T.E. HARRIS. Delayed Recognition Memory Span in HIV-1 Infection.
We administered the spatial Delayed Recognition Span Test, a measure performed abnormally by patients with basal ganglia disease, to 37 HIV-seropositive and 18 seronegative subjects with a high prevalence of substance abuse. Subjects also completed two psychomotor tasks, the Symbol Digit Modalities Test and the Trail Making Test, which detect HIV-related mental slowing in gay men. Scores on the Trail Making Test did not discriminate the groups, but HIV-seropositive subjects had significantly shorter spatial spans ($p < .006$) and lower SDMT scores ($p < .05$) than controls. These effects were not accounted for by differences in age, education, estimated intelligence, or psychological distress. The DRST is a promising measure of HIV-related cognitive dysfunction in substance abusers, who are often nonspecifically impaired on psychomotor tasks.

R. KADERMAN, B. LEVIN, & J. BERGER. Relationship Between Cerebrospinal Fluid Quinolinic Acid and Cognitive Functioning in HIV-1.
Increased levels of quinolinic acid (QUIN) have been obtained from the CSF of HIV-1-infected individuals. This excitatory amino acid has been implicated in the neurodegeneration and cognitive dysfunction which frequently accompanies HIV-1. The current study examines CSF QUIN and cognitive functioning in 95 HIV-1-infected homosexual males, stratified according to elevations of CSF QUIN Correlational analyses, removing the effects of disease progression (CDC), revealed significant associations between CSF QUIN and performance on tasks of executive functioning, reasoning, and verbal and visual memory. Two year, prospective follow-up in Low versus High QUIN groups revealed no changes in neuropsychological performance. These findings suggest that although elevated QUIN is related to select cognitive deficits in HIV-1, sustained concentrations in QUIN over time do not inevitably result in further neuropsychological deterioration.

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J.M. COSCIA, B.K. CHRISTENSEN, & R.R. HENRY. Risk and Resilience in the Neurocognitive Development of HIV-1 Exposed Children: A Preliminary Analysis.
Although biological and environmental risk factors show an age-dependent effect on children's neurocognitive development, outcome studies with children born to HIV-1 infected mothers have not considered the role these factors play in children's neurodevelopment. This study explored the age-dependent differential impact of such risk factors on the neurocognition of children exposed in utero to HIV-1. Eighty-two children were administered a neurocognitive measure and divided into two groups depending on their age when tested. Group 1 included children age 2–28 mo ($n = 48$); Group 2 included children age 2.5–8.5 yr ($n = 34$). Correlations between mental test scores (MTS) and specific risk factors reveal an age-related double-dissociation. Serostatus and CD4 percent correlated strongly with MTS in Group 1; however, these correlations were attenuated in Group 2. Conversely, caretaker status and MTS were uncorrelated in Group 1, but were correlated in Group 2.

J.J. MANLY, R.K. HEATON, T.L. PATTERSON, S.J. SEMPLE, J.H. ATKINSON, J.L. CHANDLER, W.L. KOCH, I. GRANT, & THE HNRC GROUP. The Relationship of Actual and Self-Reported Neuropsychological Functioning to Depressed Mood and Coping Activity Among HIV+ Men.
The relationships between actual and self-reported neuropsychological (NP) ability, coping activity, and depressed mood were examined among 151 symptomatic and asymptomatic HIV+ men. ANCOVAs were performed comparing coping efforts of NP impaired and unimpaired subjects with and without cognitive complaints, while controlling for depressed mood and CD4+ cell count. Subjects with complaints, regardless of their actual ability, reported using significantly more avoidant coping efforts than subjects without complaints ($F = 10.62$, $p < .001$). These results suggest that: (a) those who perceive cognitive difficulties deal with life adversity using more coping activities that might require less cognitive effort and flexibility, or (b) those who use more avoidant coping are less successful in everyday tasks and therefore perceive themselves as "impaired."

S.G. SILVA, R.A. STERN, N. CHAISSON, E. SINGER, S.F. BAUM, R.N. GOLDEN, & D.L. EVANS. The Effects of Cognitive Reserve on Neurobehavioral Functioning in Asymptomatic HIV-Seropositive Gay Men.
We studied 51 asymptomatic seropositive and 42 seronegative gay men over an 18-mo period. Exclusion criteria included history of psychiatric and/or neurologic disorders. A cognitive reserve score (CRS) was derived from baseline education level, occupational attainment, and estimated premorbid IQ. Based on median CRS, the following groups resulted: low CRS seropositives (L+), high CRS seropositives (H+), low CRS seronegatives (L−), and high CRS seronegatives (H−). Neuropsychological performance was assessed at baseline and month 18. Analyses conducted on clinical ratings and factor scores indicated that L+ subjects had significantly greater motor and processing speed deficits at each assessment. ANOVA-RMs did not reveal interaction effects. These findings suggest early neurobehavioral impairments associated with HIV infection are most evident in individuals with less cognitive reserve, although less reserve did not predict cognitive decline during the study period.

R.L. MAPOU, W.A. LAW, G.G. KAY, S. CLASBY, T.L. ROLLER, & L.R. TEMOSHOK. Performance on Conventional and Computerized Reaction Time Measures in HIV-1-Infected Individuals.
Ninety-six HIV-1-infected (HIV+; 8% with AIDS) and 87 HIV-seronegative (HIV−) control subjects completed conventional simple (SRT) and choice (CRT) reaction time (RT) tasks and computerized RT tasks. MANCOVA and ANCOVA, with age as a co-variate, indicated that HIV+ subjects were significantly slower ($p < .01$) on all conventional and 3/6 computerized reaction time tasks. When analyses were limited by gender and ethnicity, and when estimated IQ and mood state also were co-varied, groups still differed significantly on 3 tasks, two of which measured simple RT. These findings further demonstrate the usefulness of RT measures in HIV-1 disease, but also show that results can differ as a function of RT task and demographic variables.

Special Session

CURRENT VIEWS ON MODULARITY AND BRAIN LOCALIZATION

M. Farah & E. Zurif

FRIDAY AFTERNOON, FEBRUARY 10, 1995

Paper Session 12

TRAUMATIC BRAIN INJURY

S.D. GALE, E.D. BIGLER, S. JOHNSON, & D.D. BLATTER. Global Degeneration Following Traumatic Brain Injury: Anatomic and Neuropsychologic Correlates.
Morphometric analysis of Magnetic Resonance scans in 88 TBI patients demonstrated significantly larger ventricle-to-brain ratios (VBR), temporal horn volumes, and smaller fornix-to-brain ratios (FBR), and corpus callosum measurements compared to 73 controls. Additionally, TBI patients were grouped according to Glasgow Coma scale (GCS) for a within TBI group comparison. The severe TBI group (GCS = 3–6) differed from the mild and moderate injury groups on measures of the internal capsule. VBR, temporal horn volume, and corpus callosum. The group with the smallest fornix size demonstrated the lowest memory performance. Furthermore, anatomic measures correlated with severity of injury, and tests of memory and motor function. Results demonstrate the diffuse nature of degeneration in TBI with more severe injury.

E. FARACE & E. TURKHEIMER. Utility of Analyzing Lesion Location in an Outcome Study of Traumatic Brain Injury.
Previous studies of stroke patients have shown that analyses of the volume of the lesion and the *location* of the lesion, are both very important in predicting neuropsychological outcome. However, studies of traumatic brain injury outcome rarely, if ever, include analyses of lesion location. Lesion location is likely to be one of the largest sources of variance for predicting TBI outcome. We propose a quantitative method of covarying lesion location with neuropsychological performance at 3 mo post-injury. This method is applied to a sample of 55 patients with visible brain lesions who had been administered neuropsychological tests.

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Our results indicated that lesion location accounts for a large percentage of variation in performance.

B. ROSS, N. TEMKIN, & S. DIKMEN. The Relationship Between Age and Psychosocial Outcome Following Traumatic Head Injury.
Age is considered to be an important predictor of outcome following traumatic head injury. The goal of this study was to assess the relationship between age and psychosocial outcome in a large representative sample of head-injured adults. 458 head-injured subjects, ages 18–89 yr, were studied prospectively 1 yr post-injury. The results of this study suggest that there is a systematic relationship between age and psychosocial morbidity, with older individuals exhibiting a less favorable outcome from traumatic head injury than younger adults. This relationship appears to be stronger and more consistent for more global and objective measures of psychosocial functioning. The age effect may reflect more severe damage to the brain with aging or impaired recovery processes with aging.

V. ANDERSON, S. MORSE, G. KLUG, C. CATROPPA, & F. HAITOU. Recovery Patterns Following Head Injury in Preschool Children: A Prospective Analysis.
While recovery patterns following adult head injury are well documented, little is known about recovery following head injury in very young children, where interactions between possible recovery and normal development are difficult to differentiate. This study examines this issue using 2 groups of children, head-injured and healthy children, ages 2–6 yr and matched for age, gender, SES, and premorbid ability. Head-injured children ($n = 30$) were evaluated on emergence from PTA, and again 6 mo and 12 mo post-injury. Controls were evaluated at equivalent intervals. Intellectual, language and memory skills were assessed. Results show that head-injured children perform more poorly on all occasions, fail to show expected "recovery" in acute post-injury phase, and exhibit flatter developmental curves than healthy controls.

M. SHERER, C. BOAKE, B. SILVER, E. LEVIN, G. RINGHOLZ, M.C. WILDE, & K. ODEN. Assessing Awareness of Deficits Following Acquired Brain Injury: The Awareness Questionnaire.
Accurate assessment of awareness of deficits following acquired brain injury is important due to the effect of unawareness on patient outcome. Previous studies have operationalized self-awareness by comparing patient self ratings to the ratings of family and staff and to objective findings on neuropsychological tests. The present paper presents new questionnaires designed to assess unawareness in the areas of physical, cognitive, behavioral, and community functioning. Ratings are available for both specific and general awareness of deficit areas. Separate questionnaires are available for patients, family, and staff. In a preliminary study of the conceptual validity of the awareness questionnaire, the Awareness Questionnaire was administered to 64 moderate or severe traumatic brain injury survivors and their family members. Findings supported the conceptual structure of the questionnaires.

T.E. SULLIVAN, B.K. SCHEFFT, J.S. WARM, W.N. DEMBER & M. O'DELL. Effects of Olfactory Stimulation on Vigilance Performance and Stress in Closed-Head-Injured Subjects.
Accessory olfactory stimulation in the form of occasional whiffs of peppermint-scented air has been shown to enhance the quality of sustained attention in normals. In this study 20 head-injured patients and 20 matched controls completed a vigilance task in which they received infrequent bursts of either peppermint-scented or unscented air. While the number of false alarms made by injured subjects receiving olfactory stimulation resembled that of the controls, that of injured subjects receiving only air increased dramatically. Recent research has shown that olfactory stimulation causes an increase in arousal of the frontal lobe. This increased arousal may make the frontal lobe more efficient in the performance of sustained attention tasks. In addition, this increased activation may have helped injured subjects maintain more effective control over their behavior.

Paper Session 13

CHILD DEVELOPMENT II

G.N. COHEN, M.B. CASEY, M.B. BRONSON, E. PEZARIS, & E.C. TUCKER. Comparisons of Planning Measures as Predictors of School Functioning Among Normal School-Aged Children.
This investigation examined whether different types of planning measures, including those used in neuropsychological frontal lobe test batteries, predicted for school functioning in third graders. Separate regressions were performed for three scoring methods: outcome, process, and latency. Three planning tasks were entered into each regression: Trail-making, Tower of Hanoi, and a teacher designed planning task (the Classroom-based Planning task). Analyses were repeated, controlling for IQ and the teacher who assigned the grades. Standard planning tasks, Trail-making and Tower of Hanoi, did not predict for school performance. In contrast, both the outcome and process measures for the Classroom-based Planning task predicted for GPA, with the process measure remaining significant when IQ was controlled. The results suggest that when assessing planning in children, school-based measures of the on-going planning process should be included in neuropsychological batteries.

L. EWING-COBBS, B.L. BROOKSHIRE, M.A. SCOTT, & J.M. FLETCHER. Traumatic Brain Injury in Children and Adolescents: Analysis of Narrative Discourse.
Narrative discourse and intellectual functioning were evaluated 3 yr following traumatic brain injury in 9 children with left hemisphere lesions and deficits on baseline language measures, 8 brain-injured controls equated on neurologic and demographic variables, and 9 sibling controls. Based on a story retelling task, the groups did not differ on measures of fluency, rate of speech production, hesitational phenomena, or word retrieval errors. In comparison with the sibling controls, the language impaired group produced significantly fewer words and had a restricted vocabulary; lexical, personal reference, and demonstrative reference cohesive markers conjoining meaning across sentences were produced less frequently. In comparison with the brain injured controls, the language impaired group demonstrated deficits producing and sequencing propositions. Results will be discussed relative to other studies of narrative discourse following traumatic brain injury.

M. PARSONS & D. TUCKER. Word Completion Priming in Normal Reading and Learning Disabled Children: Evidence for a Deficit in Phonological Representation.
This study examines the differential effects of word phonology and imageability on implicit (priming) and explicit (recognition and recall) memory performance in normal reading and language related learning disabled (LD) children. A word completion priming task, in which both word imageability and phonologic factors were manipulated was administered to 35 normal readers (mean age = 10.1 yr) and 15 LD children (mean age = 13.0 yr) equated for reading ability. The groups exhibited equivalent rates of word completion priming overall, however, interactions suggested that LD children show an inability to represent phonological information in implicit memory. No statistically significant differences were observed on explicit memory measures. The implications of these findings for the understanding of memory deficits associated with LD and implicit memory are discussed.

K.E. ERICKSON, D.M. PASCUALVACA, B.D. FANTIE, & A.F. MIRSKY. ADHD With and Without Learning Disabilities: Performance of Children on Neuropsychological Tests of Attention.
We examined the attentional capacities of children with ADHD or ADHD/+LD using a model of attention that encompasses four factors: sustain, focus-execute, encode, and shift (Mirsky et al., 1991). The tests

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included the CPT, the WCST, the Stroop, Digit Cancellation, Trail Making, and the Digit Span, Arithmetic, and Coding subtests of the WISC-R. The ADHD group made more commission errors than the control group on the CPT, but did not differ on other attentional measures. Children with ADHD/+LD performed more poorly than the other groups on the WCST, Coding, and Arithmetic subtests. These findings suggest that ADHD is primarily a disorder of impulse control and that attention problems are more prominent when a learning disability is present.

J.R. LUCAS & L.C. RICHMAN. Psychosocial Dysfunction in Children With Learning Disabilities: A Neuropsychological Perspective.
Previous studies investigating psychosocial concomitants of learning disabilities have found inconsistent results. This study was designed to determine whether LD children classified according to neurocognitive profiles could be empirically differentiated on a measure of social behavior completed by their parents. Subjects were subtyped as having a Nonverbal Learning Disorder (NLD) or a Language-based Learning Disorder (LLD). Findings revealed that NLD children were rated as displaying significantly higher levels of inappropriate social behavior compared to children with LLD. However, only about one-third of NLD children could be accurately discriminated from LLD children on the basis of scores on a measure of inappropriate social behavior. Results support hypothesis that the processing mechanisms in the right hemisphere mediating spatial cognition may be dissociable from those mediating social cognition.

D.S. MANOACH, T.A. SANDSON, & S. WEINTRAUB. The Developmental Social-Emotional Processing Disorder Is Associated With Right Hemisphere Abnormalities.
We report the findings of neurological examination, neurophysiological studies and neuroimaging studies in a series of 17 adult and adolescent patients with the social-emotional processing disorder (SEPD). The sample was selected objectively, blind to neurodiagnostic findings, on the basis of neuropsychological profile and clinical presentation. SEPD is a clinical syndrome characterized by a relative deficiency of nonverbal cognitive ability, poor paralinguistic communication skills and a history of markedly poor interpersonal adaptation. The findings provide direct evidence from neurodiagnostic studies that SEPD is associated with right hemisphere abnormalities. These cases suggest that SEPD arises from early dysfunction of the right hemisphere which results in its failure to support the adequate development of the cognitive, affective and behavioral functions it subserves in the normal adult.

Symposium 7

EXECUTIVE FUNCTIONS: WHAT ARE THEY AND CAN THEY BE EVALUATED?

J.L. MACK & M.B. PATTERSON. Executive Functions: What Are They and Can They be Evaluated?
Executive control functions are involved in the programming or planning, selection, and ongoing regulation or monitoring of non-routine behavior. Lezak (1982, 1983) has emphasized the extent to which disruptions in the formulation of goals, planning, carrying out plans, and performing effectively can be disrupted even when subjects are capable of scoring at a high level on many standard neuropsychological tests. In spite of the possible significance of executive control for the performance of complex tasks, the formal evaluation of executive functioning has remained problematic. In this symposium we examine the performance of patients with dementia and with frontal lobe lesions on measures of some aspects of executive functioning, explore procedures for evaluating executive functioning in adults and children with neurologic disorder, and consider the treatment of executive deficits in rehabilitation settings. We will discuss our current understanding of executive deficits from cognitive and physiological perspectives.

J.L. MACK & M.B. PATTERSON. Executive Dysfunction and Alzheimer's Disease: Performance on a Test of Planning Ability, the Porteus Maze Test.
We evaluated 85 AD and 65 control subjects. AD subjects performed worse than controls on Porteus Test Age (PTA) and two of four qualitative error scores. Factor analysis demonstrated three Porteus factors: PTA and First Third Errors, Cut Corner and Cross Line Errors, and Last Third Errors. Among AD subjects, factor analysis of Porteus measures and cognitive tests representing language, visual-spatial ability, and primary and second memory revealed four factors. A nonverbal factor included PTA and three nonverbal measures. A verbal factor included no Porteus measure; the remaining factors resembled the second and third factors from the analysis of Porteus scores alone. Stepwise discriminant function analysis demonstrated that PTA, with Animal Fluency and nonverbal attention span, best predicted daily functioning. We concluded: Porteus Maze Test is a useful measure of planning in demented subjects. Further analysis of the relationship of the Porteus with other measures of executive ability, specific cognitive abilities, and more complete measures of daily functioning are needed.

H.G. TAYLOR & C. SCHATSCHNEIDER. Executive Dysfunctions in Children With Neurologic Disorders.
Children with neurologic disorders frequently exhibit symptoms suggestive of executive dysfunction, including deficits in attention and impulse control, organizational skills, and working memory. Rarely, however, have these deficits been examined in relation to other consequences of brain disease, such as more general intellectual limitations. The clinical utility of measures of executive dysfunction is also unclear. The present study summarizes the results of analyses carried out to examine the construct and concurrent validity of tests of executive dysfunctions in several different samples of children with brain insults and their controls. Overall, results provide support for both types of validity. Findings by other investigators are reviewed in light of these results, problems in measurement and theory noted, and directions for future research considered.

B.A. WILSON, J. EVANS, N. ALDERMAN, P. BURGESS, & H. EMSLIE. Testing for Executive Deficits in Brain-Injured Patients.
The Dysexecutive Syndrome (DES) includes disorders of attention, planning, and problem solving. Patients with DES are likely to be impulsive, distractible, have problems utilising feedback and behave inappropriately in social situations. They are among the most difficult of all brain injured patients to treat. Testing for executive deficits is also difficult as traditional tests do not reflect real life demands. They often assess component skills of the central executive rather than executive functioning per se. We describe a number of tasks analogous to real life executive demands that we use to assess the presence or absence of DES in brain injured patients. In addition to results from patients and control subjects, we discuss the use of these tests as outcome measures to evaluate rehabilitation programmes.

J. WINEGARDNER. Executive Problems Impede Rehabilitation.
Neuropsychological rehabilitation must respond to changes in the physical, cognitive, emotional and behavioral functioning of the patient. Problems caused by executive dysfunctions are consistently rated the most difficult to manage for families and for rehabilitation teams. These problems include lack of awareness of deficits, inappropriate social

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behavior, disinhibition of speech, emotions, and behavior, loss of initiative, poor planning and organizing, and poor regulation of behavior. In recent years recognition of the impact of these problems has been accompanied by the development of an increasing number of approaches to the rehabilitation of executive dysfunctions. These approaches include behavioral treatment, cognitive therapies, psychotherapy, and approaches based on language pragmatics. This paper will identify some common ways in which executive dysfunctions disrupt rehabilitation and report current treatment approaches.

P.W. BURGESS. What is Special About Executive Function?
Examining current theories of executive function, and using data from three recent studies, this paper argues for a distinction between process and operation in executive functions. Where current theories of executive function allow for dissociations between processes at a theoretical level, the operations which represent these processes may not be empirically separable. It is argued that reciprocal causation between processes and their operations is common in executive functions, and are what differentiate executive functions from nonexecutive ones. Examination of such mutual causal links may require methodologies new to cognitive neuropsychology.

Paper Session 14

TOXIC EXPOSURE

S.B. ROURKE & I. GRANT. A Regression Approach to Measuring Patterns of Neuropsychological Recovery in Alcoholics With Increasing Abstinence.
To improve understanding of neuropsychological (NP) improvement/deterioration over time in alcoholics with varying abstinence, we used multiple regression to develop NP change norms (corrected for baseline NP test score, age, education, elapsed time) for 44 male controls across five NP ability areas (attention, abstraction, learning, complex perceptual-motor (CPM), simple motor). Norms were then used to evaluate longitudinal NP changes in male alcoholics over similar retest interval. Alcoholics (mean age and education, 50.7 yr and 13.5 yr, respectively) were divided into 3 groups at follow-up: (1) resumed drinkers (RES; $n = 63$); (2) intermediate-term abstinent (ITA; $n = 33$; abstinent mean 1.8 yr); (3) long-term abstinent (LTA; $n = 32$; abstinent mean 6.7 yr). NP change scores indicated RES group declined significantly over time, relative to ITA/LTA, on 4 of 5 NP abilities. ITA group continued to show relative impairments on attention and learning, but improvements on abstraction, CPM, and motor ability. LTA group did not show NP deficits. Thus, NP impairments in alcoholics recover at different rates depending on length of abstinence.

J.D. RIPPETH, S.B. ROURKE, I. GRANT, & L.M. KWON. Neuropsychological Effects of Differential Levels of Relapse Drinking Among Alcoholics.
We examined 165 subjects to characterize the neuropsychological (NP) effects of different rates of relapse, a distinction not made in studies of resumed drinkers. Groups of alcoholics were characterized according to relapse drinking levels at follow-up: heavy relapsers (>560 g/wk; RES1); mild/moderate relapsers (<560 g/wk; RES2). Comparisons were performed between abstainers (intermediate term abstainers; ITA and long term abstainers; LTA) and controls (NAC), matched on age ($M = 51.29$ yr) and education ($M = 13.5$ yr). The Halstead-Reitan Neuropsychological Battery was grouped into the following domains: (Attention, Complex Perceptual-Motor, Motor, Learning, Memory, Abstraction/Cognitive Flexibility). The heavy relapsers were impaired on most domains, while the mild/moderate group was more mildly impaired and on some tests nearly indistinguishable from abstainers and controls.

L.M. KWON, I. GRANT, S.B. ROURKE, & J.D. RIPPETH. Aging, Alcoholism, and Abstinence: Evidence for Lessened Reserve.
We investigated possible differential effects of aging on neuropsychological (NP) performance in alcoholics versus control, using measures of complex perceptual motor ability, abstract reasoning, attention, and visuospatial skills. Male subjects included 174 recently detoxified alcoholics (RDA; mean abstinence = 29 d), 97 long-term abstinent alcoholics (LTA; mean abstinence = 3.8 yr), and 112 nonalcoholic controls (NAC), ranging from 22 to 68 yr of age. Multiple linear regression analyses were conducted to determine possible between-group differences in the slope of NP test scores in relation to age. Contrast comparisons determined the combined alcoholic groups and the LTA group had steeper slopes, indicating more impaired performance with increasing age, than controls on Block Design, Category Test, TPT, and Speech-Sounds. We conclude that alcoholics appear to be more impaired by aging than controls. Although long-term abstaining alcoholics can have normal NP performance, suggesting considerable brain recovery, it is possible that their "cerebral reserve" is lessened, and this is revealed in enhanced age-related NP decline.

M.W. HAUT, D. POOL, T.S. CALLAHAN, J.S. HAUT, & M.D. FRANZEN. Neurobehavioral Effects of Inorganic Mercury Vapor.
Mercury is a known central nervous system toxin. We report on the neuropsychological and emotional functioning of thirteen individuals exposed to inorganic mercury vapor over a two to four week period at the same worksite. Subjects were compared to thirteen age and education matched normal control subjects. Evaluations were completed at least ten months since the termination of exposure. Cognitive deficits were observed with motor skills, speeded processing with and without a motor component, verbal fluency, cognitive flexibility, verbal memory, and visual abstract reasoning. On the MMPI, patients demonstrated evidence of physical focus, depression, anxiety, and social withdrawal. The results of this study are consistent with previous findings with the additional finding of deficits with higher level abstraction.

L.A. MORROW, S.R. STEINHAUER, R. CONDRAY, & G.G. DOUGHERTY. P300 Latency Prolongation in Journeymen Painters Exposed to Organic Solvents.
Neurophysiological function was evaluated by auditory event-related potentials (ERPs) in journeymen painters and compared to nonexposed controls of similar age. Within the painter group, 10 painters were evaluated within 48 h of exposure to organic solvents (acute condition) and 15 painters were evaluated with no exposure in the past five d. Mean latency values for the P300 component of the ERP increased across the three groups: 345 ms for normal controls, 366 ms for journeymen in the free condition, and 371 ms for journeymen in the acute condition. These data suggest that solvent exposure results in neurophysiological alterations that affect information processing: persons with chronic solvent exposure exhibit delays in the processing of relevant information and this processing is further delayed when there has been a recent exposure to solvents. The findings support the hypothesis that solvent exposure may contribute to CNS disturbances and that the use of P300 may serve as an objective marker of such changes.

K. LINDGREN, V. MASTEN, D. MALONE, D. FORD, & M.L. BLEECKER. Neuropsychological Functioning in Lead Smelter Workers.
Four hundred sixty-eight Canadian male lead smelter workers were administered a neuropsychological screening battery. Time-weighted average (TWA) of lead exposure was derived from blood lead records obtained through regular medical monitoring. The sample was divided into three exposure level groups (high, medium, and low) based on TWA

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terciles. The exposure groups differed significantly in age and education. A multivariate analyses of covariance was conducted with age and education as the covariates and thirteen neuropsychological measures as the dependent variables. No significant multivariate effect was found between exposure groups for TWA. A potential explanation for this finding is that recovery of functioning occurred following exposure to high air-born levels of lead in the late 1960s and early 1970s.

Poster Session 5

AGING, MEMORY

R.J. IVNIK & J.F. MALEC. Older Persons' Reactions to a Computerized Assessment Battery in Comparison to Traditional Testing With Psychometrists.
Three hundred seventy-three older normal persons rated their reactions to traditional (person-to-person) testing versus computer-based testing in an effort to examine whether older persons are less receptive of, or "put off" by, computerized assessment techniques. Neither approach was rated as very similar to or dissimilar from ". . . activities I do often." Traditional approaches were slightly better "enjoyed" and also perceived as slightly more "reasonable ways to evaluate reasoning and memory." However, each approach was favorably rated with regards to these latter two judgments. Cautions regarding overgeneralizing these findings are appropriate. It may not be correct to assume that similar results will be found when patient ratings are obtained, or if different person-to-person or computer-based tests are used.

H. KAHN. Text Processing, Prior Knowledge, and Normal Aging.
Research on discourse and text processing in older adulthood has yielded conflicting results over the past several years. The current study compared two age groups (young vs. old) on a text processing task. It was hypothesized that the degree to which prior knowledge is invoked would influence the accuracy of comprehension. When text referred to information that fit prior knowledge there was no difference between age groups, however, when text did not fit prior knowledge, an age-related difference occurred. There was no effect of memory load according to age. We conclude that these results can be explained by age-related differences in the allocation of working memory resources.

S.C. MARSHALL & D. MUNGAS. Age and Education Correction for the Mini-Mental State Examination.
Mini-Mental State Examination (MMSE) scores have been shown to significantly differ across different ethnic groups. A number of studies have indicated that this difference is due to variations in educational level. This study developed a statistical method for adjusting MMSE scores for age and educational level. A population based sample of subjects with mixed age, educational level and ethnic origin was used. Results show that the adjusted MMSE variable (MMSEAdj) in comparison with the raw MMSE score has better overall sensitivity and equivalent specificity. The MMSEAdj also revealed more stability of sensitivity and specificity across education levels. Results indicate that the MMSEAdj variable has potential as a screening variable for dementia that is free of cultural and educational bias associated with the MMSE.

A.J. GIULIANO, C. McLAIN, & B. MARCOPULOS. Memory Assessment in Low Education Rural Elderly.
A sample of low education, rural community-dwelling elderly adults ages 55-98 yr provide age- and education-specific norms for several memory measures commonly used in the diagnosis of dementia. As expected, this group performed significantly below normative expectations. Analyses revealed significant main effects for age and education on most measures. However, performance on the Fuld Object Memory Evaluation was not influenced by education and most savings scores were resistant to the effects for age and education. Neither sex nor race were associated with performance on any index of memory, suggesting that corrections for these demographic variables may be unnecessary. Correlations among memory indices revealed modest positive relationships, indicating considerable variability in an individual's performance across these tests. Implications for memory assessment in low education elderly patients are discussed.

T.P. ROSS, P.A. LICHTENBERG, & B.K. CHRISTENSEN. The Clinical Utility of the Boston Naming Test for Use With Elderly Adults in an Urban Medical Sample.
Normative data on a sample of ethnically diverse medical patients found that age, education and race were significant predictors of BNT scores, and found lower BNT scores than was found in previously published norms (Ross, Lichtenberg, & Christensen, 1994). This study examined the utility of the BNT to discriminate between 123 cognitively intact versus 151 cognitively impaired persons in an urban, ethnically diverse medical sample of older adults (mean age = 77 yr). Discriminant Function Analysis correctly classified 72.5% of the overall sample. Cutoff scores were derived for three age groups (70-74, 75-79, 80+). Setting specificity in the low .80's, sensitivity ranged from .56-.68. Cutoff scores from previous norms (e.g., Van Gorp et al., 1986) resulted in the misclassification of 70-80% of cognitively intact persons in the present sample.

J.D. SUMMERS, P.A. LICHTENBERG, & S.J. VANGEL. Normative and Discriminability Properties of the Fuld Object-Memory Evaluation in an Urban Geriatric Population.
This study examined performance on the Object Memory Evaluation (Fuld, 1980) using a less educated and more ethnically diverse sample than was utilized in the original normative study. Sixty-three cognitively intact and 92 cognitively impaired patients, ages 70 to 89 yr, comprised this sample. Among the cognitively intact group, age was the only demographic variable related to each OME index. Means and standard deviations on the OME indices were almost identical to those found by Fuld. Discriminant function analysis results revealed that the cognitively intact group scored significantly higher on the OME than did the cognitively impaired patients. Cutoff scores at levels of adequate specificity, however, revealed low sensitivity. Overall, the results provide support for the usage of the OME with an urban, ethnically diverse sample.

S. WILKINS, S. OSATO, J. PICKETT, K. TINGUS, D. McNEILLY, J. SCHEIBEL, & R. KERN. Neuropsychological Findings in Depressed Geriatric Inpatients.
Older adults are reported to be at risk of developing cognitive dysfunction secondary to depressive illness. This study assessed 15 subjects with a diagnosis of Major Depression from an inpatient Geriatric Psychiatry unit in order to determine if they exhibited cognitive dysfunction related to their depressive disorder. Results indicated that most measures of neuropsychological ability were not correlated with level of depression (as measured by the Hamilton Rating Scale). The one exception was performance on Trails A, which evidenced a trend toward being correlated with severity of depression. In addition, the group was found to perform within normal limits on every test within the neuropsychological battery administered. These results suggest that depression in the elderly may not be a primary factor responsible for cognitive compromise.

M. SANO, D. DEVANAND, Y. STERN, & R. MAYEUX. Depression and Cognition in Non-Demented Elderly.
We examined the impact of depression on both memory complaint and cognitive impairment in a group of nondemented community dwelling elderly in northern Manhattan. Based on neurologic, neuropsychologic and medical evaluation, 586 elders were identified who were free of

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dementia or serious cognitive impairment. Participants were rated as depressed or not depressed based on a semi-structured interview with good predictive value for DSM-III-R criteria for depression. The depressed group had significantly more memory complaints, and poorer performance on organizational measures of memory and on a timed attention test than the non-depressed group. However, measures of immediate and delayed recall, language and abstract reasoning were not different between the two groups. These results suggest that memory complaint associated with depression may result from attention and concentration deficits.

D. SCHRETLEN, D.D. CORREA, M.T. SLODZINSKI, & M.A. DiCARLO. Learning, Forgetting, and Components of Recognition Memory in Depressed vs. Nondepressed Elderly Adults.
A three-trial, word list learning task, with 15-minute delayed free recall and yes/no recognition testing, was used to compare aspects of explicit memory performance in depressed and nondepressed elderly adults. To date, 25 nondemented patients with major depression, and 36 sex-, race-, and education-matched normal adults have been tested. The depressed patients learned fewer words over trials 1–3, but did not show a "flatter" learning curve than normal elderly adults. The patients showed marginally worse discrimination (*Pr*) between target words and foils, but did not differ in decision bias (*Br*), from normal controls. Finally, the two groups differed most strikingly in rate of "forgetting." Results are discussed in relation to previous findings regarding the impact of depression on mnestic abilities.

I.R. BELL, E.B. MONTGOMERY, Jr., W.C. KOLLER, T.J.K. LAMANTIA, M.C. NEWMAN, E.F. SWANSON-HYLAND, & A.W. KASZNIAK. Olfactory Identification Deficits Associated With Subclinical Depression in Older Adults.
Previous research in mixed age samples suggests that olfaction, which is impaired early in neurodegenerative disorders such as Alzheimer's (AD) and Parkinson's (PD) diseases, is either normal or impaired in major depression. Late onset depression can precede AD and PD. The purpose of this study was to examine the relationship, if any, between depression and olfactory identification performance in older, clinically healthy adults. Nineteen older adults (mean age = 64.0, $SD = 8.1$; 52.6% women) completed the Beck Depression Inventory (BDI), standardized University of Pennsylvania Smell Identification Test (UPSIT, age- and gender-corrected), and the Animal Naming Task (as a control for any naming impairment confounds in UPSIT performance). After removal of one outlier, mean BDI = 4.2, $SD = 2.4$; mean UPSIT = 73.8, $SD = 18.1$; mean Animal Naming = 18.1, $SD = 4.1$. BDI correlated negatively with UPSIT ($R = 0.56$, $p = 0.008$) but not with age or Animals. On stepwise multiple regression, BDI accounted for 31.2% of the variance in UPSIT scores (beta = −0.56, $t = -2.7$, $p = 0.016$). The findings suggest an association between greater depression and poorer olfaction in older adults with clinically normal neurological status. Replication and extension to late onset geriatric major depressives is now indicated.

M.I. VRBANCIC & S. FREY. Procedural Memory and Cognitive Functioning Following Left Parietal or Temporal Lobe Cortical Lesions and in the Normal Elderly.
Individuals were administered a mirror-tracing (MTr) task to assess procedural memory capabilities, and a neuropsychological battery to assess cognitive functioning. Nine out of 10 normal elderly (NE) and 3 out of 5 individuals with either left temporal lobe (LT) or parietal lobe (LP) lesions were able to complete the MTr task. The three groups did not differ significantly in age or level of achieved education. The NE had a significantly higher estimated premorbid level of intelligence, vocabulary, and learning and memory skills than the other two groups. The LT group had significantly lower learning and memory than the other two groups. Conversely, the LP group made significantly more sequencing and initiation errors than the other two groups. Both the LT and LP lesion groups had learning and memory difficulties and increased sensitivity to proactive interference. Regardless of the group cognitive differences, all individuals demonstrated learning on the procedural memory task (MTr), retained this skill over time, and generalized it to a novel figure.

N.L. DENBURG, P.S. FASTENAU, L.A. DOMITROVIC, & N. ABELES. Increasing Neuropsychological Asymmetry With Age: Mixed Evidence for the Right-Hemisphere Hypothesis.
There is behavioral data and some neuroanatomical evidence suggesting that right hemisphere functioning, the more visual-spatial hemisphere, may decline with age more rapidly than the left, more auditory-verbal hemisphere. Auditory-verbal and visual-spatial tasks were administered to 90 healthy adults (age-/sex-stratified, ages 30–80+). Utilizing regression analyses, a negative relationship between age and visual-spatial abilities and a sex effect wherein males showed higher visual-spatial abilities than females ($p \leq .001$) emerged. An Age × Sex interaction was found for the auditory-verbal cluster ($p \leq .05$) in which a positive relationship was demonstrated for females and age only. The results of this present study provide mixed support for the right hemisphere hypothesis.

G.E. SWAN, D. CARMELLI, & A. LaRUE. The Relationship Between Blood Pressure During Middle-Age and Cognitive Impairment in Old-Age.
We examined the relationship between cardiovascular risk factors measured during middle-age and incidence of global cognitive impairment 27 to 33 yr later. Beginning in 1960, blood pressure was assessed biannually through 1969. Also assessed were educational attainment, central obesity and a variety of other cardiovascular risk factors. Between 1986 and 1994, 1,183 male subjects (mean age = 75 yr) were assessed using standard neuropsychological measures. Cognitive impairment was defined on the basis of test performance, self-report of dementia, or death or disease due to dementia. This definition resulted in 91 cases of cognitive impairment. Those who became cognitively impaired were older at intake ($p < 0.0001$), had lower educational attainment ($p < 0.03$), and higher mean systolic blood pressure during middle age ($p < 0.0001$). There was a tendency for those with cognitive impairment to have more central obesity during middle age ($p < 0.09$). In multivariate logistic regression analyses, systolic blood pressure during middle age remained a significant independent predictor of cognitive impairment in old age after adjustment for age, education, central obesity, and the presence of stroke at the time of cognitive testing. These results suggest that higher levels of systolic blood pressure measured during middle-age are predictive of the incidence of cognitive impairment in old age.

C.A. MANNING, W.S. STONE, & P.E. GOLD. Glucose Effects on Memory Retrieval in Healthy Elderly.
This experiment examined enhancement of memory storage by glucose in elderly humans. Glucose (50 g) or saccharin was administered shortly before acquisition of a prose passage (preacquisition condition) or immediately before recall of the passage 24 h later (postacquisition retrieval condition). Compared to performance in the saccharin condition, glucose administration before hearing the passage or before recalling the passage 24 h later significantly enhanced performance. These findings suggest that glucose enhances memory retrieval processes in elderly humans as seen in the postacquisition condition and, as seen in the preacquisition condition, enhancement of memory outlasts the transient elevations in blood glucose after glucose ingestion.

B. COLLINS & A. TELLIER. The Role of Working Memory in Explaining Age-Related Differences in Cognitive Flexibility.
Folk wisdom as well as an impressive body of empirical evidence attests to the fact that cognitive flexibility declines with age. Definitions of cognitive flexibility suggest that it is dependent on working memory capacity. The current project investigated the degree to which the relationship between age and cognitive flexibility (as measured by the number of perseverative errors on the Wisconsin Card Sorting Test) could be attributed to age differences in working memory (as reflected in an index

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comprised of scores from a variety of measures of working memory). Controlling for working memory capacity did not eliminate age differences in cognitive flexibility but, in fact, enhanced the latter relationship. The results are discussed in terms of a "processing resources" account of cognitive aging.

J. QUINLAN, M. NICHOLAS, L.K. OBLER, & M.L. ALBERT. Confrontation Naming and Verbal Fluency in Normal Aging.
This study looked at the effect of aging on retrieval of words in three types of lexical retrieval tasks: confrontation naming (Boston Naming Test, Action Naming Test), list generation by category (Animals), and by letter (FAS) in 119 normal adults aged 31–82 yr. Significant age effects were seen on the BNT, ANT, and Animals, but not on FAS. Performances on confrontation naming tasks were correlated with each other but not with FAS. Animals, however, was not correlated with BNT or ANT. We conclude that lexical retrieval of names on confrontation naming tasks may involve different mechanisms than those involved in the retrieval of names in verbal fluency tasks, and that aging has differential effects on these retrieval processes.

J.H. BOBHOLZ, M. SEIDENBERG, & R. FARINPOUR. Relationships Between Measures of Executive Functioning and Memory Among Healthy Older Adults.
This study investigated the relationship between executive functioning and indices of both short-term memory (STM) and long-term memory (LTM) in a sample of 45 healthy elderly individuals (mean age = 75.1 yr, $SD = 6.6$). Measures of visual-perceptual functioning were also completed to determine if findings were specific to measures of executive functioning. Significant interrelationships were found between age, STM, LTM, executive functions, and visual-perceptual functions. Simultaneous multiple regression analyses indicated that executive functioning accounted for a significant amount of variance in STM but not LTM. This relationship was specific to executive functioning since visual-perceptual functioning did not have the same pattern of associations with STM and LTM. These findings support recent proposals which have suggested a significant role for executive functioning in STM.

M.A. PAVOL, P.J. MASSMAN, K.F. MORTEL, M.J. MARIOTTO, & J.S. MEYER. The Effect of Leuko-Araiosis on Frontal Lobe Functioning in Nondemented Elderly Subjects.
The relationship between frontal lobe white matter brain lesions (leuko-araiosis) and performance on neuropsychological tests of frontal lobe function was examined. Frontal lobe leuko-araiosis was quantified using CT scan data, and regression analyses were performed relating neuropsychological measures (Controlled Oral Word Association (COWA), Trail Making Test (TMT), Wisconsin Card Sorting Test, Design Fluency Test, and Similarities subtest of the WAIS-R) to this leuko-araiosis index. Nondemented elderly subjects ($N = 17$) were evaluated and two of the neuropsychological tests, COWA and TMT, were found to predict the quantity of leuko-araiosis. However, the tests were not significant predictors after accounting for frontal lobe size. The relationship between whole-brain atrophy and neuropsychological performance was also examined. Degree of brain atrophy was predicted from COWA, TMT, and years of education.

B. LEVINE, D.T. STUSS, & W.P. MILBERG. Concept Generation Performance in Normal Aging and Frontal Dysfunction: Preliminary Validation of a Clinical Test.
A concept generation test involving grouping of stimuli was administered to 60 normal Ss in three age groups and 14 Ss with frontal lesions. This test was designed to fractionate the processes underlying sorting performance in quickly administered, paper and pencil format. Both elderly and frontal lesion Ss were impaired in the generation and naming of groupings. This effect was not attributable to lower overall output. Repetition errors were associated with age and brain damage. When structure was provided via cueing, group differences were attenuated or eliminated. The task's validity was supported by the pattern of correlations with other measures. These findings were consistent with those expected from the literature on cognitive functioning in the elderly and patients with frontal systems dysfunction.

F. SPAGNOLO, M. NICHOLAS, & M.L. ALBERT. Across the Ages: Idiom and Proverb Interpretation in Normal Aging.
Figurative language tasks, such as interpreting idioms and proverbs, are routinely used in evaluating neurological patients, including patients with unilateral brain damage. Few studies have evaluated idiom and proverb interpretation in normal aging. Given the impairment in the ability to interpret figurative language demonstrated by patients with right brain-damage, in conjunction with the hypothesis that right hemisphere functions are more susceptible to normal aging, we may expect some decline in idiom and proverb interpretation with normal aging. This study investigated the ability to interpret 11 common idioms and proverbs in 78 adults (ages 33–82 yr). Using a newly developed, reliable scoring system, we found only minimal decline on these tasks, and conclude that there is no age-related impairment in the ability to interpret figurative language.

P. LICHTENBERG, S. VANGEL, & T. ROSS. Normative and Utility Data for the Logical Memory Subtests of the WMS-R Using an Ethnically Diverse Older Sample.
A paucity of data exists for the Logical Memory subtests of the WMS-R for urban, ethnically diverse samples. This project utilized 99 cognitively-intact and 245 cognitively-impaired older urban medical patients to derive normative and utility data on LMI and LMII. Age and education were significant correlates with LM subtests whereas race and gender were not. Means for the cognitively intact group were slightly lower than those reported by Ivnik et al. (1992), reflecting the lower educational level of this sample. Discriminant Function Analyses were significant in differentiating intact versus impaired subjects for both LMI and LMII. However, cutoff scores at the .85 specificity level produced poor sensitivity (.50). Clinicians must be cautious not to rely solely on LM subtests for memory assessment with this population.

D. WEISS, K. BOONE, J. MURRAY, & W. VAN GORP. The Neuropsychological Sequelae of Chronic Cigarette Smoking in a Healthy, Older Adult Population.
The devastating medical effects of chronic cigarette smoking are extensively documented but its neuropsychological effects are surprisingly unexplored. Chronic smoking is believed to produce a recurrent hypoxic effect on brain functioning. Smokers, ex-smokers, and nonsmokers ($N = 123$) were included in the study. Results indicated a significant negative correlation between years smoked and memory, executive functioning, naming, word generation, and Performance IQ. Significant group differences in NP performance were not revealed. However, a trend emerged between ex-smokers and smokers on a measure of visual memory. Although the present study was unable to find significant differences in neuropsychological impairment between smokers and nonsmokers, it does appear that prolonged smoking is associated with decline in selected areas of cognitive functioning.

D. MUNGAS, S.C. MARSHALL, & B.R. REED. Development of English and Spanish Language Neuropsychological Tests for the Elderly.
The purpose of this project was to develop a neuropsychological test battery for use with the elderly that has matched English and Spanish language versions. Twelve scales with neuropsychological relevance were defined and 90 to 100 items were generated and translated for each. Scale construction follows a two step process in which biased items are eliminated and items are then selected to fit a uniform distribution of difficulty. A population based sample of English and Spanish speaking elderly is being used for test development. Data analyses indicate that this process yields scales that are closely matched in overall reliability and in mean and distribution of item difficulty. Differences related to language group were present for only one of the twelve scales after con-

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trolling for the effects of education. This approach appears to have considerable promise as a method for constructing psychometrically matched tests.

B. ROPER, L. BIELIAUSKAS, M. BASSO, & S. COLMAN. The Influence of Age and Impairment Status on the Southern California Figure-Ground Visual Perception Test.
The Southern California Figure-Ground Visual Perception Test (FG) was administered to 49 cognitively normal (CN) geriatric medicine inpatients and 28 patients with a history of cerebrovascular accident (CVA). The CN patients scored substantially lower than a younger adult normative sample reported by Bieliauskas, Newberry, and Gerstenberger (1988), and CVA patients scored substantially lower than CN patients. Results suggest that comprehensive elderly norms are needed for FG. Refinements in the assessment of visual perceptual abilities are needed to adequately differentiate certain disease sub-types in the elderly.

A. VAZZANA, F.W. BYLSMA, & C. KAWAS. Performance of Normal Elderly Persons on the Rey-Osterrieth Complex Figure Test (CFT).
The effects of age, sex, and education on CFT copy performance were assessed in 138 elderly persons (83 male, 55 female) between the ages of 70 and 93 yr ($M = 77.4$) from the Baltimore Longitudinal Study of Aging (BLSA/NIA). Subjects had Mini-Mental State Exam scores above 24, and they averaged 16 yr of education (range 8-25). Subjects were grouped by sex, education (high school, some college, college graduate, post graduate), and age (70-74, 75-79, 80-84, 85+). Sex had no effect on performance (Male: 30.8 ± 3.7; Female 30.5 ± 3.6). Increasing age and fewer years of education negatively impacted CFT copy scores more for males than females, however, these effects were not statistically significant. Performance on the copy trial of the CFT was not affected by age, education, or sex of subjects in this sample of highly educated elderly subjects.

N.A. PACHANA. Case Report of Frontal Lobe Functioning in a Young Woman With Wernicke-Korsakoff's Syndrome.
A case is presented of a young woman diagnosed with WKS. Neuroimaging and neuropsychological testing early and late in her hospital course demonstrate a favorable change in frontal functioning, as measured by regional cerebral blood flow (rCBF) changes as well as improved performance on executive tasks. Structural abnormalities in the mammillary bodies remained unchanged, as demonstrated by magnetic resonance imaging (MRI). This case illustrates changes in memory and frontal functioning as part of a WKS, changes which are not confounded by age effects in this young patient.

B.A. WILSON, R. GREEN, T.W. TEASDALE, K. BECKERS, F. CALICIS, S. DELLA SALA, E. WEBER, R. KASCHEL, & U. SCHURI. How Normal is the Performance of Amnesic Subjects on Tests of Implicit Memory?
We administered three tests of implicit memory to 136 control subjects and 16 amnesic subjects. The tests were fragmented pictures (a visual perceptual priming task), Korean melodies (an auditory perceptual priming task) and mirror tracing (a motor skill learning task). Having established normal performance on these tasks we compared the results of amnesic subjects to the controls. Amnesic subjects, as a group, were poorer than controls on two of the three tasks although they showed a similar pattern of learning over time. There was no difference between groups on the auditory task. Using a cut off point of 2 *SD* from the mean of the controls we looked for poor performance among Amnesic subjects and for double dissociations between tasks. We found such dissociations, and this suggests that functionally distinct systems underly the performance of implicit memory tasks.

S.M. DELANEY & E.L. GLISKY. Implicit Learning in Post-Traumatic Amnesia.
The purpose of these two studies was to demonstrate preserved implicit memory performance for word lists and factual information in post-traumatic amnesia (PTA) patients. The first study compared implicit and explicit memory performance for eight PTA patients and matched controls. PTA patients showed intact priming, while performing significantly worse than controls on explicit memory tests. The second experiment used the method of vanishing cues developed by Glisky and Schacter to teach five fictitious facts to four patients (while in the PTA state) and four matched controls. PTA patients showed retention of the information following the 5-day and multi-week delays. Discussion will focus on implications for rehabilitation, as well as underlying memory systems proposed by Schacter and Tulving to mediate these abilities.

M. IACOBONI, J. RAYMAN, & E. ZAIDEL. The Effect of the Previous Trial in Lexical Decision.
The effect of previous trial variables on current performance in a lexical decision task was investigated. An incorrect encoding of the previous trial significantly enhanced current performance in the left visual field, but had an opposite (albeit nonsignificant) effect on current right visual field performance. In addition, the presence of a target in each visual field in the previous trial enhanced the current performance in the corresponding visual field. It is proposed that the observed previous trial effects are effective at a late state of response programming.

R.C. MARTIN, M.W. HAUT, & K. GOETA-KREISLER. Neuropsychological Functioning in a Patient With Paraneoplastic Limbic Encephalitis.
We describe the case of a 54-yr-old female diagnosed with Paraneoplastic Limbic Encephalitis (PLE) following biopsy diagnosed adenocarcinoma of the right upper lung lobe. Neuropsychological evaluation revealed within normal limits on measures of language, visual perception, visual construction, perceptual organization, and psychomotor speed. However, she displayed profound memory impairment for all auditory and visually-based immediate and delayed free recall memory tasks. Her recognition memory performance for the most part was only at chance levels. Overall, her performance was characterized by a profound anterograde amnesia which reflected impaired consolidation processes for new information. This data is consistent with the neuropsychological literature with other MTL amnestic patients, and adds further support to the idea that MTL structures are critical for consolidation processes.

S. McARTHUR, D. SHORE, & S. VOELKER. Cognitive Recovery Following Unilateral Electroconvulsive Therapy (ECT).
Attempts to minimize the cognitive sequelae of ECT have led to emphasis on nondominant hemisphere application. The present study examined the effects of unilateral ECT on general cognitive functioning and various components of memory for 34 neurologically normal, severely depressed, predominately elderly subjects ($M = 68$ yr). All subjects received pre- and post-testing before and either immediately following ECT ($n = 27$) or 60 d after ECT ($n = 7$). The groups were matched on demographics, thus allowing for an analysis of the influence of time on cognitive recovery. Nonmemory variables most immediately disrupted by ECT evidenced the greatest improvement after 60 d, suggesting that observed declines are likely to be temporary inefficiencies. Memory improved with time, but failed to normalize. The implications of these results are discussed.

D.A. WHITE, S. CRAFT, S. HALE, J. SCHATZ, & T.S. PARK. Working Memory Following Improvements in Articulation Rate in Children With Cerebral Palsy.
It has been shown that articulation rate is strongly related to verbal working memory capacity (e.g., Baddeley et al., 1975). A previous study of normal controls (NC) and children with spastic diplegic cerebral palsy (SDCP) suggested that covert rather than overt rehearsal rate determines working memory capacity (White et al., 1994). In the current study, NC children and children with SDCP who underwent surgery to relieve spasticity were retested on articulation and word span measures 8 mo later.

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The SDCP group showed improved articulation rate, though span was again equivalent to that of controls. These findings suggest that increases in articulation rate are not necessarily accompanied by improved memory span, and provide additional evidence that working memory capacity is determined by covert rather than overt rehearsal rate.

P. SAMSON, R. FERRARO, T. PETROS, C. YEAGER, & L. FELLBAUM. Impairment of Working Memory in Adult Children of Alcoholics.

Male adult children of alcoholics (ACA) and control subjects, matched on age and WAIS-R vocabulary scores, were administered the Sternberg Memory Scanning task and the digit span task. The results indicated that ACA subjects searched short term memory at a slower rate than controls. In addition, no group differences were found on digit span forward but ACA subjects recalled fewer items than controls on the digit span backward task. The results indicated that working memory functions less efficiently in adult children of alcoholics than in control subjects.

K. CARROLL, R. McGLINCHEY-BERROTH, M. VERFAELLIE, L. CERMAK, & R. BAUER. Orienting to Stimulus Significance and Stimulus Repetition in Amnesia.

Response to stimulus significance and repetition was investigated in a recurrent detection paradigm on amnesic Korsakoff patients, alcoholic controls, medial temporal amnesics, and normal controls. The subject's task was to respond to the second presentation of a significant item. Behavioral recognition was significantly impaired in amnesics compared to their respective controls. Skin conductance response, a physiological measure of orienting, revealed greater orienting to significant versus nonsignificant stimuli and to the second versus first presentation of a stimulus for all groups. A significant interaction indicated orienting only to the second presentation of significant stimuli. For amnesics orienting occurred only for those items that were overtly recognized. This suggests that the deficit in recognition memory in amnesia is accompanied by deficits in physiological orienting.

L. FREEDMAN & L. McFADDEN. Diencephalic Amnesia Secondary to Craniopharyngioma.

The neurocognitive and radiological findings are described in a 35-yr-old male (Case 1) and 58-yr-old female (Case 2) presenting with craniopharyngiomas. For Case 1, the prominent neurocognitive deficit over serial post-operative examinations was a global amnesia characterized by rapid forgetting. A post-operative MRI in Case 1 showed recurrent tumor invading the hypothalamus, mamillary bodies, mamillothalamic tract, and anterior thalamic nuclei. Case 2 demonstrated a global amnesic disorder accompanied by impairment in nonmemory function related to a left hemispatial neglect. A post-operative CT scan showed residual tumor in the hypothalamus, mamillary bodies and fornix. The lesion geography in these cases reflect a diencephalic amnesia, and the anatomy from Case 2 indicates that thalamic damage is not necessary for its development.

S.C. BOWDEN, M.L. AMBROSE, & G. WHELAN. Thiamin Enhances Memory Performance in Alcohol Dependent Patients Without WKS.

Recent estimates of the incidence of Wernicke-Korsakoff Syndrome (WKS) have been reported at 1-2%, indicating that WKS is more common than suggested by clinical prevalence figures. Thus there may be an unrecognised subgroup of alcohol dependent (AD) people who may benefit from thiamin treatment. The present study sought to evaluate the therapeutic effect of intramuscular thiamin in a sample of 20 AD subjects without obvious WKS. The study compared the post-treatment neuropsychological performance at four different levels of thiamin dosage (5, 20, 50, 100 mg IM, respectively) under a randomized double-blind design. The results suggest that after two days of treatment, there is a dose-response relationship between parenteral thiamin administration and performance on tasks sensitive to CNS functioning.

R. HART, S. SCHWARTZ, & M. MARTELLI. Memory Consolidation Deficit in a Case of Cardiopulmonary Arrest.

We assessed a severely amnestic survivor of cardiopulmonary arrest (CPA) and compared his performance on forgetting tests for words, pictures and designs to that of small group of matched control subjects. In addition to memory impairment he displayed milder deficits in spatial-constructional-organizational skills and psychomotor speed, consistent with reports of other CPA survivors. The finding of major interest was the patient's abnormally rapid forgetting of all three stimuli relative to control subjects, characterized by chance performance on recognition memory tests at a 2-h delay. The pattern of findings suggests a deficit in memory consolidation which might be predicted on the basis of neuropathological changes following CPA.

B.J. DIAMOND & J. DeLUCA. Executive Functions and Memory Impairments in Patients with Aneurysms of the Anterior Communicating Artery.

Memory impairments often accompany Anterior Communicating Artery (ACoA) aneurysm. The purpose of this study was to examine visual memory performance when subjects were administered an organizational strategy for remembering the Rey Complex Figure Test. Ten AcoA subjects, 6 amnesics and 4 nonamnesics served as subjects. While displaying normal copy scores the amnesic compared with the nonamnesic group exhibited a profound loss of information between the Copy and the Immediate Conditions ($p = .001$). Importantly, when a Composite Memory Index (CMI) score was computed (representing recall, recognition or spatial discrimination) no significant differences were found between the two groups. These findings may suggest that at least some amnesic ACoA's have impairments in executive function and encoding, but does not support accelerated forgetting of visual material.

L.M. GRATTAN, P.J. ESLINGER, T. PRICE, & F. ALDRICH. Recall of Contextually-Congruent and Contextually Incongruent Information After Frontal Lobe Lesion.

The posterior ventromedial (PVM) frontal lobe plays an important role in learning and memory. Anecdotal and theoretical evidence suggests this region is specialized in the spatial-temporal components of contextual memory. However, recent empirical studies fail to confirm this hypothesis. Using a new experimental procedure, 8 patients with PVM frontal lobe lesions were compared to patients with orbital frontal, dorsolateral frontal and cortical nonfrontal lesions on recall of contextually congruent and incongruent social information. Findings indicate that the PVM and orbital frontal groups had similar recall for the two congruency conditions while recall for incongruent information was better for the other groups. The PVM and orbital frontal lobe regions may play a specialized role in memory for novel or incongruent information.

F.J. BARDENHAGEN & S.C. BOWDEN. Declarative and Procedural Memory in Delayed Matching to Sample.

Successful performance in delayed matching to sample (DMTS) is thought to require memory for both the rule of the task and for the stimuli presented. There is some dispute, however, over whether knowledge of the rule is procedural or declarative. To clarify this issue, alcohol-dependent subjects and normal controls were tested on a lists version of DMTS where rule provision and acquisition training were manipulated in a factorial design. No group differences were found, but there was a significant effect for rule provision, and a highly significant effect of list length. The results suggest that knowledge of the delayed matching rule does contribute to performance, and that memory for the stimuli over time is the crucial declarative component of DMTS.

L.A. DOMITROVIC, N.L. DENBURG, & P.S. FASTENAU. Recognition and Matching Trials for WMS-R Visual Reproductions: Psychometric Properties.

The reliability and validity for Recognition and Matching Trials were demonstrated with 90 nonneurological community-dwelling adults. Cor-

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relations with other visuospatial measures of secondary memory and perceptual integrity demonstrated some convergence in a common domain, yet without redundancy ($r = .32$–$.65$, $p < .01$). Cronbach alphas were modest (Recognition Trial, $\alpha = .58$) to weak (Matching Trial, $\alpha = .40$), and item difficulty indices were low. This was to some degree an artifact of the limited number of items and the simplicity of the items. Recommendations for future modifications are offered.

P.S. FASTENAU, N.L. DENBURG, & L.A. DOMITROVIC. Intentional and Incidental Learning: Order Effects in Clinical Testing (WMS-R, CFT, and Cowboy Story).
We tested the hypothesis that the administration of intentional memory tests early in a clinical battery artificially enhances performance on subsequent incidental memory tests. Ninety healthy adults were randomly assigned to two testing conditions (Incidental-followed-by-Intentional and vice versa). Incidental measures were Complex Figure Test and Cowboy Story; intentional measures were WMS-R Logical Memory and Visual Reproductions. Dependent variables were immediate recall, delay recall, and recognition for each of the four tests. A main effect for Condition appeared for only one incidental measure, Cowboy Delay ($p < .05$), and the effect size was small ($r = .18$). Clinicians can take comfort from these results and be confident that order of administration does not confound test interpretation.

R.A. LANHAM, R.J. BLAKE, S.M. LUNDGREN, & B.J. SIGFORD. Revisiting the Structure of the Wechsler Memory Scale-Revised (WMS-R) With Multidimensional Scaling: A New Approach to an Old Issue.
Factor-analytic studies of the Wechsler Memory Scale-Revised (WMS-R) have produced inconsistent structural solutions which may reflect shortcomings of the procedure as a discovery tool for dimensions beyond the unidimensional, general memory factor that the majority of past studies have found. This study applied a multidimensional scaling (MDS) procedure to age-corrected raw and percent retained (savings) scores derived from a mixed clinical sample. Results suggest that the clusters of variables reflect a two-dimensional space, the first corresponding to immediate versus recent memory and the second to visual versus verbal memory. This representation of the data "fits" with the manner in which these subtests are clinically interpreted and may indicate MDS as a more appropriate technique for analyzing the WMS-R's structure.

J.S. KIXMILLER, K.A. CHASE, M. VERFAELLIE, & L.S. CERMAK. Intrusion Errors on the WMS-R Visual Reproduction Test: A Comparison Between Three Groups of Amnesic Patients.
To examine the contribution of amnesia and frontal dysfunction to the production of intrusion errors, Alcoholic Korsakoff (AK), mesial temporal amnesic (AMN), and anterior communicating artery aneurysm (ACoA) patients were assessed using the Visual Reproduction subtest of the WMS-R. At immediate recall, AK patients made more intrusions than AMN and ACoA patients. Because AK and ACoA patients perform equivalently on frontal tests (and more poorly than AMN patients), but differ in severity of amnesia, these results suggest that intrusions are due to a combination of deficient memory and frontal dysfunction. After a delay, ACoA patients made more intrusions than the other groups. Intrusions increased for ACoA patients because of diminishing memory and decreased for AK patients, reflecting the total loss of information in memory.

A.K. ROGERS & B.E. GRIDLEY. The Internal Structure of the Wide Range Assessment of Memory and Learning: Who's Right?
Investigations have questioned whether the WRAML factor structure accurately reflects the nature of the latent variables involved in children's memory. The present study subjected the WRAML intercorrelation matrices ($N = 2363$) to confirmatory factor analyses using LISREL-VII. Six competing latent variable models for each age group (≤8 yr, ≥9 yr) were established a priori with factor compositions suggested by previous research. Results did not support the WRAML factor structure. A model containing Visual, Verbally-Mediated, and Attention factors provided the best data fit. Results suggested differential effects of memory and attention on selected subtests which may provide developmentally significant data for future WRAML research.

M.C.S. HARNADEK & D.L. SHORE. Validity of a Model-Based Procedure for Assessing Episodic Memory.
The construct validity of the acquisition measures (α' and α) included within a newly developed two-stage Markov model of learning is investigated. Twenty left temporal lobectomy (LT), right temporal lobectomy (RT), and normal control (NC) subjects, matched for age and education, were administered a verbal list-learning task. Low estimates of acquisition (α' and α) distinguished the LT group from the RT and NC groups. The sensitivity of the acquisition measures in differentiating left temporal lobectomy patients apart from right temporal lobectomy patients and control subjects supports the validity of the acquisition parameters.

J. DONDERS. Confirmatory Factor Analysis of the Wide Range Assessment of Memory and Learning.
Confirmatory factor analysis was performed on the WRAML standardization sample. Four hypothetical models with regard to what functions are measured by the WRAML were evaluated, with an emphasis on models that had not been tested with CFA previously. Results indicated that a three-factor model including Visual Memory (Picture Memory, Design Memory, Finger Windows, Visual Learning), + Verbal Memory (Verbal Learning, Story Memory, Sound Symbol), + Attention/Concentration (Sentence Memory, Number/Letter) was far superior to any of the other models. It was concluded that there is no clear psychometric support for the use of the conventional Verbal, Visual, and Learning indices proposed by the WRAML test authors. Implications for further research were discussed.

L.A. SIMON, K.B. BOONE, & J. MURRAY. Construct Validity of the Recognition Memory Test: A Factor Analytic Investigation.
A principal components factor analysis with a varimax rotation procedure was conducted to investigate the construct validity of the Recognition Memory Test (Warrington, 1984). Nine variables including the RMT subtests, WAIS-R, VIQ and PIQ, and WMS-R subtests were utilized in the analyses and a three factor solution was generated. The verbal IQ measure and verbal recall measures loaded most heavily on Factor one. Measures evaluating nonverbal recall abilities and nonverbal IQ loaded most heavily on Factor two. Finally, the RMT subtests loaded on the third factor. The solution accounted for 57% of the variance in the nine variables. The construct validity of the RMT was supported, as both RMT subtests loaded on a factor separate from the IQ and free recall measures.

F.F. LEFEVER & E.I. KUMKOVA. The Face in Space Test (FIST): An Attempt to Assess "What" and "Where" Visual Memory Concurrently but Separately, and What/Where Associative Memory.
Current visual memory tests do not fully or explicitly exploit knowledge of parallel cortical processing streams, a dorsal one dealing with location or orientation and a ventral one for object identification. The Face In Space Test (FIST) measures memory for faces in an irregular array within an irregular space intended to discourage verbal encoding of rectangular coordinates, with separate but concurrent scores for Faces, Locations, and Face/Location associations. For 16 females and 15 males (ages 26–72), Face and Location each correlated weakly with face recognition in Warrington's Recognition Memory Test (RMT) but not with each other, so FIST may measure separate aspects of visual memory in one brief procedure. RMT, requiring only discrimination of old from new items, did not correlate with Face/Location; it is significant that FIST, especially its Face/Location recall, measures association of com-

plex stimuli (all made familiar in practice trials), for which the hippocampus is uniquely important.

G.G. KAY, V.N. STARBUCK, & L. LEVY. Functional MRI in Transient Global Amnesia: A Case Study.
The current study used fMRI technology to evaluate a case of transient global amnesia (TGA). The patient (MP), a 55-yr-old Korean American, was studied during a 6-h period of amnesia and again 2 wk later, when memory functions had returned to normal. Auditory verbal memory testing was conducted during fMRI recording. fMRI images were recorded from locations maximizing left medial temporal (hippocampal) and frontal regions. MP was unable to recall or recognize items at the initial test session. fMRI results from the initial session showed no activation during memory testing. In contrast, after TGA had cleared the patient demonstrated normal word list learning and recognition. Activation in the mid-temporal region occurred during list learning and recognition. Frontal activation was seen only during recognition testing.

C. GOW, D.T. STUSS, & F.I.M. CRAIK. Source Amnesia in Patients With Focal Frontal Lobe Damage.
Memory for facts, and for the source of those facts was comparatively examined in patients with focal damage to either left (LF) or right (RF) frontal lobes, and age- and education-matched normal control subjects following a 15 minute, and one week delay. Fact recall was equivalent between the groups; however, the RF group tended to have more difficulty recalling the intra-experimental source, while the LF group had more difficulty recalling the extra-experimental source. These data support the postulate that relatively distinct functional units exist within the frontal cortex, and concur with recent evidence implicating right frontal lobe activation in attention-demanding tasks, and episodic memory.

P.J. MATTIS, C.A. MEYERS, & H.J. HANNAY. The Effects of Treatment and Malignancy on Memory Tests in Patients With Primary Brain Tumors.
Past research has suggested that brain tumors do not exhibit the same focal findings as other types of lesions. The current study looks at the effects of the severity of the malignancy and treatment with radiotherapy and chemotherapy on memory functions. Multivariate statistics were used to investigate localization issues. The current study did exhibit evidence to support the hypothesis that these factors effect the focal quality of a brain tumor lesion.

P.J. MATTIS, C.A. MEYERS, & H.J. HANNAY. Verbal and Nonverbal Memory in Patients With Primary Brain Tumors.
Performance on memory tasks have been related to damage to specific cerebral locations. However, on other cognitive measures patients with brain tumors have not always exhibited the expected focal findings. The present study looked at performance on a verbal (VSRT) and nonverbal (NVSRT) selective reminding memory test in a sample of adult patients with primary brain tumors. Multivariate statistics were used to investigate localization issues. As expected, patients with left hemisphere damage did not perform as well as patients with right hemisphere damage on the VSRT, with the worst performance seen in patients with left temporal lobe damage. Recall after a delay was found to be a more sensitive measure than a learning score. There were no localization findings for the NVSRT.

L. FREEDMAN & D. IZUKAWA. Amnesia and Right Superior Quadrantanopia Following Rupture of a Choroid Fissure AVM.
The neurocognitive and radiological findings are described in a 27-yr-old male presenting with a ruptured choroid fissure AVM. The patient exhibited prolonged temporal disorientation and confusion post-rupture. The acute CT showed intra-ventricular hemorrhage, including the left temporal horn. Neurocognitive testing identified a profound global amnesia along with a right superior quadrantanopia. The neurocognitive profile additionally showed moderate impairment in other domains. Late MRI showed an area of high signal in the left temporal horn, compatible with a thrombosed choroid fissure AVM. Anatomically, the hippocampus and Meyer's loop form the medial and lateral borders of the temporal horn respectively, and damage to these structures in the left hemisphere resulted in the global amnesia and right superior quadrantanopia.

Birch Memorial Lecture

WHAT CAN "PET" TELL US ABOUT MEMORY?

Endel Tulving

SATURDAY MORNING, FEBRUARY 11, 1995

Paper Session 15

SCHIZOPHRENIA

S.L. ROSSELL, J.K. FOSTER, & P.R. MEUDELL. Recency Judgment in Schizophrenia.
A test of recency memory was administered to a group of patients with schizophrenia and a group of matched control subjects. Schizophrenic subjects were unimpaired when tested for recognition of target items. However, in contrast to controls, schizophrenics showed a significant tendency to base their recency judgments upon an assessment of the "trace strength" of stimuli. This effect did not appear to be related to an individual's level of pre-morbid intelligence. However, a significant relationship did emerge between the magnitude of the strength effect and (i) performance on tests of frontal functions, (ii) the degree of current illness severity. These findings are important in considering the types of memory-related dysfunctions which may occur in schizophrenia and the putative neurological mechanisms underlying such deficits.

R. SALO, L.C. ROBERTSON, & T. NORDAHL. Negative Priming in Persons With Schizophrenia.
Groups of patients with schizophrenia were compared to healthy controls in a study of negative priming using Stroop stimuli. Negative priming is used as a measure of inhibitory attentional processing. Patients were volunteers in a clinical trial and were tested once off and once on medication. Controls exhibited typical negative priming. Schizophren-

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ics tested OFF medication showed no negative priming, and if anything the reverse. In contrast, the schizophrenics tested ON medication showed negative priming similar to the healthy controls. The lack of negative priming in the unmedicated condition may reflect a dysfunctional inhibitory system. Improved performance of the patients on medication suggests that neuroleptic treatment may improve these aspects of attentional processing.

M.F. GREEN, R.S. KERN, O. WILLIAMS, C.D. CHRISTENSON, D. HANDRICH, & S. PARK. Is Procedural Learning Intact in Schizophrenia?
Schizophrenia patients show deficits on a variety of declarative learning tests. However, the literature is mixed concerning whether or not they also have deficits in procedural learning. Procedural learning was assessed in 20 schizophrenia patients and 21 normal controls using measures of serial reaction time (SRT) and pursuit rotor. The SRT involves two types of procedural learning: visuomotor association learning, and motor sequence learning. The groups had significantly different learning slopes for the pursuit rotor. For the SRT, the learning slopes for the two groups were quite similar. Despite this quantitative similarity, the patients showed a qualitative difference: they had proportionally less motor sequence learning than controls. This pattern of results from the SRT may reflect intact visuomotor association learning, but delayed or dysfunctional motor sequence learning.

C.J. CARPENTER, C. RANDOLPH, & J.M. GOLD. Prefrontal Functioning in Schizophrenia.
Recent neuropsychological studies have suggested frontal lobe impairment in schizophrenia, a finding confounded by the use of complex tests to assess frontal function. In this study, 24 schizophrenia, 22 patients with borderline personality disorder, and 30 normal controls, with estimated IQ's above 100, were tested with computerized simple hybrid delayed response tasks found sensitive to prefrontal functioning in nonhuman primates. A brief battery of standard tests was also administered. Compared to both control groups, schizophrenic patients performed significantly worse on delay tasks. Following extensive teaching of the delayed alternation task, a subgroup of schizophrenics were still unable to improve their performance, suggesting a fundamental impairment of elementary working memory function, likely implicating prefrontal dysfunction.

P.J. MOBERG, J.A. HOLDNACK, R.L. DOTY, B.E. TURETSKY, R.C. GUR, T. ACOSTA, & R.E. GUR. Relationship of Olfaction to Emotional Processing in Schizophrenia.
Patients with schizophrenia (SZ; $n = 37$) and healthy controls (NC; $n = 22$) were administered a test of unilateral olfactory identification. A subset of these patients also completed a computerized battery of facial emotion discrimination as well as tests of frontal and temporal lobe function. Results indicated an overall deficit in olfactory identification for both right and left nostrils relative to controls. Preliminary analyses revealed a strong correlation in controls between olfactory identification scores for both right and left nostrils with emotional discrimination. In contrast, only right-nostril performance was correlated with facial emotion discrimination in SZ patients. No comparable relationships were seen between olfactory identification scores and other neuropsychological measures. These findings suggest that limbic areas associated with emotional processes may be important for olfactory identification.

R. MAHURIN, E. McCLURE, S. GIESECKE, & D. VELLIGAN. Supervisory Response Selection and Frontal System Deficits in Negative Symptom Schizophrenia.
Supervisory control involving the temporary suppression of preferred responses in favor of alternative actions is thought to be impaired in schizophrenia. Forty schizophrenics and 40 age-matched controls were tested with three computer-based reaction time subtests from the NeuroCognitive Assessment Program (NeuroCog): (1) Simple reaction time; (2) Choice reaction time (respond in direction of stimulus arrow); and (3) Reverse reaction time (RRT, respond *opposite* to direction of arrow). RRT scores reflecting supervisory control were significantly impaired in the schizophrenic group relative to controls. Within the schizophrenia group RRT scores were highly correlated with putative tests of frontal-lobe function and with Negative Symptom Assessment ratings. The results support previous findings of prefrontal deficits in schizophrenia, and suggest a specific impairment in supervisory control.

Paper Session 16

MEMORY (PHYSIOLOGICAL BASES)

A.J. SAYKIN, R.B. BURR, H.J. RIORDAN, A.C. MAERLENDER, & J.B. WEAVER. Temporal Neocortical and Hippocampal Memory Activation as Measured by Functional Magnetic Resonance Imaging.
Functional MRI (fMRI) measures cerebral activation by quantifying changes in local blood oxygenation. Five normal subjects underwent fMRI during an auditory verbal memory study consisting of 20 low-imagery words. Memory conditions included encoding, silent free recall and recognition tasks. As hypothesized, verbal encoding selectively activated the left anterior hippocampus (3.8% increase relative to initial resting baseline). Free recall and recognition conditions showed similar left anterior hippocampal activation. Within-subject z-transformations, adjusting for individual differences in variance across images, resulted in nearly identical patterns of activation. Spatial and time course statistical maps were also constructed for each subject. Results suggested individual differences in activation patterns. However, the most frequently observed activation occurred in the left anterior temporal neocortex and hippocampal formation.

D.C. KOLTAI, X. DING, J.A. TKACH, P.M. RUGGIERI, G.J. CHELUNE, & C. O'DONOVAN. Functional MR Imaging During Delayed Memory Tasks: Preliminary Observations.
T_2^* weighted gradient echo MRI techniques were applied at 1.5 T to detect alterations in paramagnetic deoxyhemoglobin in the cerebral blood pool during covert delayed memory tasks. Hyperintense areas were seen in subtraction images in temporal lobe structures, but not in the occipital lobe or deep white matter. The temporal pattern of signal intensity versus time curves associated with the former was consistent with the experimental conditions. However, they were superimposed on a linear increase in average baseline signal intensity. An attempt to characterize and identify the source of this linear increase was made by examining the influence of acquisition parameters (TR, TE; SE vs. GE) and cardiac/respiratory cycles. Preliminary results suggest that signal intensity changes must be interpreted cautiously due to unexplained linear increases.

J.D. RAGLAND, R.C. GUR, L.H. MOZLEY, D.P. MOZLEY, R. SMITH, A. ALAVI, & R.E. GUR. Cerebral Blood Flow Activation During Word and Face Memory: Positron Emission Tomography in Normal Subjects.
Previous ^{133}Xenon cerebral blood flow (CBF) research was expanded by administering word and face recognition tests to 19 healthy male and female volunteers (11 men, 8 women) during positron emission tomog-

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raphy (PET) scans of CBF. This allowed the study of subcortical regions implicated in memory not imageable by the Xenon method. CBF was measured during control baseline, word recognition, and face recognition conditions. CBF was higher for women, and increased during facial versus verbal recognition tasks. Replicating previous findings, CBF was appropriately lateralized in the middle-temporal lobe for both tasks. Contrary to predictions, subcortical activation was greatest in the mamillary bodies rather than the hippocampus. Overall CBF during all conditions correlated positively with performance, indicating that higher levels of blood flow were associated with better memory performance.

B. GIORDANI, B.F. HUANG, P.A. PANDYA, L.R. JUNCK, M.J. BOIVIN, R.A. KOEPPE, D.E. KUHL, S. LEHTINEN, & S. BERENT. Alzheimer's Disease Patients Show Different Relationships Between Brain Metabolism and Learning Than Do Normal Subjects.
The association between memory and steady-state cerebral metabolic activity remains unclear. Using positron emission tomography, we compared right-to-left asymmetries in regional glucose metabolic rate to discrepancies between visual and verbal learning and retention scores in 30 normal controls and 10 patients with Alzheimer's disease (memory testing with one day of scan). After partialing out the effects of age, education, and IQ, significant findings were different for normals and patients. While normals evidenced a negative relationship between memory discrepancy and temporal and parietal asymmetry scores, the opposite was true for patients. The differences between patients and controls demonstrate that basis brain-behavior relationships may differ dramatically depending on the integrity of the involved neurological structures.

P.D. CONNOR, S.D. GALE, S.C. JOHNSON, C.V. ANDERSON, E.D. BIGLER, & D.D. BLATTER. Cingulate Degeneration Following Traumatic Brain Injury: Quantitative Neuroimaging, Memory and Executive Functions.
Quantitative neuroimaging studies of 50 Traumatic Brain Injury (TBI) patients and 38 normal controls were performed and analyzed to determine differences in cingulate cortex and peri-cingulate CSF volumes. In addition, TBI patients were administered a variety of standardized memory tests and the Category Test as part of a follow-up neuropsychological assessment battery. Neuropsychological test results were correlated with neuroimaging data of the cingulate. Results indicated that TBI patients had significantly larger collections of peri-cingulate CSF but not in cingulate gyrus volume. Category test results correlated with right anterior cingulate cortex, but no other morphologic findings reached significance. Likewise, there were few significant correlations with memory function and cingulate morphology. These results are discussed in terms of the protective effects of paleocortical structures in TBI and the lack of relationship between cingulate morphology and neuropsychological outcome.

P.J. ESLINGER, L.M. GRATTAN, & A.E. EASTON. Neural Substrate for Retrograde Amnesia: Role of Different Temporal Lobe Sectors.
Two cases with contrasting and asymmetric temporal lobe lesions after encephalitis were compared on standardized and experimental measures of retrograde memory. Strikingly different profiles were evident in name stem completion, name:face matching, temporal ordering and forced choice recognition of past famous names and faces. EK (predominant left temporal lobe lesion) showed extensive loss of retrieval and knowledge associated with names but not faces. DR (right temporal lobe lesion) showed a moderate difficulty in utilizing facial prompts and forced choice recognition of famous faces. Comparative anatomic analysis suggested the deficits may be related to damage in the lateral and medial occipitotemporal gyri. This region may serve as a critical storage site for retrograde memory. It receives extensive hippocampal output and is interconnected with the temporal polar and cortical association areas implicated in retrieval.

Symposium 8

MATERNAL ALCOHOL CONSUMPTION DURING PREGNANCY: ENDURING EFFECTS ON COGNITION AND ADAPTATION IN THE OFFSPRING

A.F. MIRSKY & A.P. STREISSGUTH. Maternal Alcohol Consumption During Pregnancy: Enduring Effects on Cognition and Adaptation in the Offspring.
This symposium summarizes an ongoing 20-year investigation of cognition (with emphasis on attention, memory and learning) and adaptation in 462 children whose mothers' alcohol consumption during pregnancy was recorded. In addition, 20-year follow-up data on a group of children with Fetal Alcohol Syndrome will be presented. Kopera-Frye compares the psychological consequences of Fetal Alcohol Syndrome and Fetal Alcohol Effect; Streissguth describes the latent variable analysis of the relation between alcohol intake variables and neuropsychological functions in the 14-year-olds; Carmichael Olson addresses the issue of behavior and learning problems; Barr reports on the measures of attention over the period from ages 4–14; and Sampson presents data on the lifespan trajectory of individual children with alcohol-related problems.

K. KOPERA-FRYE, A.P. STREISSGUTH, & H.M. BARR. FAS vs. FAE: Similarities and Differences in the Psychological Profiles of 124 Patients.
Intellectual functioning, academic achievement, and adaptive behavioral functioning were examined in a clinical sample of 58 patients diagnosed with fetal alcohol syndrome (FAS) and 66 with possible fetal alcohol effects (FAE). Statistical analyses of the diagnostic group means revealed significant differences on the Wechsler Full Scale, Performance, and Verbal IQ Scores, with the FAE group exhibiting higher scores. Despite large differences in intellectual functioning, the groups were similar on achievement levels. While both groups were comparably deficient in daily living skills, socialization, and overall adaptive score, the FAE group exhibited greater competence in communication skills. Findings suggest comparable patterns of impairment among diagnostic groups.

A.P. STREISSGUTH, P.D. SAMPSON, H. CARMICHAEL OLSON, K. THIEDE, F.L. BOOKSTEIN, & H.M. BARR. Latent Variable Calibration of the Effects of Prenatal Alcohol Exposure on Adolescent Neuropsychologic Performance.
Eleven neuropsychologic tests (CPT, serial reaction time, stepping stone maze, a spatial-visual processing task, and others) yielding 85 scores, were given to 462 adolescents in a longitudinal prospective study. A Partial Least Squares analysis calibrates the effects of prenatal alcohol exposure measured with 13 scores reflecting dose, timing, and duration of gestational exposure. Composite Alcohol and Neuropsychological Latent Variables correlate ($r = .28$) with little effect of adjustment for covariates. The calibration reveals that functional dimensions salient for prenatal alcohol exposure include speed of information processing, spatial-visual reasoning, and poorer spatial memory and sustained attention. No single outcome characterizes the enduring effects of prenatal alcohol which are best assessed with multiple outcomes of deficits across many tests.

H. CARMICHAEL OLSON, A.P. STREISSGUTH, P.D. SAMPSON, H.M. BARR, F.L. BOOKSTEIN, & K. THIEDE. Prenatal Alcohol Exposure and Behavioral and Learning Problems in Early Adolescence.
This study examined the relationship between 186 measures of behavior and learning problems in early adolescence (adolescent, parent, and psychometrist report) and prenatal alcohol exposure assessed prospectively by maternal report. Partial Least-Squares analyses revealed a sig-

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nificant dose-response relationship ($r = .31$) between the alcohol latent variable (LV) and the adolescent outcome LV. This relationship remained significant at $r = .18$ after accounting for covariates. The salient outcome profile included school problems, antisocial behavior, negative self-perceptions, impulsivity, and disorganization during testing. This LV correlated $r = .62$ with classroom performance at ages 7 and 11. Not all exposed offspring showed this profile. For the group, prenatal alcohol exposure was associated with increased adolescent problems.

H.M. BARR, A.P. STREISSGUTH, F.L. BOOKSTEIN, & P.D. SAMPSON. Attention: Prenatal Alcohol and Components of Vigilance From 4 to 14 Years.
The longitudinal components of vigilance performance, and behavior ratings by parents, teachers, and examiners, assessed at ages 4, 7, and 14 yr, were examined in 512 children in relation to prenatal alcohol exposure assessed prospectively. A vigilance Latent Variable (LV) comprised of the laboratory-obtained scores at 4, 7, and 14 yr, respectively, correlated ($r = .21$, .22, and .20) with an LV comprised of 13 patterns of prenatal alcohol exposure. Standard Deviation of Reaction Time (SDRT) and False Alarms on the AX-task were the scores most salient for prenatal alcohol across this 10-yr period. Cross-lagged correlations revealed that the 7-yr vigilance LV not only predicted Teachers Ratings of Attention 1 yr later ($r = -.38$), but also Teacher Ratings of Attention 3 yr later ($r = .36$).

P.D. SAMPSON, F.L. BOOKSTEIN, A.P. STREISSGUTH, H. CARMICHAEL OLSON, & H.M. BARR. Detection of Individual Children with Alcohol-related Learning and Behavioral Problems at 14 Years: Lifespan Trajectories on Multiple Assessments.
We address the detection of individuals with neurobehavioral fetal alcohol effects from longitudinal profiles of deficits in children prenatally alcohol exposed. We approached this (1) by examining the 14-yr consequences of a 7-yr profile of neurobehavioral deficit identifying individuals first detected at 7 yr as "truly" alcohol-affected, and (2) by "looking back" at the longitudinal pattern of deficits for those highly exposed subjects most deficient in terms of neuropsychology and/or behavior at 14 yr. We believe that this first demonstration of methods suitable for the detection of alcohol-affected individuals from neurobehavioral profiles will prove more valuable than methods based primarily on growth and morphology which are important diagnostically in younger children but frequently lose their importance as children mature.

Poster Session 6

HANDEDNESS, HEMISPHERIC SPECIALIZATION, AND LANGUAGE

L.H. MOORE, W.S. BROWN, T.E. MARKEE, D.C. THEBERGE, & J.C. ZVI. Interhemispheric Integration of Finger Localization in Phonologically Dyslexic Adults.
Dyslexia, particularly phonological dyslexia, has been associated with neurological complications, and specifically with inefficient information transfer between the two cerebral hemispheres. Twenty-one dyslexic subjects were compared to 21 controls on the Finger Localization Task (FLT) in order to observe patterns of tactile-motor integration and interhemispheric collaboration. When compared to control subjects, dyslexics showed consistent deficits on direct measures from the FLT, but showed no difference on a ratio score of between hand to same hand responses (thought to reflect inter-hand transfer of tactile information). In contrast, regardless of diagnostic group membership, phonological processing ability was found to be highly correlated with the ratio score from the FLT which specifically reflects the transfer of learned material from one hand to the other.

P. ARNETT, M. HUSSAIN, S. RAO, S. SWANSON, & T. HAMMEKE. Case Report of an MS Patient With Gerstmann's Syndrome.
The occurrence of Gerstmann's Syndrome in Multiple Sclerosis (MS) is rare. Only one case of a 12-yr-old boy was found in the literature. We present a case study of a 26-yr-old MS patient who developed the acute onset of right-left disorientation, dyscalculia, and dysgraphic features consistent with Gerstmann's Syndrome. She also showed a verbal memory deficit, in addition to Conduction Aphasia. Neuroimaging revealed a white matter lesion in the left temporoparietal area encompassing the angular gyrus. Although many of the patient's cognitive functions were intact, the findings support Benton's (1977) notion that Gerstmann's Syndrome is part of a large cluster of symptoms (e.g., aphasia) that commonly occur with damage to the left parietal region.

M. BLOCH & E. ZAIDEL. Differences in Hemispheric Asymmetry Between Dyslexics and Normals on a Lateralized Lexical Decision Task.
The present study investigated three neuro-psychological models of dyslexia. These models include the Reversed Laterality model, the Dysfunctional Hemisphere model, and a new model, the Dysfunctional Hemisphere/Phonetic Specific (DH/PS) model. A lateralized lexical decision task, manipulating wordness, length, word frequency and word regularity of grapheme-phoneme conversion, was administered to male dysphonetic dyslexics and normal controls. Analyses revealed that the groups differed in accuracy only when responding to nonwords and phonetically regular words. Normal children showed the anticipated Right Visual Field Advantage (left hemisphere dominance) while the dyslexics failed to show any visual field advantage. The results support the DH/PS model, which suggests that deficits in left hemisphere processing are apparent only when the dysphonetic dyslexics are attempting to utilize the rules of phonics.

T. ELLIOTT, J. WATKINS, & B. LIPPE. Indices of Laterality in Turner Syndrome (TS): Preliminary Results.
Hand preference and manual skill were examined as indices of laterality in females with TS (age 5–27) and were correlated with IQ measures to test competing neurofunctional theories of TS. Increased prevalence of mixed-handedness was apparent using self-report (21%, $N = 82$) and demonstration measures (24%, $N = 29$). While this supports a "decreased laterality" theory of TS, no significant correlations were found with IQ scores. While the group mean for the Pin test of manual advantage was normal ($M = 1.3$, $N = 28$), the Pin correlated significantly negatively with Verbal IQ ($r = -.43$, $p < .05$, $N = 25$), Performance IQ ($r = -.41$, $p < .05$, $N = 25$) and Full-Scale IQ ($r = -.52$, $p < .01$, $N = 25$) (as IQ scores increased, manual laterality decreased). This finding supports a "right-hemisphere deficit" theory of TS.

N.Y. WEEKES & E. ZAIDEL. The Effects of Hormonal and Psychological Levels of Masculinity in Females on Neuropsychological Functioning.
There is mounting evidence that both hormonal and psychological measures of masculinity affect the functioning of the brain. While there is a great deal of support for such a role in general cognitive ability (including strong correlations between masculinity and visuospatial skill), there is less evidence regarding its influence on hemispheric specialization and interhemispheric interactions. The current study attempts to investigate the role of both stable and fluctuating hormone levels further. Using both stable measures of masculinity and endogenous fluctuations in estrogen, we have found evidence that more masculine females demonstrate greater right ear advantages than less masculine females do regardless of the level of the fluctuating hormone. Effects of fluctuating hormones were also found but appear to be independent from the effects masculinity level.

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L.A. MEAD & E. HAMPSON. A Selective Effect of Ovarian Hormones on Left Visual Field Performance in Verbal and Nonverbal Tachistoscopic Tasks.
Recent studies have suggested that ovarian hormones may modulate perceptual asymmetries. To investigate this further, right-handed women ($N = 44$) were given verbal and non-verbal tachistoscopic and dichotic listening tests at the menstrual and midluteal phases of the menstrual cycle. Tachistoscopic results will be presented here. The verbal (rhyming words) and nonverbal (face recognition) tachistoscopic tests produced right visual field and left visual field (LVF) advantages respectively. For both tests, accuracy in the LVF was greater at the menstrual phase than at the midluteal phase. This was true in within-subjects analyses for both tasks and in between-subjects analyses for the faces task. These results suggest that ovarian hormones may have a suppressive effect on certain regions or functions of the right hemisphere.

L.L. AVANT & A.A. THIEMAN. Gender and Hemispheric Differences in Prerecognition Visual Processing.
Three experiments tested effects of 5-dot Gestalt pattern goodness on perceived durations of paired 10-ms pre- and postmasked lateralized visual inputs. Patterns were from 1- and 4-member equivalence sets. For inputs to each hemisphere in Experiment 1, females judged flash durations to be equal for patterns from 1- and 4-member sets if they could be encoded as members of the alphabet, and these perceived durations were longer than those for other patterns from 4-member sets. Males made similar discriminations for right, but not for left, hemisphere inputs. Experiment 2 showed that, with the same visual inputs, subjects could not report which of two patterns was a "better" pattern. Experiment 3 showed that, with paired 10-ms inputs, subjects could not discriminate which flash was blank and which presented a pattern. A model of prerecognition visual processing is discussed.

D. KIMURA & M.W. CARSON. Finger-Ridge Asymmetry is Unrelated to Handedness in Heterosexuals.
The pattern of ridges on human fingertips (dermatoglyphics) is fixed by the fourth fetal month. Total number of ridges is higher in males than females, and higher on the right than the left hand for both sexes. The incidence of the minority Left > (L>) pattern is significantly higher in women and in homosexual males, and in the latter is significantly associated with adextrality. Within R-handers, L> and Right > (R>) Ss show different cognitive patterns. The present study compared the incidence of L> versus L not> pattern in 154 dextral (D) and 28 adextral (A) heterosexual men and 96 D and 32 A women. There was no significant relation between handedness and dermatoglyphic asymmetry in either men ($\chi^2 = 1.09$, df = 1) or women ($\chi^2 = 1.89$, df = 1), or in men and women combined ($\chi^2 = .0097$, df = 1).

F.A. WOLKENBERG & D. FREIDES. Familial Handedness and Language Processing.
Familial handedness has been related to individual differences in language processing, specifically to relative reliance on semantic versus syntactic information in reading comprehension. Using a word by word reading paradigm, we measured the effect of individual and parental handedness on the reading speed of 108 subjects (55 male, 53 female). They were presented via computer with some sentences using simple transitive verbs, and others using passive and reverse transitive verbs which are thought to interfere with syntactic processing. Subjects clustered into three groups, two of which were clearly affected by syntax, while the third, smaller group appeared to rely more heavily on semantic content in this paradigm. Group differences were found for paternal handedness and for sex, but not individual or maternal handedness.

Y. KANG. On the Subgroups of Handedness: A Cross-Cultural Study of Koreans and Americans.
The 10-item Edinburgh Inventory was administered to 858 Korean college students and 502 American college students. Cluster analyses revealed three distinct subgroups of handedness for each sample: Right-handers, consistent left-handers, and inconsistent left-handers. For Americans, the dissociation between writing hand and throwing hand was found in the ILH group. The same dissociation, however, was not found in the Korean sample. For Koreans, the ILH used their *right*-hand for writing and eating, and left-hand for throwing and other skilled behaviors, while the CLH consistently used their *left*-hand not only for throwing and other skilled behaviors but also for eating and writing. Discriminant analysis showed that, for Koreans, knife, throw, and scissors were the best items for distinguishing the right-handers from the left-handers, whereas write (draw) and spoon were the best items for the Americans.

A.L. FOUNDAS, N.L. CADIEUX, & K.W. GREVE. Hand Preference in a Student Population: Predictors of Subtypes.
Using the Brigg-Nebes modification of Annett's handedness inventory we found three handedness subtypes based on gradations of hand preference: consistent right handers, consistent left handers, and mixed (inconsistent right and left handers). Our data demonstrated a J-shaped distribution with a right shift: 88.8% consistent right handers, 6.3% consistent left handers, and 4.9% mixed. The best predictors of hand preference were: self-professed, hand used to hammer and write. Left and right handers did not differ on subject variables such as gender, writing posture, and familial sinistrality. Our data suggest that inconsistent left and right handers may be more likely to have learning disabilities than consistent right and left handers. We did not find immune disorders more common in left handers as compared to right handers.

J.E. OBRZUT, J. HORGESHEIMER, & C.A. BOLIEK. Auditory Spatial Attention on Dichotic Listening: Developmental Effects.
This study investigated the extent to which the magnitude of the dichotic REA is a function of auditory spatial attention with younger and older children. Attention was manipulated by presenting a lateralized tone cue to the targeted ear at shorter (150,450,750 ms) and longer (500, 1250, 2000 ms) Stimulus Onset Asynchronies (SOAs). For younger and older children, sizeable REAs (27%) apparent at the shortest SOA (150 ms) were substantially attenuated (17% and 14%, respectively) at longer intervals (450 and 750 ms SOA). However, REAs obtained beyond 750 ms SOA (i.e., 1250 and 2000 ms SOA) were not substantially attenuated from that obtained at 500 ms SOA. This suggests that it may be difficult for children to maintain attention to the left side of space for more than a certain period of time (i.e., a threshold effect of attention with children). It is concluded that the precuing technique provides a powerful means for specification of the extent to which auditory spatial attention and hemispheric functional capabilities contribute to ear asymmetries over the course of development in children.

W.F. McKEEVER, P.J. SUTER, & L.J. CERONE. Fingerprints & Handedness.
Fingerprints are laid down early in fetal life and do not change during life. If fingerprints were found to differ between dextrals and sinistrals, this would imply that handedness is specified prior to birth and would infirm the view that left handedness is generally the product of birth complications. We classified the fingerprints of normal left and right handers into the usual pattern types. Whorls were significantly more common as a fingerprint type in sinistrals. Ulnar loops were significantly more common in dextrals. Pattern differences were clearest on the right hand. Additionally, the overall congruence of print types on corresponding fingers of the hands was significantly greater in dextrals. Fingerprints may be useful in differentiating "genetic" from "nongenetic" sinistrality.

D.C. BOURASSA, I.C. McMANUS, & M.P. BRYDEN. Handedness and Eye-Dominance: A Meta-Analysis of Their Inter-Relations.
About 10% of people are left-handed and 30% are left-eyed. The association of handedness and eyedness is unclear since some eyedness measures are potentially contaminated by measures of handedness. A meta-analysis of hand-eye concordance in 54,162 subjects from 52 populations, found that concordance was 2.67× greater in questionnaire

rather than performance studies, 1.95× greater in studies using unimanual monocular performance measures, and 7.22× greater in studies using non-sighting measures of eye-dominance. In the remaining studies, which seemed to show no evidence of bias, the odds-ratio for hand-eye concordance was 2.54×; in a population with 9.25% left-handedness and 63.47% right-eyedness, then 65.57% of right-handers and 42.86% of left-handers are right-eyed. This pattern of hand-eye association poses problems for genetic models of cerebral lateralization, which must invoke pleiotropic alleles at a single locus or epistatic interactions between multiple loci.

J. CREBOLDER & M.P. BRYDEN. Assessing the Properties of Categorical and Metric Spatial Relations.
This study evaluated visual field effects for categorical and metric visuospatial tasks. In lateralized presentations, 31 subjects judged whether a dot appeared above or below a horizontal line (categorical), and whether a dot was near to or far from a line (metric). A left visual field advantage was observed for the near/far task, while no difference in performance as a function of field of presentation was evident for the categorical task. These findings provide supporting evidence for Kosslyn's theory, which proposed right hemisphere dominance for judgments of metric distance (coordinate relations). However, the above/below task used in this study does not provide support for his prediction of a left hemisphere advantage for encoding categorical spatial relations. This task may involve both categorical and relational aspects.

M.P. BRYDEN & M.B. BULMAN-FLEMING. Dichotic Tasks: Relating the Emotional Words Test to the Fused Dichotic Words Test.
A wide variety of dichotic listening tasks are employed in experimental neuropsychology, yet few have been directly related to functional cerebral asymmetries. The Fused Dichotic Words Test (FDWT) has been shown to be closely related to language lateralization determined by amytal testing. In the present study, 128 subjects, equally divided between left-handers and right-handers, were given both the FDWT and an Emotional Words Test (EWT) that simultaneously produces a right-ear effect for words and a left-ear effect for emotion. Strong laterality effects somewhat reduced in left-handers, were obtained on both tasks. Laterality measures on the two tasks were significantly correlated ($r = .33$), although the correlation was much higher in left-handers than in right-handers, presumably because of the greater underlying neurological variability in left-handers. While the two tasks share common variance, the relatively low correlation between them suggests that factors other than language lateralization influence performance on the EWT.

H. ERHAN, J. BOROD, C. TENKE, J. WELKOWITZ, J. TOWEY, & G. BRUDER. Identification of Emotion in a Dichotic Oddball Task: Behavioral Asymmetries.
Hemispheric specialization for emotional perception was studied in right-handed college students (13 males, 11 females) using a dichotic oddball task. Pairs of nonsense syllables (e.g., "ba"), stated with seven emotional tones, and matched for duration, intensity and accuracy levels, were presented in four blocks. Subjects pressed a button to one of four target emotions (happiness, interest, anger, sadness), providing accuracy and reaction time measures. Overall, subjects demonstrated greater left-ear accuracy, and a subset of subjects showed a trend for shorter reaction times with left- than right-ear stimulus presentation. Females had better accuracy scores and faster reaction times for targets presented to the left than right ear. Men showed a similar trend for accuracy. These findings underscore the importance of the right hemisphere for prosodic perception.

J.S. CAROSELLI, M. HISCOCK, T. ROEBUCK, & N. CROHN. A Scattergram Method: Its Usefulness in Dual-Task Studies.
Webster (1988) presented a method using a scattergram where one can enter the manual and cognitive results of a dual-task paradigm into a single analysis. This method has usually not been employed in the literature. Dual-task studies have analyzed only manual results or analyzed the manual and cognitive results separately. We applied Webster's method to right-handed subjects. The dual-task paradigm consisted of a manual task such that the subjects tapped faster with their nondominant hand and a verbal task. It was found that the interference between the two tasks was greater with right-hand tapping than with left-hand tapping. Therefore, these results are consistent with the assertions of the functional cerebral distance model.

S. CHRISTMAN. The Role of Weight Versus Interest Versus Directionality in Aesthetic Preferences.
Research examining lateral aspects of pictorial organization (e.g., leftward vs rightward biases of content) has revealed three dimensions that influence aesthetic preferences: (i) weight, (ii) interest, and (iii) directionality. These effects have been interpreted as reflecting aspects of observers' neural organization. However, no studies have systematically examined all three dimensions within a single experiment. Discrepancies in the literature may have arisen due to uncontrolled interactions among various dimensions. The current study employed a stimulus set consisting of arrangements of geometric elements for which all three dimensions were factorially combined. Ss viewed pairs of mirror-image stimuli and indicated which stimulus was more aesthetically pleasing. Results indicated that the dimension of directionality plays a predominant role in determining aesthetic preferences, with a consistent preference for left-to-right directionality. However, the dimension of interest played a moderating role, such that the presence of left-biased interest eliminated the preference for left-to-right directionality.

S. CHRISTMAN. Left-Handers Exhibit Greater Preference for Symmetric Organization in Aesthetic Judgments.
Research on aesthetic judgments indicates that right-handed Ss display consistent preferences for laterally asymmetric patterns of pictorial organization. In contrast, left-handers exhibit smaller or non-existent preferences for asymmetric stimuli. These results have been interpreted to reflect the greater versus lesser degree of hemispheric asymmetry in right- versus left-handers, respectively. No studies to date, however, have used symmetric stimuli. Given the important role that balance and symmetry play in formal theories of aesthetics, the current study compared right- and left-handers' preferences for symmetric versus asymmetric patterns of pictorial organization. Left-handers displayed a significantly stronger preference for symmetric patterns; conversely, right-handers, but not left-handers, displayed significant preferences for asymmetric stimuli with right-biased content.

J.C. BOROD, K.D. RORIE, C.S. HAYWOOD, F. ANDELMAN, J. WELKOWITZ, L.K. OBLER, R.L. BLOOM, & J.R. TWEEDY. Lexical Emotional Perception and Narratives of Emotional Experiences in Patients with Unilateral Lesions: Dissociations, Intrahemispheric Factors, and Demographic Variables.
Emotional experimental and nonemotional control tasks were used to study lexical/verbal perception and narratives of recollected experiences in right-brain-damaged (RBD), left-brain-damaged (LBD), and normal control (NC) right-handed adults. Accuracy scores were derived for perception, and narratives were rated for emotionality. Our earlier reports demonstrated significant impairments for RBDs, relative to LBDs and NCs, for emotional tasks. In this study, we focused on the relationship between processing modes. Overall, there were no significant correlations between perception and expression/experience. Among patients with cortical lesions, patterns of deficits did not vary for either mode as a function of lesion caudality. When lesion level was examined, subcortical lesions were more implicated on narratives than on perception tasks. Demographic variables and months post-CVA onset did not significantly influence lexical performance.

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R.S. FISCHER & C.A. LEAVELL. Analysis of Configural and Detail Errors on Block Design.
The Block Design subtest is generally recognized as the best measure of visuospatial skills in the WAIS-R. Investigators have described "typical errors" made by patients with different focal lesions on this test. Patients with right hemisphere lesions have been noted to "break configuration", whereas patients with left hemisphere lesions have tended to leave out supporting details. However, descriptions of these error patterns are mostly based upon the clinical impressions of the examiners, and not on "objective" grounds. In the present investigation we administered the Block Design subtest to 236 (153 left CVA and 83 right CVA) patients of equivalent age, education and time post onset with unilateral left and right hemisphere stroke as verified by CT scan. Findings suggest that patients with right hemisphere lesions, as a group, are more likely than patients with left hemisphere lesions to make configural errors, while patients with left hemisphere lesions are more likely to make detail oriented errors despite comparable level of score. These findings confirm that the qualitative analysis of performance on this task is of greater relevance than the absolute level of score.

P. HENNINGER. Drawing Inkblots Elicits Right Hemisphere Control in the Split Brain.
Two right-handed complete commissurotomy subjects who had previously exhibited left hemisphere control during tests of the right hemisphere were presented four original (twice) and ten Rorschach inkblots, and two line drawings, in the left and right visual fields using the lateral limits technique. Subjects drew with the ipsilateral hand what they saw. Three judges matched the drawings to the inkblots. Drawings by the left hand were identified correctly more frequently than those by the right hand, and "don't know" responses were given more frequently to drawings done by the right hand than by the left hand ($p < .05$). Line drawings copied with either hand were easily identified. Results support the view that drawing nonrepresentational stimuli elicits right hemisphere control in normal subjects. Clinical implications are discussed.

J.M. CLARKE & E. ZAIDEL. Subcortical Visual Transfer in Commissurotomized Patients.
It has been claimed that commissurotomized patients can sometimes compare stimuli across the visual fields (VFs) via subcortical transfer of higher-order 'cognitive', as opposed to visual-sensory, codes. We examined this issue using a relatively large set of hard-to-verbalize nonsense geometric shapes presented as same or different pairs to either a single VF or one to each VF. Two commissurotomized patients were at chance performance for cross-VF comparisons despite above chance performance in the LVF (A.A.) or in both unilateral VFs (L.B.). A third patient (N.G.), performed well above chance for LVF (85% correct), RVF (73%), and, surprisingly, for the cross-VF condition (90%), which was replicated across four additional sessions with added experimental controls. N.G.'s cross-VF performance is not likely due to the transfer of a verbal or abstract code, nor to cross-cueing strategies, instead, she probably possesses a particularly efficient superior collicular system that enables the transfer of simple visual features.

Z. EVIATAR. A Cross-Linguistic Test of Qualitative Hemispheric Differences in Processing Letter Trigrams.
Previous studies with English versions of the task have reported consistent hemispheric differences in the processing of letter trigrams: a quantitative left hemisphere advantage for errors, and a qualitative difference in the distribution of particular types of errors in the two visual fields. Two types of interpretations for the qualitative differences have been proposed. One suggests that the right hemisphere uses a sequential strategy, while the left hemisphere uses a parallel, phonological strategy. The second suggests that the hemispheres differ in their ability to process local elements in a multipart visual array. Hebrew orthography is "deep" in the sense that the phonological representation of words is accessed post-lexically. This makes it a good test of the two interpretations presented above. The experiment presented here shows that the quantitative data patterns in Hebrew are identical to the English data. The qualitative patterns differ systematically. The language-specific and general factors that affect these patterns are explored, as are the implications for a more general interpretation of the visual field differences to hemispheric processing and abilities.

J. SARDO, D. GALYON, & P. DONOVICK. An Atypical Presentation of a Right Middle Cerebral Artery Stroke in a 46-Yr-Old Right-Handed Female.
C.C., a 46-yr-old, right-handed, female school teacher suffered a right middle cerebral artery stroke. Routine neuropsychological testing was conducted on the neurosurgical unit of a regional hospital. She was subsequently seen for a 7 1/2 month reevaluation. Initially, C.C. exhibited classic right hemisphere stroke symptomology including left hemiparesis, left visual field neglect, lower left facial weakness, and emotional liability. Radiological examination revealed that the stroke involved almost the entire middle cerebral artery distribution. Atypical symptoms were observed. C.C. was dysphasic and dysarthric and moderately dysnomic. Testing found improved language, visual-spatial, and intellectual functioning at seven months post stroke, but deficits in articulation, and reduced frontal functioning, including poor verbal fluency, limited abilities for abstract thought, and impaired sequencing abilities remained.

B. CLOUD, C. SOCHA-GELGOT, K. WOODS, T. LEWIS, & C. ARMSTRONG. The Road Map Test: Spatial Rotation and Laterality Effects, Does the View Count?
We sought to understand the nature of the impairment in dementia and normal groups as they perform the spatial rotations on Money's Road Map Test. Subjects were 51 dementia patients and 43 controls (age range = 57-90), divided into age-matched groups. Turns originating from an orientation other than the upright vertical require mental rotation. Dementia subjects were more impaired in the geocentric, egocentric, and spatial conditions, but no effect for greater degree of angular deviation was found. Older normals were more impaired than younger normals on all analyses. Results suggest dementia subjects do not demonstrate differential deficits in spatial rotation. Aging effects accounted for most impairments. Our method of analyzing the Road Map Test suggests this test may be sensitive to laterality but not spatial rotation.

N. DRIESEN & N. RAZ. Sex, Age and Handedness-Related Differences in Corpus Callosum Morphology: A Meta-Analysis.
In this quantitative review, we assess the magnitude of sex, age and handedness-related variations in the size of the corpus callosum (CC). Meta-analysis of the 41 studies available for this investigation indicates that, although effects were small, CC and splenial area are larger in men than in women, left-handers possess greater CCs than right-handers and CC area decreases with age. The implications of these findings for theories relating cerebral laterality to sex, age and handedness are discussed.

C.M.J. BRAUN, C. POTVIN, & A. ACHIM. The Relation of Callosal Synaptic Density in Cortex and Electrode Site in the Estimation of Interhemispheric Relay Time With Evoked Potentials.
Increasing target excentricity significantly prolongs estimates of interhemispheric transfer time (ITT) in simple reaction time (SRT) (St-John et al., 1987) because receptive fields of visual callosal neurons are primarily foveal. In the present study electrode sites overlying cortical areas densely packed with "foveal" visual neurons included the T3-T4 and T5-T6 pairs. Sites overlying visual areas sparse in "foveal" neurons included the O1-O2 and P3-P4 pairs. We predicted longer ITT evoked potential estimates of ITT at the latter sites than at the former in normal subjects ($N = 10$). The prediction was supported for the T3-T4 pair but not the T5-T6 pair. We propose that callosal synaptic density in cortical patches relates to electrode sites which in turn relate to ITT, but that this also depends on greater receptive field sizes of inferotemporal (T3-T4) than posterior temporal (T5-T6) visual neurons.

L.A. SMITH & B.P. ROURKE. Callosal Agenesis: A Case Study in NLD.
Callosal agenesis is a congenital malformation whereby the corpus callosum is totally or partially absent, and its occurrence in isolation is a rare phenomenon. Studies have assessed the functioning of acallosals under lateralized conditions to compare findings to those of "split-brain" patients, but few investigators have conducted comprehensive neuropsychological evaluations. A 48-yr-old woman with total agenesis as documented on MRI, was administered a full neuropsychological battery. It has been suggested that individuals with extensive white matter compromise are likely to exhibit the pattern of assets and deficits of the Nonverbal Learning Disabilities (NLD) syndrome. Thus, it was hypothesized that G.W.'s assessment results would be consistent with this neuropsychological profile, as was the case. Her results were discussed within this context.

R.C. GUR, L.M. HARPER MOZLEY, P.D. MOZLEY, S.M. RESNICK, A. ALAVI, S.E. ARNOLD, & R.E. GUR. Gender Differences in Regional and Hemispheric Resting Cerebral Glucose Metabolism.
We measured cerebral glucose metabolism in healthy young adults and found gender differences in regions important for cognitive and emotional processing, and systematic asymmetries. Women had relatively lower metabolism than men in all temporolimbic regions and cerebellum, and higher in cingulate gyrus. This may relate to gender differences in aggression relative to verbal mediation of emotional expression. Consistent with hypotheses of left hemispheric dominance for language and right hemispheric dominance for perceptual and emotional processing, metabolism was relatively higher in left association cortices and the cingulate gyrus, and in right ventro-temporal limbic regions and their immediate projections.

R.T. SCHULTZ & L.H. STAIB. Corpus Callosum Morphology in Twins: Evidence for Heritability and Sex Differences in Structure-Function Relationships.
Corpus callosum morphology was assessed in 39 healthy, right-handed young adults, including 10 monozygotic and 7 dizygotic twin pairs. Midsagittal surface area, callosal perimeter, and the area of the splenium were measured from magnetic resonance images using a computer assisted program which enabled reslicing of the image data at the structural midline. Comparison of monozygotic and dizygotic callosal measurements suggests that macroscopic morphology is strongly but not completely influenced by genetic factors. Moreover, in agreement with several recent studies, significant correlations were found between the size of the splenium and measures of cognitive ability, including IQ, verbal memory and verbal fluency, but the direction of these relationships was mediated by sex.

L. DUKE & J. ALLEN. Asymmetrical EEG Alpha Activity During Matched Verbal and Spatial Tasks.
The present study sought to replicate findings of asymmetrical EEG alpha activity during psychometrically matched verbal fluency and dot localization tasks. Subjects were 14 right-handed, clinically depressed, unmedicated men and women. Artifact-free EEG data was submitted to a frequency domain analysis. Subjects' power difference spectra difference were calculated (spatial-verbal), and grand-averaged topographic maps of paired t tests for homologous sites showed significantly less alpha power in the right posterior region during the spatial versus the verbal task ($p < 0.05$). ANOVAs were conducted with task and hemisphere as variates. The task by hemisphere interaction was significant for the temporo-central-parietal region only ($p < 0.01$). Results support findings from previous studies demonstrating asymmetrical EEG alpha parietal activity during matched verbal and spatial tasks.

M. SINGH & M. MANJARY. Observed Hand Preference Among Elementary School Children in India.
We made an attempt to assess the pattern of hand preference among 720 elementary school children ages 3–13 yr (mean 7.2, *SD* 1.8). These children were observed while they were engaged in performing the 10 unimanual hand preference activities. The results showed that for all the 10 activities, only 4.50, 9.12 and 86.37 percents were classified as left-, equal-, and right-handers. This hand preference pattern among young children turned out to be comparable with the pattern obtained for older students (similar population) assessed through standard questionnaire method. However, no sex, as well as birth order differences were obtained. The observation method used in the present study seem to be comparable with the usual handedness questionnaire method. These results will be discussed in the light of various methods for the assessment of hand preference.

M. ARGUIN & D. BUB. Spelling and Reading Share a Common Orthographic Lexicon.
An unresolved question about human cognition is whether a common representation system for lexical orthographic knowledge contributes to both reading and spelling, or whether duplicate knowledge bases separately subserve each function. This was examined in a brain damaged patient with symptoms of surface alexia and agraphia. These disorders affect reading and spelling, respectively, and both are attributable to lost or inaccessible lexical orthographic representations. Dissociations were observed in several reading experiments between words the patient consistently spelled correctly or incorrectly. That dissociations in reading performance can be predicted from spelling accuracy on an item-specific basis indicates that a single representation system is responsible for both input and output operations which refer to lexical-orthographic knowledge.

A. ECONOMOU. Lexical and Phonemic Sources of Error in the Reading and Repetition of Nouns and Verbs in Aphasic Patients.
Nouns and verbs show different patterns of breakdown in aphasia. Studies using various elicitation tasks have found a greater verb than noun impairment in nonfluent aphasics. Although the opposite pattern has been assumed for fluent aphasics, research findings have been inconsistent. The present study investigated the reading and repetition of fluent and nonfluent aphasics using nouns and verbs carefully controlled for frequency and phonemic structure. Preliminary analyses revealed a trend toward greater verb than noun impairment in some nonfluent aphasics in the reading condition, only. The one fluent aphasic analyzed so far showed differences between noun and verb production in the nature of his errors rather than in their overall number. Results are discussed with respect to theories of noun and verb production.

L.A. GILL, A. TAN, & D.L. MOLFESE. Preschoolers' Auditory Evoked Responses to Nouns and Verbs in a Matching Task.
Auditory evoked responses (AERs) were recorded from the left and right hemisphere frontal, temporal, and parietal regions of 17 preschool-age children while each watched a video tape of scenes and listened to series of auditorily presented nouns and verbs that either matched or did not match the objects or actions depicted in the video. Analyses of the AERs indicated that different portions of the brain response recorded from left hemisphere regions at one point in time and from both hemispheres at different times discriminate between nouns and verbs and between match and no match situations. The results are discussed in light of other AER work with adults suggesting multidimensional hemispheric differences in the mechanisms involved in the processing of nouns and verbs.

S. SARKARI, D.L. MOLFESE, & P.G. SIMOS. Electrophysiological Correlates of Orthographic and Phonological Processing Using the Probe Procedure.
The present study attempted to determine whether auditory evoked responses (AER) could discriminate between different aspects of the procedure that presumably leads to word recognition in a series of three tasks. The phonological task required subjects to identify letter strings that sounded like words. The orthographic task required subjects to decide whether a given letter string contained legal letter combinations.

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The third task (visual) required lexical decisions between pairs of words and pseudowords that sounded alike. AERs were recorded to task irrelevant auditory probe tones while subjects made decisions in each task. Different patterns of hemisphere differences were noted across tasks. The visual task elicited different AER responses between hemispheres for all three electrode sites, the phonological task elicited differential hemispheric responding from both anterior brain regions, while the orthographic task only elicited hemisphere differences over frontal electrode sites. These findings are discussed in terms of reading theories.

C. DYWAN, J.M. BYRNE, & J.F. CONNOLLY. Event-Related Brain Potential Assessment of Receptive Vocabulary in Normal School-Aged Children.

An ERP paradigm based on the Peabody Picture Vocabulary Test-Revised (PPVT-R) and designed to measure the perception of semantic match and mismatch between picture-word pairs was administered to 15 normal 10-yr-old children. The children showed ERP components that differentiated matching picture-word pairs from mismatching pairs for receptive vocabulary *within* their psychometrically determined range. ERPs were not differential at vocabulary levels *above* age range. This group study provides support for the clinical use of ERPs in the assessment of receptive vocabulary for children who are unable to provide verbal or motor responses due to severe multiple handicaps.

S. HUNTER, R. KARRER, & D. SOLOMON. Nondisabled and Down Syndrome Infants' Visual ERPs and Discriminative Looking Predict Their Later Verbal Abilities.

Hunter, Karrer, and Nelson (1994) reported that in a sample of nondisabled children looking behavior at six months of age predicted later verbal abilities indexed by subtests of the WPPSI-R, while attention-related ERPs only moderately correlated with these subtests. Given an extension of the original sample, we present data that support and elaborate those earlier findings. Results of correlational and multiple regression analyses indicated that WPPSI-R Verbal IQ at 3-5 years of age is significantly predicted by a Looking Novelty Score ($p < 0.04$) and the difference in infants' looking time toward the stimuli predicted performance on the Similarities ($p < 0.001$) and Information ($p < 0.05$) subtests. An ERP index of attention and memory marginally predicted Verbal IQ ($p < 0.10$). For Down Syndrome subjects, differential looking toward the stimuli marginally predicted later Verbal IQ ($p < 0.10$), while their ERP measures moderately correlated with later verbal and nonverbal abilities quotients. These findings lend further support to the use of indices of infants' early discriminative looking behavior and their concurrent ERPs as a predictor of later Verbal capabilities in both normal and developmentally disabled children.

J. RUMSEY, K. NACE, & P. ANDREASON. Phonologic and Orthographic Components of Reading Imaged with PET.

Regional cerebral blood flow was measured with positron emission tomography in ten healthy right-handed men (ages 19–40) during phonologic and orthographic pronunciation tasks (reading of pseudowords and of low-frequency exception words), lexical decision making tasks, and a visual fixation control. Only the phonologic decision making task activated the inferior parietal cortex. Only pseudoword pronunciation activated the left posterior superior temporal cortex. Decision making, but not pronunciation, activated predominantly left occipitoinferotemporal regions (areas 19 and 37), suggesting a role for this region in the conscious recognition of letter strings as words. Phonologic decision making and orthographic pronunciation activated a region deep in left inferior frontal cortex near the insula, compatible with a role for this region in semantic association.

M.K. JÓNSDÓTTIR. A Selective Deficit for Reading Vowels: A Case Description.

An unusual reading pattern was observed in a 60-yr-old man following a hemorrhage in the left temporoparietal area. Reading was slow and word-length effects were observed. The responses mostly preserved the target word's length. Most of the errors were substitutions and they preserved the consonant/vowel status of the target letter in 98.6% of the cases. The error rate for vowels was significantly higher than for consonants (23.5% vs. 5.6%). The same error pattern was found with nonwords although the error rate for non-words was significantly higher. Spelling was preserved and it is felt that the deficit in processing vowels was limited to reading. This reading pattern was rather transient but his reading is still impaired and very effortful.

M. BONAFINA. Visual Activity During Global Reading. Graphic Variables that Support an Optimum Recognition of Logograms.

During the process of graphic-semantic transcoding, words are seen like specific visual-graphic patterns that allows an immediate identification by the reader. This activity of "minimization" is done at the expense of precise graphic keys that participate as prominent stimuli for this recognition, and whose variables are intended to be identified in the present study. A task of 9 items of different level of complexity was designed to evaluate reading. Specific traits were masked in the written stimuli in order to increase task difficulty. The sample consisted of university graduates ($n = 20$) with usual habit of reading. Diverse variables were considered and their analyses showed significant data with respect to the process of visual identification for reading.

D.J. WILLIAMSON, J. ADAIR, D.H. JACOBS, A. RAYMER, & K.M. HEILMAN. Lexical Retrieval in Alzheimer's Disease: Nouns Worse than Verbs.

Recent studies have suggested that whereas object naming may be mediated by the temporoparietal regions, action naming is mediated by the frontal lobes. Because the temporoparietal regions are the primary site of cortical pathology in early to moderately advanced Alzheimer's disease (AD), we administered measures of object naming (Boston Naming Test) and action naming (Action Naming Test) to a group of 10 AD patients and a group of 10 controls. Although AD patients were impaired on both measures, their impairment was greater on the test of object naming, and this effect remained after controlling for the effects of age and word frequency. These results support the notion that verbs and nouns are organized differently in the brain, and suggest that AD patients may be valuable subjects in studies that attempt to fractionate different aspects of language processing.

D.P. CORINA, L. PRESSMAN, D. KEMPLER, E. ANDERSEN, & M. SEIDENBERG. Relationship Between Anomia and Semantic Knowledge: Evidence from Alzheimer's Dementia.

Anomia is a common language disturbance in patients with Alzheimer's disease, yet the nature of the deficit remains uncertain. This paper presents three experiments designed to explore the relationship between anomia and semantic knowledge. The first experiment elicits anomic states from partial semantic cues (e.g., semantic cue: A honking bird, flies south in the winter; target: goose). The second experiment investigates whether patients can name these same target items in a picture identification task. The third experiment explores whether subjects are able to verify semantic properties of the nouns in a true/false judgment task (e.g., True or False: "A goose lays eggs?"). The results indicate a high correlation between anomia and verification of semantic properties. The results are discussed in relation to current models of lexical access.

J. ANDRIKOPOULOS. Language Impairment in Presenile and Senile Dementia of the Alzheimer's Type.

Some research has suggested that patients with presenile onset (onset before age 65) Alzheimer's disease have disproportionate language impairment compared to senile onset patients (at or over age 65). The present study consisted of 38 consecutive patients with a diagnosis of Alzheimer's disease. There were 12 patients in the presenile group and 26 in the senile group. Block Design, Picture Completion, Visual Memory Span and the Facial Recognition Test were used to equate the two

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groups. There was no statistically significant difference between the two groups on the Token Test, Visual Naming or Controlled Oral Word Association. When properly matched for severity of dementia there should be no language differences.

R.M. McPHEE & B. PURVES. Effects of Context on Comprehension of Figurative Meaning.
This study investigated processing of figurative versus literal meaning of idioms. In an on-line reaction-time task, normal adult subjects identified target words in spoken passages. Targets were final words of six idioms, embedded in contexts biasing to figurative or literal interpretation, in an ambiguous context in which neither was predictable, or in a filler condition without the idiom. Subjects responded faster to targets in idioms than to those in the filler condition. Reaction times for targets in the literal context were faster than those for figurative and ambiguous contexts; only the difference between literal and ambiguous contexts was significant. Results support the claim that idioms are processed word by word, until a key word allows recognition of the idiom, triggering a figurative interpretation.

C.V. FLAHERTY, P.J. ESLINGER, & L.M. GRATTAN. Delayed Development of Serial Position Effects After Severe Closed Head Injury.
Although it is common to compute serial position effects from single-trial learning of different word lists, this does not consider "trial-to-trial" changes in learning performance. Based upon the altered serial position effects observed in frontal lesion subjects across learning trials, we hypothesized that similar dynamic changes may be evident after closed head injury (CHI), where frontal lesions can occur. Twenty-two CHI subjects, classified into mild-moderate versus severe GCS groups, were studied in the post-acute phase with a word list learning paradigm over 5 trials. Significant serial position effects were evident in the mild-moderate CHI group. In contrast, there was a slow emergence of serial position effects (delayed until trial 5) in the severe CHI group, who showed recency effects only in the early learning trials. Findings suggest that severe CHI subjects show a pattern of trial-to-trial learning that is distinct from both mild-moderate CHI and focal frontal lobe lesions.

S.K. DANIELS & A.L. FOUNDAS. Speech Apraxia and Acquired Stuttering: A Case Study With Lesion Localization.
We describe a patient with apraxia of speech and acquired stuttering with coexisting aphasia and limb apraxia following a unilateral left hemispheric lesion restricted to the supramarginal gyrus (Broadmann's Area 40). In our patient examined at one and nine months after the acute event, we found resolution of speech apraxia but persistence through improvement of acquired stuttering and limb apraxia. Neural substrates that mediate these behaviors are anatomically close in the left hemisphere, but the neural networks for speech dysfluency and limb praxis are probably independent and partially overlapping. We propose that the supramarginal gyrus is crucial for accurate performance of complex learned oral and limb movements.

V. CLEMENT, M. SHERER, C. BOAKE, & M. WILDE. A Comparison of the Boston Naming Test and the Multilingual Aphasia Examination Visual Naming in Traumatic Brain Injury.
Deficits in confrontation naming are frequently seen in traumatic brain injury survivors. The Boston Naming Test and the MAE Visual Naming Test are the most frequently used neuropsychological measures of this function. The present study compares the performance of 36 TBI patients on the BNT and VNT. Scores on the two tests are significantly correlated. Performance on the two tests in our sample was not related to education level, age, or time since initial injury. Furthermore, groups of patients with predominantly left hemisphere, right hemisphere, or bilateral injury did not significantly differ in performance on either test. Performance on both tests was related to initial severity of brain injury. Fifty percent of patients classified as impaired on the BNT were classified as normal on the VNT while 40% of patients classified as impaired on the VNT were classified as normal on the BNT.

M. BEST, M. NICHOLAS, L.K. OBLER, & M.L. ALBERT. Executive Functioning Predicts Naming: A Longitudinal Perspective.
While lexical retrieval failure in aging has been demonstrated, the neuropsychological mechanisms underlying such decline are unknown. Research suggests that executive functioning plays a role in the monitoring of language output. Our study used both a cross-sectional and longitudinal design to examine the relationship between executive system functioning and naming in an elderly population. We administered tests of executive function and naming to seventy-two individuals. Subjects were divided into a sixties or seventies group. We used executive function measures to predict naming by employing multiple regression analyses. We found executive function measures predicted naming better for the older group. We conclude that executive functions are critical to word finding ability, especially in older populations.

S.Z. RAPCSAK & P.M. BEESON. Broca's Aphasia: A Right Hemisphere Hypothesis.
Broca's aphasia is typically associated with large left hemisphere lesions involving the distribution of the upper division of the left middle cerebral artery. The anatomical structures that mediate the residual language functions in these patients have not been elucidated. We present two right-handed individuals who experienced left hemisphere strokes so extensive that left-hemisphere control of language was no longer considered plausible. When tested several years post-onset of stroke, both patients exhibited classic Broca's aphasia, characterized by adequate auditory comprehension and lexical-semantic functions, but severely limited syntactic competence. These findings demonstrate that Broca's aphasia can arise when language is mediated exclusively by the nondominant hemisphere.

D.N. CANALES & N.M. THOMPSON. Communication Deviance in Females With Fragile X Syndrome.
Fragile X Syndrome (FraX), the most common inherited cause of mental retardation, is associated with visual-spatial and executive function deficits, as well as higher rates of schizotypal personality disorder in the carrier female. Five females with FraX were compared to five unaffected matched controls on a qualitative measure designed to elicit communication deviance (CD; Jones & Doane, 1979). Each woman with FraX produced more deviant language than her matched control. Within the control group, CD was related to age and inversely related to FSIQ and education, yet CD was unrelated to any demographic characteristic in the FraX group. Within the FraX group, amount of CD increased as a function of the gene defect amplification. The absence of typical relationships between CD and demographic variables and the strong link to the length of the trinucleotide amplification attests to the overriding influence of the genetic defect on pragmatic competence.

E.A. ROY, T. WINCHESTER, D. ELLIOTT, & H. CARNAHAN. Manual Asymmetries in Visual Aiming Movements: The Effect of Spatial Variability.
Roy and Elliott (1986, 1989; Roy, Kalbfleisch, & Elliott, 1994) have attributed the observed advantage for the right hand in pointing to hand differences in movement variability. The potential spatial variability in a pointing movement, then, should affect observed performance asymmetries with hand differences being smaller when spatial variability is reduced. This hypothesis was examined by comparing pointing movements on a graphics tablet which were constrained to the Y axis (guided movements) with ones which were free to vary on both axes (free movements). As predicted spatial variability was greater, movement time greater, peak velocity smaller, and time in deceleration greater for the left hand only in the more complex, free movement condition. These findings are discussed as they pertain to current theories of movement complexity and manual asymmetries.

Paper Session 17

IMMUNE-RELATED AND DEMYELINATORY DISORDERS

D.S. BURNISON, E.B. LARSON, & W.S. BROWN. Evoked Potential Interhemispheric Transmission Time and the Bilateral Field Advantage in Multiple Sclerosis.

Lesions of the corpus callosum (CC) and CC atrophy are common in multiple sclerosis (MS). Thus, MS patients may suffer from subtle neurocognitive deficits in hemispheric integration. We studied two measures of hemispheric integration in a group of 28 MS subjects and 30 age-matched normal controls: (a) evoked potential (EP) measures of speed and efficiency of transmission across the hemispheres, and (b) speed and accuracy of bilateral versus unilateral visual field comparisons of letters, the Bilateral Field Advantage (BFA). MS subjects displayed slower EP interhemispheric transmission and smaller ipsilateral EPs than controls. Thus, EPs provide an important physiological index of the integrity of posterior callosal pathways. However, MS subjects did not differ from controls on BFA. BFA may reflect anterior callosal functioning. Thus EP and BFA provide independent measures of hemispheric integration.

W.W. BEATTY, K.R. KRULL, S.L. WILBANKS, C.R. BLANCO, K.A. ADAMS, & R.H. PAUL. Memory Disturbances in Multiple Sclerosis: Reconsideration of Patterns of Performance on the Selective Reminding Test.

Performance on the Selective Reminding Test (SRT) by 99 patients with multiple sclerosis (MS) and 32 healthy controls was studied. The conditional probability of delayed recall for words that were consistently retrieved during acquisition was better than for words that were inconsistently retrieved. Recall and recognition of words that were in short-term memory at the end of acquisition were poorer than for words in long term storage (LTS). These findings validate the measures from the SRT. When all of the patients were compared to controls, their SRT performance suggested mild storage deficits and major difficulties in consistently retrieving information from LTS. However, centroid hierarchical analysis indicated that about 25% of the patients performed entirely normally, 22% exhibited marked impairment in both storage and retrieval, and 53% showed mainly retrieval difficulties.

K.M. ROBINSON, K. ONISHI, H. THOMPSON, M. D'ESPOSITO, & M. GROSSMAN. Impaired Grammatical Processing During Sentence Comprehension in Multiple Sclerosis (MS).

Language deficits rarely are reported in MS. We hypothesize that impaired speed of information processing, a common finding in MS, contributes to impairments in sentence comprehension. We compared 20 MS patients with age-/education-matched controls during three sentence comprehension tasks. Sentence stimuli were manipulated according to grammatic complexity, voice, and semantic constraint. All subjects were tested on measures of speed of information processing, memory, visuoperception, and executive function. Group analyses demonstrated marginally significant differences in sentence comprehension. Individual analyses identified an impaired subgroup of MS patients across the three tasks. Comparison of this impaired MS subgroup with their intact counterparts demonstrated significant deficits in speed of information processing, but no differences in other domains, nor on clinical variables. Thus, deficits in speed of information processing may contribute to grammatical processing impairments.

B.J. KAPLAN, D.L. McALLISTER, S.G. CRAWFORD, S.M. EDWORTHY, L. MARTIN, R. RAMSEY-GOLDMAN, & R. TALAVERA. The Influence of Systemic Lupus Erythematosus on Fetal Brain Development.

The immunoreactive theory (Gualtieri & Hicks, 1985) claimed that male fetuses are more antigenic to mothers, resulting in increased maternal immunologic attack on the developing CNS, and increased probability of brain dysfunction. Individuals with Systemic Lupus Erythematosus (SLE) provide a unique situation in which to investigate possible influences of maternal immunoreactivity. We evaluated parent-reported prevalence of five developmental problems (stuttering, other speech problems, hyperactivity, attention deficit, and reading problems) in two groups: 154 children aged 8–20 yr born to women with SLE, and 154 age- and sex-matched controls. Questions about handedness, and pregnancy and birth complications were also asked. Results provided confirmation that the presence of developmental problems in boys was associated with pregnancy and birth complications, as well as with the degree of maternal immunoreactivity.

D. RENTZ, B. PRICE, M. EMRE, M. TROYER, & M. NATOWICZ. Frontal Lobe Dementia in Adult-Onset Metachromatic Leukodystrophy With Normal MRI.

Adult-onset Metachromatic Leukodystrophy (MLD) is a familial, early-onset dementia that typically presents with psychotic and comportmental changes prior to the appearance of neurological symptoms. This clinical presentation often leads to misdiagnosis and ineffective treatment. A clearer descriptive profile of this dementia would be helpful for making a correct diagnosis. We present a 22-yr-old woman with a 7-yr history of MLD/pseudo-deficiency syndrome whom we have followed over the last 2-1/2 yr. The neuropsychological profile was characterized as a frontal network syndrome with salient deficits in comportment, attention, motivation and executive functions which interfere with daily living activities. Memory, language and visuospatial skills were relatively normal. Serial MRIs and EEGs were normal and should not be used to exclude the diagnosis.

T. LEWIS, B. FREUNDLICH, & C. ARMSTRONG. Eosinophilia-Myalgia Syndrome (EMS): An Autoimmune Disorder With Selective Cognitive Impairment.

Eosinophilia-Myalgia Syndrome (EMS) results from ingestion of the contaminated amino acid L-tryptophan. EMS has been found to result in numerous physical and cognitive symptoms. This study reexamined the neuropsychological sequelae associated with EMS. Twenty-three EMS patients were compared to 18 controls on a comprehensive neuropsychological battery. Patients were impaired in two cognitive domains previously identified: visual memory and conceptual problem solving. We did not find evidence of impairment in semantic memory or motor speed as reported in another center's study. However, we also identified an impairment in selective attention and a test of working memory, which together suggest that EMS patients are most vulnerable to disruption of executive functions. Longitudinal findings on 5 cases are presented.

Paper Session 18

MEMORY (COGNITIVE PERSPECTIVES)

I. KISS, C. PISIO, A. FRANCOIS, & D. SCHOPFLOCHER. Electrophysiological Indices of Working Memory.

Subjects viewed random length series of 2 to 5 individually presented, single digits. Each series was followed by a set of 2 digits. They compared each set to the preceding two individual digits, requiring ongoing revision of working memory contents (updating). Event-related potentials (ERPs) were recorded separately for each serial position. A control condition and digital subtraction minimised influences of per-

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ceptual and response processes to isolate ERP correlates of cognitive processes. ERP amplitude and area increased with serial position when subjects revised a stored memory set but not during the storage phase. Two additional experiments confirmed these ERPs' sensitivity to operational differences between control processes and support the application of this novel, cognitive psychophysiological paradigm in the investigation of working memory.

J. DYWAN, S.J. SEGALOWITZ, W. MURPHY, T. MURPHY, & A. YONELINAS. Source Monitoring: ERP Evidence for Changes in Memory Experience With Age.
We asked older and younger adults to read a list of words that they would later be asked to recognize. At test subjects were presented with the study words interspersed with new items. A subset of the new words were repeated at a lag of 6. Subjects were asked to indicate whether each item was or was not from the study list, and to ignore the familiarity that occurred as a result of test list repetitions. ERPs were collected concurrently with stimulus presentation during test. As expected, older adults were more likely than the young to mistake lag items for targets. The ERP slow positivity (300–600 ms) that accompanies repeated items was analyzed only for correct responses. Amplitude was greater for study than lag items for young adults. For older adults amplitudes were greater for lag items than for study items. In order to make correct decisions with respect to lag items, older adults must inhibit the salient repetition effect that attends the more recently seen lag stimuli. Familiarity in this context promotes erroneous identification of repeated test items and therefore inhibition of familiarity as the main or only criterion seems necessary for the older subjects but not for the young.

M. SCHMITTER-EDGECOMBE. The Effects of Divided Attention on Implicit and Explicit Memory Performance Following Severe Closed Head Injury (CHI).
The relation between attention and memory was investigated in a CHI population. Twenty-seven severe CHI participants (>1 yr post-injury) and 27 matched controls encoded target words under conditions of full and divided attention. Memory for the target words was assessed with a mainly automatic implicit test (tachistoscopic identification) and a more controlled explicit test (recognition). The results revealed impaired explicit but preserved implicit memory following a CHI. Contrary to hypothesized, the CHI subjects recognition performance was not significantly more impaired than controls by the divided attention manipulation; however, the groups may have used different processes to complete the task. Finally, the CHI subjects' priming effects were affected by the divided attention manipulation while the control subjects were not, suggesting that priming processes may require additional attentional resources following injury. Priming magnitude also interacted with threshold tachistoscopic identification processing rate, indicating that nonmemory cognitive factors may influence measured priming performances.

J.F. FAHY, W. MARKS, M.E. SCHMITTER-EDGECOMBE, & C.J. LONG. Dissociations Among Memory Tests After Severe Closed Head Injury: Systems Theory Versus a Processing Account.
The purpose of this study was to demonstrate dissociations among implicit and explicit measures after severe closed head injury (CHI) while testing predictions suggested by the processing account of memory. A modification of Blaxton's (1989, 1992) design was implemented. Twenty-five severe CHI subjects and 25 matched controls completed four memory tests, each test combined one system with primarily data-driven or conceptually-driven processing. The results suggested data-driven processing was less affected by severe CHI than conceptually-driven processing. However, explicit test conditions were more difficult for CHI subjects than implicit conditions, independent of type of processing. A theory which integrates the processing account with a systems perspective was best able to explain these findings.

C. ARMSTRONG, K. ONISHI, M. D'ESPOSITO, K. ROBINSON, & M. GROSSMAN. Memory Encoding Versus Retrieval Impairment in Multiple Sclerosis.
Neurocognitive studies of MS have identified a robust long-term memory deficit in MS, showing that impaired retrieval on supraspan or other standard memory tests occurs in a high proportion of MS patients. Performance on tests of the short term store is usually normal. We hypothesized that MS patients demonstrate a common deficit in retrieval and that encoding into long-term memory is not impaired. We found that a minority of MS subjects failed to encode the middle portion of a supraspan word list. A larger proportion demonstrated post-encoding retrieval failure characterized as negative recency, and patients did not order-link their recall of recency words. MS subjects were able to transfer information into long term memory. Negative recency has been explained as failure of temporal discrimination of memory traces.

M.L. GLISKY, M.R. POLSTER, & S.Z. RAPCSAK. Acquisition and Integration of Novel Person-Specific Information in Right Hemisphere Damaged Patients.
The present study investigated the ability of 9 patients with unilateral right hemisphere lesions (RHD) and 10 control subjects to learn and integrate three types of person-specific information. After studying twelve novel face, name, and voice triplets RHD patients performed worse than controls on an old/new recognition test for faces and voices, but were no different for names. Subsequent four alternative forced choice cued recognition tests assessed how well the three types of information were integrated and revealed that RHD patients performed more poorly than controls when faces and voices were the targets, regardless of the type of cue. Moreover, patients were unable to benefit from cues in the same fashion as control subjects. The results parallel those found in the retrograde domain.

Symposium 9

CLOSED HEAD INJURY AND ALZHEIMER'S DISEASE: EPIDEMIOLOGIC, NEUROBEHAVIORAL, AND NEUROPATHOLOGIC LINKS

H.S. LEVIN & F.C. GOLDSTEIN. Closed Head Injury and Alzheimer's Disease: Epidemiologic, Neurobehavioral, and Neuropathologic Links.
Recent studies suggest an association between closed head injury (CHI) and Alzheimer's disease (AD), but specification of whether and how they are related remains controversial. This symposium draws together researchers from different fields to explore evidence for such a relationship. Four studies are presented: (1) Epidemiologic data examining CHI as a risk factor for AD; (2) Behavioral changes in older CHI patients and parallels between those present in AD; (3) Similarities and differences in the cognitive profiles of older CHI and AD patients; and (4) Neuropathologic changes occurring after CHI and AD. This symposium provides an integrated overview for understanding linkages between these two disease entities, and the findings are discussed in terms of theoretical and clinical implications.

Y. STERN & R. MAYEUX. Head Injury in Alzheimer's Disease.
Head injury may affect central amyloid production, which probably plays a role in the pathogenesis of Alzheimer's disease (AD). Several studies have suggested a relationship between head injury and AD. In

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our community-based study, we obtained risk factor data for AD patients and elderly controls. AD was associated with head injury (OR = 3.7, CI 1.4–9.7). The association was strongest for head injuries: (1) after age 70; (2) within 5 yr of AD onset; and (3) with unconsciousness of >1 h. The association remained significant when subjects with head injuries within 2 yr of AD onset were eliminated from the analysis. Information was also obtained about first-degree relatives of the patients and controls. Head injury was associated with an increased risk of AD in relatives of both patients and controls. Family history was also a risk factor for AD, but was independent of head injury. Our observations support head injury as a putative risk factor for AD, but the temporal relationship between head injury and AD remains in question.

H.S. LEVIN, F.C. GOLDSTEIN, L. KUSNERIK, A.R.T. COLLOHAN, & H.M. EISENBERG. Closed Head Injury in Older Adults: Assessment by the Neurobehavioral Rating Scale.
The Neurobehavioral Rating Scale (NRS) was given to 15 patients 50 yr and older who sustained a mild to moderate closed head injury. In comparison with 16 uninjured controls of similar age and education, the NRS scores of the head injured patients indicated marked impairment in the cognitive, somatic, and psychiatric domains after a mean postinjury interval of about one month. Significant group differences were confirmed on all four factors of the NRS and the total NRS score. Implications of this study for posttraumatic dementia are discussed.

F.C. GOLDSTEIN, H.S. LEVIN, V.J. ROBERTS, & A.D. KALECHSTEIN. Neuropsychological Features of Older Adults With Closed Head Injury or Alzheimer's Disease.
This study examined similarities and differences in the neuropsychological profiles of older adults with closed head injury (CHI) or Alzheimer's disease (AD) who were comparable in general cognitive status. Compared to normal controls, both the CHI and AD patients exhibited poorer learning and recall as well as word retrieval deficits. However, the AD patients displayed more devastated memory functioning and sparser output on a category retrieval task compared to patients with CHI. Theories to account for these differences, including the role of semantic processing, will be discussed.

G.W. ROBERTS, S.M. GENTLEMAN, W.S.T. GRIFFIN, & D.I. GRAHAM. Age, Head Injury and Alzheimer's Disease.
Head injury is a risk factor for the subsequent development of Alzheimer's disease. We reported that a severe head injury resulted in the deposition of β-amyloid protein (βAP) in the cortical ribbon of 30% of patients who survived for less than two weeks. We have now examined multiple cortical areas from 152 patients (age range 8 wk–81 yr) following a severe head injury with survival times of 4 hours to 2.5 yr. This series was compared to a group of 44 neurological normal controls (age range 51–80 yr). Forty-six (30%) of the head injury cases exhibited βAP deposits as compared to no βAP positive controls under age 60. Increasing age appeared to accentuate the extent of βAP deposition.

SATURDAY AFTERNOON, FEBRUARY 11, 1995

Paper Session 19

LATERALITY

C. POTVIN, C.M.J. BRAUN, & A. ACHIM. Distinct Functional Channels in Interhemispheric Relay: Experimental Evidence.
It has become evident that distinct functional channels exist in the cerebral commissures. This study explored the relations of evoked potential estimates of interhemispheric transfer time (EP-ITT) at eight symmetrical electrode-pair sites with ITT derived from a simple reaction time experiment in ten normal subjects. EP-ITT correlated positively and significantly with RT-ITT at anterior sites F7–F8 and T5–T6, but not at prefrontal, central, posterior temporal, parietal or occipital sites. Similarly EP-ITTs and RT-ITT were of same duration for F7–F8 and T5–T6, but differed significantly at all other sites. We propose that RT-ITT is primarily motor, and that EP-ITT at parietal and occipital sites is primarily sensory.

E. ZAIDEL, F. ABOITIZ, & J.M. CLARKE. Sexual Dimorphism in Interhemispheric Relations: Anatomical-Behavioral Convergence.
An embryogenetic hypothesis states that hemispheric specialization is inversely related to callosal connectivity (Geschwind & Galaburda, 1985). We tested this hypothesis (i) anatomically by relating planum temporale asymmetry to callosal morphology post-mortem and (ii) behaviorally by relating the right visual field advantage in a lateralized lexical decision task to callosal morphometry using MRI. The post-mortem study showed a significant negative correlation between planum temporale asymmetry and the number of small diameter fibers in the isthmus of the corpus callosum, but only for males. The MRI study showed a significant negative correlation between the right visual hemifield advantage and the cross section size of the isthmus of the corpus callosum, but again only in males. There was no sex difference in either the anatomical asymmetry, the behavioral asymmetry, or the callosal morphology. Callosal morphometry did reveal a larger normalized isthmus in right handed females than males. These convergent results suggest that there is a sexual dimorphism in interhemispheric relations.

W.F. McKEEVER, P.J. SUTER, & L.J. CERONE. A New Family Handedness Data Set: Transmission Problems for the Right Shift Model?
Four hundred thirty-nine mothers reported the hand used for writing by each of their children, by themselves, and by the fathers of the children. A total of 1266 offspring, including 275 left handers, were included. Offspring handedness as a function of the handedness of parents was computed. Results showed significant relationships of maternal sinistrality to sinistrality of sons and of paternal sinistrality to sinistrality of daughters. A trend toward a relationship of maternal and daughter sinistrality was seen, though it was short of significance. Most importantly, there was no trend whatever for an association between sinistrality of fathers and sons. The data is generally consistent with a sex-linked recessive mode of transmission and poses problems for the "right shift model" of Annett.

D.M. MOSNIK, A.P. TRANEL, D.S. O'LEARY, & N.C. ANDREASEN. Planum Temporale (PT) Asymmetry in Groups Defined by Dichotic Ear Advantage: A Study of Schizophrenic Patients and Normal Controls.
The PT is larger on the left in most right handers, which may be the neuroanatomical substrate of left hemispheric language dominance. Abnormalities in PT lateralization may also be associated with language-related disorders in schizophrenic patients. Selecting subjects with extreme scores on a dichotic task we composed four groups: 5 patients and 5 controls with a strong right ear advantage (REA) and 5 patients and 5 controls with a weak left ear advantage (LEA). All subjects were right-handed males. PT areas were traced on sagittal MRI slices and a PT laterality index was compared across groups. Area of the PT was larger on the left in all groups, and the asymmetry was greater in subjects with a LEA for both controls and patients.

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S.W. GANGESTAD, R.A. YEO, P. SHAW, R. THOMA, W.F. DANIEL, & A. KORTHANK. Associations Between Hand Preference and Human Leukocyte Antigen Alleles.
We examined relations between HLA (human leukocyte antigen) alleles and hand preference. Based on established associations between handedness and autoimmune diseases related to HLA alleles, we predicted that left-handers would be more likely to possess the A1, B8, and DR3 alleles. In a sample of 664 individuals who filled out the Annett Handedness Questionnaire, these predictions were generally supported. In addition, we found that handedness and the B8 allele were negatively related to number of offspring, with age controlled. These results are discussed in light of the developmental instability model of the origins of handedness, as well as the Geschwind-Galaburda model.

E.I. BARTOLIC, B.K. SCHEFFT, W.N. DEMBER, M. SCHWARTZ, M.K. TITANIC, & T.A. GLAUSER. Effects of Experimentally-Induced Emotion on Frontal Lobe Cognitive Task Performance.
This study tested hypotheses derived from the EEG literature on hemispheric asymmetry in emotion and cognition. Empirical evidence suggests that asymmetrical patterns of activation in the parietal lobes at a given point in time can predict performance on subsequent tasks of spatial and verbal cognition. Research on emotion has shown that left and right frontal regions are differentially more activated during positive and negative mood states, respectively. It follows, then, that positive mood should be associated with more efficient performance on a left frontal lobe cognitive measure (i.e., verbal fluency), whereas negative mood should be associated with greater efficiency on a right frontal measure (i.e., figural fluency). A significant mood × task interaction was found in a sample of 60 normal, right-handed females to support the hypotheses.

Paper Session 20

DEMENTIA II

E. KOSS, S. EDLAND, G. FILLENBAUM, R. MOHS, J.C. MORRIS, C. CLARK, D. GALASKO, & THE CERAD ASSOCIATES. Clinical and Neuropsychological Status in Alzheimer's Disease (AD) as a Function of Age.
Previous studies have suggested differences in the presentation of AD as a function of age of onset. We evaluated the clinical manifestations and neuropsychological performance of 421 patients with AD [226 women, 195 men; mean age = 70.8 ± 7.9; years of education = 13.1 (±3.2); MMSE score = 18.8 (± 4.5)], recruited from 21 CERAD sites in the US, with regression analyses, controlling for gender and education. Age was entered as a continuous variable. Younger patients were considerably more impaired on clinical measures of language and concentration at baseline and deteriorated faster than older patients. Similar results, of smaller magnitude, were obtained longitudinally on neuropsychological tests. However, cross-sectional findings for language tests were inconsistent. Gender was significant at baseline, but not longitudinally. Factors underlying these differences will be discussed.

J.C. ADAIR, D.L. NA, R.L. GILMORE, D.J. WILLIAMSON, S.N. ROPER, & K.M. HEILMAN. Defining Frontal Subsystems Responsible for Movement Initiation.
The frontal lobes contribute important temporal information for the execution of behavior. The anatomy of functional sub-systems within the frontal lobes remains largely undefined, however. To examine movement initiation, we tested the hypothesis that cortical stimulation of the orbitofrontal (OF) cortex impedes simple reaction time (SRT) performance. Patients under evaluation for epilepsy surgery ($n = 6$) underwent placement of subdural strip electrodes at 2 sites in each hemisphere corresponding closely with Brodmann's areas 11 and 13. No significant main effect of stimulation condition on SRT was observed. Though negative results require conservative interpretation, these findings suggest that the OF subdivision of the frontal lobe does not contain systems devoted to the initiation of movement.

D. MARSON, K. INGRAM, H. CODY, & L. HARRELL. Neuropsychological Modeling of Competency Status in Dementia Using Discriminant Function Analysis.
Neuropsychological models of competency are needed to assist physicians and judges 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 provide "rational reasons" for treatment choice) ("LS4"). Forty-four subjects (15 normal older controls and 29 AD patients) were administered the vignettes, and also neuropsychological measures theoretically linked to competency function. Subjects were assigned a status of competent, marginally competent, or incompetent under LS4 based on a cut-off score derived from control performance. Using stepwise discriminant function analysis, a three-variable model comprising Mattis DRS Perseveration (partial $r^2 = .57$, $p < .0001$), Trails A (partial $r^2 = .16$, $p < .04$), and Logical Memory I (partial $r^2 = .13$, $p = .07$) emerged which successfully classified the competency status of 72% of the sample. Nonparametric discriminant function analysis resulted in 100% classification accuracy. These findings indicated that competency status under a "rational reasons" legal standard is integrally related to cognitive capacities for executive function, verbal fluency, attention, and to some extent short term verbal memory.

E.V. SULLIVAN, P.K. SHEAR, K.O. LIM, J. JOHNSON, M. STEIN, J.A. YESAVAGE, J.R. TINKLENBERG, & A. PFEFFERBAUM. Age-Related Cortical Gray Matter Deficits in Alzheimer's Disease: A Volumetric MRI Analysis.
We used MRI to examine whether the brain tissue volume loss observed in Alzheimer's disease (AD) is attributable to gray or white matter volume abnormalities and further whether the degree of tissue loss is related to age. We quantified gray matter, white matter, and CSF volumes, corrected for normal variation in head size and age, in 31 AD and 31 normal control (NC) subjects. The AD group had significantly smaller volumes of cortical gray matter, but not white matter, than did the NC group; in addition, cortical sulci and lateral and third ventricles were severely dilated in AD. Age was significantly correlated with gray matter volumes in prefrontal, frontal-temporal, and temporal-parietal cortical regions, with younger AD patients showing greater abnormalities than older patients.

G.M. PEAVY, D.P. SALMON, V.A. RICE, & N. BUTTERS. Assessment of Severely Demented Elderly.
Severely demented patients are often unable to obtain measurable scores on tests traditionally used to assess dementia. Neuropsychological data from these patients are important for clinical management and for comparison with neuropathological autopsy data. We developed the Severe Cognitive Impairment Profile (SCIP) to assess comportment, attention, language, memory, motor functioning, conceptualization, arithmetic, and visuospatial ability in severely demented elderly. The SCIP was administered to 33 severely demented patients. Inter-rater and test-retest reliability were high (.99 and .97, respectively). Correlation between the SCIP and traditional tests of dementia (e.g., Dementia Rating Scale (DRS), $r = .95$) provide evidence of test validity. Examination of SCIP data from very severely demented elderly (DRS < 50) for whom a floor effect was found on more traditional tests, revealed meaningful scores for at least two-thirds of this group.

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N. MEIRAN & M. JELICIC. Implicit Memory in Alzheimer's Disease: A Meta-Analysis.
A Meta-Analysis on 26 articles (30 experiments) including 463 Alzheimer disease (AD) patients and 485 Controls [(C), mainly normal elderly] has shown that AD patients are slightly but significantly impaired on implicit memory tests [$r = .180$; the difference is equivalent to 0.37 SD's]. However, AD patients are spared on word-perceptual implicit memory tests (e.g., Fragment Completion) but impaired on conceptual tests (e.g., Free-Association), on nonverbal tests (e.g., Fragmented Pictures) and on Word-Stem Completion, which yielded the largest AD–C difference ($r = .313$). AD impairment on implicit memory tests is greater with zero study-test delays but is still significant even with delays greater than 20 min. The existing theories are only partly compatible with these results.

Symposium 10

CAN NEUROPSYCHOLOGICAL TESTS IDENTIFY WHEN BRAIN DYSFUNCTION IS NOT PRESENT?

G.P. PRIGATANO. Can Neuropsychological Tests Identify When Brain Dysfunction is Not Present?
Validity studies on neuropsychological tests have traditionally focused on the question of sensitivity. That is, how effective are neuropsychological measures for identifying persons with true brain dysfunction? A secondary question has been that of specificity. That is, how successful are neuropsychological measures in identifying persons without brain dysfunction? This latter question has had growing clinical application in medical/legal cases and neurology. This symposium will address this question in four patient groups: Mild head injury patients with persistent neuropsychological complaints, patients suspected of pseudoseizures, patients suspected of malingering, and patients who are thought to have a severe brain injury who were later considered to have a mild head injury and a primary psychiatric disturbance.

N. TEMKIN & S. DIKMEN. Problems and Prospects in Determining Mild Head Injury Effects.
Two important questions in the area of head injury involve determining whether there are neurobehavioral impairments and whether the impairments are related to the head injury sustained. This paper will focus on methodological issues in assessing the neurobehavioral outcome of mild head injury. Comparisons with different reference groups will reveal problems in drawing conclusions about the effects of mild head injury on neurobehavioral outcome. Even when an impairment is documented through comparisons with appropriate controls, one needs to determine whether the injury sustained caused the impairment. A variety of factors other than head injury can produce impairments that may be erroneously attributed to the head injury. These factors include preexisting conditions and malingering.

P.S. KLONOFF. Mild Head Injury, Severe Impairment on Neuropsychological Test Scores, and Psychiatric Disability.
Typically there is positive correlation between severity of known brain injury and level of performance on neuropsychological tests, particularly tests of memory and speed of information processing. This paper will discuss in detail five individuals who had a history of mild head injury but who presented with severe neuropsychological deficits on testing. In each case, evidence of significant psychiatric disability was present and seemed to be the primary factor responsible for extremely poor neuropsychological test findings. All five patients showed evidence of significant premorbid stressors, secondary gain, "atypical" response style on neuropsychological tests, and vague and unusual somatic complaints. The importance of interpreting test findings within the context of an adequate history as well as a clinical interview is stressed.

G.P. PRIGATANO & I. SMASON. Neuropsychological Indicators of Suspected Malingering: A Replication and Extension.
Previous findings that brain dysfunction patients including those with frank amnestic disorders obtain perfect or near perfect scores on the Digit Memory Test (DMT) while suspected malingerers do not was replicated with a new group of 19 brain dysfunctional patients and 4 suspected malingerers. In addition, 10 Alzheimer's patients and 7 patients with language disorder were studied using the DMT. Only those Alzheimer's patients who were severely impaired showed less than perfect performance. Only one aphasic patient also showed this pattern. If an adult is clearly not demented and/or severely aphasic, yet performs only between 75% to 85% correct on the DMT, other explanations besides brain dysfunction need to be considered.

J.J. BORTZ & G.P. PRIGATANO. Neuropsychological Assessment of Patients With Non-Epileptic Seizures: A Review of Qualitative Response Characteristics, Clinical Predictors, and Problems in Differential Diagnosis.
The establishment of video-EEG monitoring units has brought to the attention of neuropsychologists patients who present with clinical signs and symptoms of seizures, but fail to produce electrophysiological correlates of 'typical' clinical spells. These patients are often diagnosed with nonepileptic seizures (NES). Quantitative indices of neuropsychological test performance have not reliably identified patients with NES. Recent research using the CVLT indicated that qualitative aspects of patients' performance may help in differential diagnosis. In a previous study, the sensitivity of the CVLT Response Bias index in classifying NES patients was 91% with a specificity of 61%. We will present data that replicate these findings. Inspection of MMPI critical items may also be helpful in identifying patients with NES and provide insight regarding psychological mechanisms underlying NES.

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