

# Abstracts Presented at the Twenty-Third Annual International Neuropsychological Society Mid-Year Conference

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Poster Session 1/9:00 a.m.–5:00 p.m.

### FUNCTIONAL NEUROIMAGING/VISUAL PROCESSING AND HEMI-INATTENTION/CHILDREN: DEVELOPMENTAL AND ACQUIRED BRAIN INJURY/MEMORY

**H. MORTENSEN, A. GADE, I. LAW, K. KRABBE, C. AASIDE, & O.B. PAULSON.** Frontal Lobe Involvement in Memory Processes.

While the role of the temporal lobes in memory processes has been investigated for a long time, the contribution from the frontal lobes in memory has only recently come into focus. PET studies of healthy controls have shown frontal activation in encoding and retrieval paradigms. To evaluate frontal components in memory we investigate patients with various degrees of selective memory impairment and age matched normal controls. Participants are evaluated with a comprehensive battery of neuropsychological tests probing different cognitive domains and in particular different aspects of executive function and memory (metamemory, source memory, memory for temporal order, release from proactive inhibition, and autobiographical memory). Patients and controls are also PET scanned during a recognition memory paradigm. MR scans are obtained for volumetric measurements of selected brain regions and for alignment with PET scans. The study is in progress. Data on the correspondence between cognitive function and PET activation will be presented.

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**F. CAZALIS, A. FEYDY, S. GRANON, S. ASLOUN, J.L. ANTON, R. CARLIER, O. JOLIVET, J. BITTOUN, L. PIEROT, Y. BURNOD, & P. AZOUVI.** Prefrontal Activation After Traumatic Brain Injury (TBI): An fMRI Study With a Tower of London Task.

*Objective:* To assess cortical activation during performance of the Tower of London (TOL) in severe TBI patients, in comparison to healthy controls. *Participants and methods:* Eleven patients at the subacute stage after a severe TBI characterized by diffuse axonal injury were compared to healthy controls matched for age and education duration. Functional MR imaging using echoplanar sequences were acquired on a standard 1.5 T MRI. The experimental paradigm, using a simplified TOL task, was designed in order to manipulate the working memory load (*control, easy, and difficult* levels), and to require sustained attention. *Results:* The control group exhibited cortical activation around the superior prefrontal sulcus, the intraparietal sulcus and in the cingular gyrus. TBI patients performed

the task significantly slower than the controls. Three patients performed the task as accurately as controls, with the same pattern of cortical activation. Eight patients performed poorer than controls, and exhibited inconsistent and unstable activation patterns. *Conclusion:* These results confirm previous data suggesting that performance of the TOL activates dorsolateral prefrontal, cingulate, and parietal areas. Deficit in TOL performance after severe TBI was found associated with an inconsistent and unstable activation of this cortical network. These results suggest that cognitive impairments after severe TBI may be related to a deficient activation of cortical (and particularly prefrontal and cingulate) areas, presumably secondary to underlying white matter injury. Grants to F.C. (Fondation de l'Avenir 1998) and to S.G. (Sidaction 1998)

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**B. RAVNKILDE JENSEN, P. VIDEBECH, A. GADE, & R. ROSENBERG.** Stroop's Test and Verbal Fluency as Measures of Frontal Lobe Function: A PET Study.

Stroop's Test and the Verbal Fluency Test are commonly argued to be measures of the integrity of prefrontal cortex. This assumption has only to some degree been confirmed by lesion studies. In the present study positron emission tomography (PET) was used to further validate Stroop's test and Verbal Fluency as measures of frontal lobe function by implementing both tests as activation paradigms during scanning of normal individuals. 47 normal volunteers ( $M$  age  $41 \pm 11.7$ ) were scanned with intravenous bolus injections of  $H_2[^{15}O]$  water. Four scans with a frame of 40 s were completed. Stimuli were presented on a monitor screen outside the scanner and the participants had to respond orally. Activation tasks were Stroop's Test: (1) naming the color of congruent color words, (2) naming the color of incongruent color words, and the Verbal Fluency Test, (3) reading neutral color words, (4) generating as many 'T'-words as possible. Statistics were performed using the Montreal method. The analysis was set up as a cross-validation study. Data presented here are the results of the first analysis of 14 participants. Subtraction of the Stroop tasks (Scan 1 from 2) was found to activate the left anterior cingulate cortex (BA 32,  $p < .05$ ). When subtracting Scan 3 from 4, Verbal Fluency activated the left dorsolateral prefrontal cortex (BA 9, 45,  $p < .01$ ), supplementary motor cortex (BA 6,  $p < .05$ ), anterior cingulate cortex (BA 24, 32,  $p < .05$ ), and the cerebellum ( $p < .01$ ). From this first analysis we conclude that both Stroop's test and the Verbal Fluency test with qualifications can be considered tests of frontal lobe function. However, only the Fluency test proved to be a test of specifically prefrontal function.

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**O.M. RAZOUMNIKOVA. Topographic EEG Analysis: Relations to Assessment of Temperament.**

The temperament associated changes in spontaneous EEG mapping was examined. The temperamental types based on the combinations of some personality characteristics [extraversion, neuroticism, sensation (S)-intuition (I), thinking (T)-feeling (F), and judging (J)] which were assessed by Keirse's Type Inventory, and Eysenck's Personality Questionnaire. EEGs were recorded from 46 young men (age 17–20) in 16 referential derivations. FFT and mapping techniques were used to represent the spatial distribution of result following spectral power and coherence analysis into six (4–30 Hz) frequency bands. Three groups SJ–IF–IT (separated by high corresponding personality scores) showed distinct discrepancies in brain mapping of EEG power and coherence in several frequency bands. SJ characterized by the greatest increases of power and coherence in theta-1–alpha-2 bands as compared to other types. IT-type distinguished by greater power and coherence mainly in beta-2. IF showed the increase of alpha-rhythm amplitude, and alpha-interhemispheric coherence as compared to IT. Eysenck's types showed the less frequency and topography pronounced differences between groups with four combinations of high and low scores of extraversion and neuroticism than it is found for Keirse's types. But considerable topographic changes of power were observed in frontal, temporal, and occipital areas of both hemispheres in beta-2 band between these groups.

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**C. KLEITZ, D. GOUNOD, I. NAMER, P. KEHRLI, & M.N. METZ-LUTZ. Functional Imaging Studies in a Case of Thalamic Aphasia.**

The role of the thalamus in language function has been specifically explored since the development of morphological brain imagery in the early '80s. The main findings about the involvement of thalamus in various neurocognitive processes such as memory and language come from the study of the effects of thalamic lesions and/or stimulation upon language. Most studies pointed to its contribution to lexical–semantic functions. As for the functional imaging studies, they have demonstrated the involvement of the left thalamus in most language and memory tasks, which seems to depend upon the cortical connectivity of the thalamic region. We report here a case of thalamic aphasia following the surgical treatment of an intractable mesiotemporal epilepsy with left hippocampal sclerosis. The patient's language assessment, performed prior to the surgery, showed normal verbal abilities. The functional mapping of brain areas implicated in single word generation, reading and auditory word processing was specified in presurgical fMRI studies. Following the surgery, consisting in the ablation of the left hippocampus and polar temporal cortex, the patient sustained a focal left posterior thalamic infarction. The consecutive aphasic disorders that initially involved almost all language modalities progressively restricted to naming and verbal working memory while fMRI studies showed changes in the individual functional mapping for language. The comparison with the postsurgical fMRI data of epileptic patients who underwent similar left hippocampal and polar temporal lobectomy allowed to specify the functional changes directly related to the posterior thalamic. These findings provide arguments for a direct involvement of the thalamus in the activation of cortical language functions.

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**N. VAN NIEROP, G. BOSMA, M. ROOD, M. VAN BUCHEM, T. HUIZINGA, E. BOLLEN, & H. MIDDELKOOP. Cognitive Functioning and Volumetric Magnetization Transfer Imaging in Patients With Inactive Neuropsychiatric Systemic Lupus Erythematosus.**

*Objective:* To determine the relationship between cognitive functioning and structural brain abnormalities as assessed by volumetric magnetization transfer imaging (MTI) in patients with inactive neuropsychiatric systemic lupus erythematosus (NP-SLE). *Methods:* Twenty-two female patients (23–64 years) with inactive NP-SLE were subjected to neuropsychological assessment and MTI. Cognitive impairment scores (0 = *no impairment*, 1 = *questionable or mild impairment*, 2 = *definite impairment*) were

obtained for attention, intelligence, memory, language, visuospatial, arithmetic and cognitive flexibility, and global cognitive functioning (sum of cognitive domain impairment scores). MTI was performed with a 3-D gradient-echo pulse sequence, TR/TE/flip angle 106/6/12°, FOV 220 mm, a matrix of 256 × 128, and 28 slices with a thickness of 5 mm. Two consecutive sets axial images (one with an off-resonance radio frequency saturation pulse) were acquired. These sets—corrected for intracranial volume—yielded a global measure for 'lesion load' (MTI-LL; lower MTI-LL means higher lesion load). Finally, neuropsychological and MTI-LL data were correlated. *Main outcomes and conclusion:* Overall, higher impairment values for intelligence ( $r = -.63$ ), memory ( $r = -.62$ ), attention ( $r = -.43$ ), and global cognitive functioning ( $r = -.45$ ) were significantly ( $p < .05$ ) associated with lower MTI-LL values. In conclusion, cognitive dysfunctioning in patients with inactive NP-SLE is significantly associated with structural brain abnormalities as quantified with MTI.

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**E. GONZÁLEZ, C. JUNQUÉ, M.M. MATARÍN, J.C. MARTÍN, G. MENDOZA, E. GUARDIA, A. CATAFAU, C. GARCÍA, J. MARTÍ, & J.L. MARTÍ-VILALTA. Diaschisis in Vascular Patients: Neuropsychological, MRI, and SPECT Studies.**

*Background and purpose:* There is still little knowledge about functional brain reorganization after focal cerebral lesions. The aim of this work was to study diaschisis in vascular patients. *Methods:* Eighteen right-handed patients were assessed after their first focal vascular lesion documented by magnetic resonance imaging (MRI) study. Thirteen patients suffered ischemic lesions and 5 hemorrhages. Diaschisis was assessed by SPECT study performed at 1 month after stroke. Ipsilateral and contralateral (transcallosal) diaschisis were analyzed according to the correspondence of focal lesions and neuropsychological focalities. Language and ideomotor praxia were considered as left hemispheric functions and visuospatial, visuomotor and visuo-perceptive as right hemisphere functions. *Results:* Seventeen of eighteen patients showed diaschisis. Twelve of thirteen patients with subcortical lesions had cortical hypometabolism, and all patients with cortical lesions had subcortical (basal ganglia or thalamic) diaschisis. Neuropsychologically, 11/13 patients with subcortical lesions had neuropsychological impairment of functions corresponding to ipsilateral cortex. Transcallosal diaschisis was observed in 9 patients at 1-week exam, and persisted at 1 month exam in 3 patients. *Conclusions:* There is a high agreement between neuropsychological and SPECT studies. The functional impairment in patients is superior to that expected by structural lesions seen in MRI studies. Diaschisis phenomenon (ipsilateral and contralateral) can account for the improvement seen in the 1st month after stroke.

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**P.G. SIMOS, J.I. BREIER, J.W. WHELESS, W.W. MAGGIO, & A.C. PAPANICOLAOU. Mechanisms for Reading Words and Pseudowords: Insights From Functional Imaging and Electrocortical Stimulation.**

Evidence obtained from electrocortical stimulation studies in patients undergoing left temporal lobectomy for epilepsy treatment (Experiment 1) indicated that distinct cortical patches in the posterior part of the left superior temporal gyrus (STGp) are involved in reading aloud real words with unusual spellings (exception words) and meaningless letter strings (pseudowords). A detailed examination of the behavioral effects of transient electrical interference further revealed that regions which are indispensable for deriving the assembled phonology of pseudowords also play a crucial role in the phonological analysis of aural language. In a second experiment spatiotemporal brain activation profiles were obtained during reading of real words and pseudowords using magnetic source imaging (MSI) from 12 neurologically intact volunteers. These profiles provided information regarding the manner in which STGp cortex interacts with other temporal and inferior parietal areas during reading. In a third exper-

iment, spatiotemporal activation profiles were obtained in the context of a printed word recognition task from patients who subsequently underwent electrocortical stimulation mapping. The results showed that portions of STGp that are critically involved in the phonological analysis of aural language (as indicated by the effects of direct electrical stimulation) are routinely activated during silent word reading. It appears, however, that access to phonological representations of real words can occur through a mechanism that does not involve these areas, as suggested by the results of the first experiment. These results are consistent with the hypothesis that addressed and assembled phonology are each supported by partially distinct cerebral mechanisms.

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**P. KULISTAK, V. MATECHA, K. KUPKA, & M. KUBICEK. Neuropsychological Tests and rCBF (SPECT) Results of Neurocognitive Retraining in Patients With Disease of Brain: Longitudinal Study.**

In the framework of our longitudinal study we were following up a development of tendencies in the results of neuropsychological tests and of repeated rCBF checks by the SPECT method in the group of 6 patients (4 male, 2 female) in the age ranging from 22 to 38 years, with a disease of brain (4 TBI, 1 hemorrhage, 1 herpes encephalitis; being followed up for 747 days in average, range 370–1264 days). The patients were included into a complex rehabilitation program (range 60–120 days). In addition to motoric and physical therapy, this program also includes a neurocognitive retraining, based on computer-aided retraining (RehaCom program). We were checking a condition of perception, attention, memory, learning, executive function and fine motoric functions. Our objective was to compare a synchronicity of changes occurring in blood flow in brain—particularly in the affected area—and the corrections of deficient cognitive functions. According to our previous findings we supposed that both processes may not run simultaneously. Our preliminary results show that improvement of the rCBF (SPECT) finding is always accompanied with improved results of neuropsychologic functions. On the other hand, a stagnation of rCBF (SPECT) changes in the brain tissue may not always mean that a positive development of the neuropsychologic functions under study (including everyday functionality of a patient) was stopped. The study indicates that a brain plasticity employs also some other mechanisms, that cannot be proven by the SPECT examination of blood perfusion in brain tissue.

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**O.M. ALHASSOON, M.J. TAYLOR, B.C. SCHWEINSBURG, R.M. DUPOINT, T.L. PATTERSON, & I. GRANT. Relationship Between SPECT Prefrontal Perfusion and MMPI Scale-4 in Recently Detoxified Alcoholics.**

The prevalence of antisocial characteristics in alcohol-dependent individuals has been extensively studied; however, very little work has been done relating these characteristics to alcohol-linked brain changes. Based on the only study that has cross-sectionally examined the relationship between antisocial personality disorder and brain perfusion in recently detoxified alcoholics we hypothesized that MMPI Scale-4 (which captures risk-taking, antisocial and other characteristics) and prefrontal perfusion would be correlated in RDA. Given the transient nature of frontal perfusion changes in alcoholics, we also predicted that this correlation would weaken or disappear at follow-up. *Method:* After an average of 41.7 days ( $SD = 17.5$ ) of abstinence, 20 RDA ( $M$  age 42.7 years,  $SD = 7.1$ ) were scanned using technetium-99m-hexamethyl-propylene-amine-oxime SPECT in a cognitive activation paradigm. The RDA had consumed an average of 1193 kg ( $SD = 566$ ) of ethanol over their lifetime and their mean years of alcoholism was 16.3 ( $SD = 8.0$ ). Seven abstinent alcoholics were re-scanned after an average of 188 days ( $SD = 11.0$ ). *Results:* At first scan, the correlation between MMPI Scale-4 and left prefrontal perfusion was statistically significant, [ $r(20) = .48, p < .05$ ]. The correlation between Scale-4 and right prefrontal perfusion was not significant. At follow-up, the correlation between Scale-4 and left prefrontal perfusion approached zero [ $r(7) = -.0035, p < .99$ ]. *Post-hoc* analyses using parietal and temporal regions indicated that the finding was specific to the prefrontal cortex. *Conclusion:* Per-

fusion changes associated with antisocial characteristics in RDA are transient in nature, which might indicate reversible susceptibility of prefrontal cortex to recent toxic effects of ethanol in individuals with such characteristics. Correspondence: *Omar Alhassoon, 1818 Tulip Street, San Diego, CA 92105, USA.*

**E.H.F. DE HAAN, R.P.C. KESSELS, & A. POSTMA. P- and M-Channel-Specific Interference in the What and Where Pathway.**

There is substantial evidence for separate cerebral processing of visuospatial processing and visual recognition. In this experiment we were interested in the relative contribution of the P- and M-channels to these different processes. In this experiment, we studied interference effects of color or luminance peripheral flicker (in order to saturate either the parvocellular or the magnocellular stream) on object-identity and spatial-location memory. The results showed that color flicker interfered with object-identity recognition, whereas luminance flicker affected memory for spatial location. Moreover, it was found that overall performance was worse if colored compared to gray-scaled objects were used in the stimulus display. There was no selective effect of colored flicker affecting colored objects and chromatic flicker affecting chromatic objects. These results provide strong evidence for the theoretical position that the *what* pathway relies heavily on information derived from the P stream and the *where* pathways on the M stream.

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**L. MARSTRAND, C. GERLACH, H. UDESEN, & A. GADE. Selective Impairment of Intermediate Vision Following Stroke in the Right Occipital Lobe.**

*Introduction:* Recent studies have suggested that intermediate stages (pre-attentive and grouping processes) in visual processing can be selectively damaged. We present a patient supporting this proposal. *Case history:* The patient H.E., a 58-year-old right-handed woman, suffered from an infarct in the right occipital lobe. Visual field examination showed a left homonymous hemianopia without macular sparing. H.E.'s performance on tests of early vision (Efron Shape Test and VOSP Shape Detection Screening Test) was normal, but her performance on tests using degraded stimuli (Street's Completion Test and VOSP Incomplete Letters) was compromised. On tasks measuring spatial abilities (VOSP Position Discrimination, VOSP Number Location) and visual grouping abilities (perceiving illusory contours) H.E. performed well outside the normal range. Despite marked problems in recognizing degraded pictures H.E. nevertheless performed satisfactorily on easy and difficult object decision tasks and on picture naming suggesting preserved visual knowledge. In addition H.E. also appeared able to perform transformations of orientation. It should be noted, however, that H.E.'s reaction times were abnormally slow on the object decision tasks, the tasks involving transformation of size and orientation and on picture naming. *Conclusion:* H.E.'s early visual abilities are preserved. Also processes related to high-level vision (perceptual differentiation, transformation of orientation) appears to function relatively normally. However, H.E.'s prolonged reaction times and failure to recognize degraded visual stimuli suggest that the visual information, on which high-level vision is performed, is much reduced. Based on these findings we believe that H.E.'s performance pattern can be accounted for as a selective impairment of intermediate vision.

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**B. ROSSION, J.F. DELVENNE, F. COYETTE, & X. SERON. Do Perceptual Deficits Always Co-occur With and Cause Associative Visual Agnosia? Evidence from Neuropsychological and Neurophysiological Investigations in a Single-Case Patient.**

Associative visual agnosia is defined as a normal visual perception stripped of its meaning. However, according to Farah, all visual associative agnosias present perceptual deficits that are the cause of their agnosia. Here we tested X.B., a case of visual associative agnosia (normal copy and object matching, strongly impaired at object recognition) with a large number of pencil-and-paper and computer tests of visual processing. Several

independent measures of performances were taken, including response times and sensitivity measures as well as event-related potentials (ERPs). Our results indicate that normal visual functions can be found to be impaired when appropriate visual tasks and on-line measures are used. Among other observations, it turned out that X.B. was impaired at possible-impossible object decision and visual closure tasks, suggesting an impairment in visual configural processing. However, these deficits were mild as compared to his severe object recognition deficit and there was no correlation between his object perception and recognition performances. Visual potentials evoked by objects were of normal latency and amplitude and did not differ between objects recognized or unrecognized by X.B. Taken together, these observations indicate that careful observations with several dependent measures—including ERPs—can indeed reveal subtle perceptual deficits in associative agnosia, but that these perceptual deficits are not likely to be the main cause of the agnosic deficit.

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#### **B. CONNOR, A. WING, & M. BRACEWELL. A Model for Training Perceptual Motor Relations.**

Errorless learning is a proven method of teaching new information to individuals with memory problems, however its effectiveness with other types of cognitive and perceptual motor deficits and with unimpaired individuals, has not been explored. The reason to question this is that errors are generally believed to be essential for learning to occur. The *Judd arrow illusion*, which produces a reliable bias in midpoint judgement toward the tail, was used in a pilot study to investigate errorless learning in the training of perceptual motor relations. Ten healthy participants bisected a series of individually presented horizontal Judd arrows ( $7.5 \times 3$  cm) displayed on a computer screen, using a cross cursor moved by an active force feedback joystick. Initial baseline midpoint accuracy, followed by training, then post training accuracy was recorded. During errorless training the joystick defined a force field within which the cursor could only be moved to the target midpoint. In the errorful training force feedback was turned off. Both conditions included onscreen semantic feedback. Each participant received both types of training, on two separate days, with initial training type counterbalanced between subjects. A three-way repeated measures ANOVA comparing type of training, pre *versus* posttraining accuracy, and arrow direction showed main effects for pre- *versus* posttraining and arrow direction ( $p < .05$ ) without interaction effects. The response guided errorless learning was an effective as trial and error learning on this perceptual motor task.

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#### **B. WEBER, U. SCHWARZ, S. KNEIFEL, V. TREYER & A. BUCK. Hierarchical Visual Processing Is Dependent on the Oculomotor System.**

Using fMRI and eye movement recordings we studied the processing of letter- and object-based hierarchical stimuli. In agreement with others we found a minor left hemispheric dominance for local and right dominance for global processing. When attention was directed locally, well-known oculomotor areas were activated, and saccades were elicited in 41% of the trials. Their latencies were similar to prosaccades. During global processing virtually no saccades occurred. These results suggest two different operational modes of attention. Attending to local features induces a shift of attention, which simultaneously computes a saccade on any level above the brainstem with a computational burden equal to reflexive saccades. Conversely, attending to global features induces an expansion of the focus of attention, which reinforces fixation.

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#### **T. KOGURE & T. HATTA. Spatial Processing in 2 Cerebral Hemispheres: Effect on the Presence of Frame of Reference.**

Main concern of this study was to examine whether visual field asymmetry of categorical spatial processing (e.g., above *vs.* below, left *vs.* right) was observed when one could or could not predict a frame of reference. Participants (32 university students, all right-handed, 15 women) viewed

an 'X' (reference) and a dot (target) on a computer display. The stimuli, the pair of dots and 'X,' were presented briefly at an upper, middle, or lower and left or right visual field in random sequences. Participants' task was to indicate relative location of the target (above *vs.* below, or left *vs.* right) against the reference. The reference was presented 1 min previously (participants could predict the reference) or simultaneously with the target (they could not predict it). In the Above/Below judgment task, a right visual field advantage was obtained in the simultaneous reference condition. This result was consistent with Kosslyn's theory that categorical spatial relationships are processed more effectively in the right visual field/left hemisphere. In contrast, no visual field asymmetry was found in the previous reference condition. Similar results to the Above/Below judgment task were obtained in the Left/Right judgment task. These evidences suggest that visual field asymmetry of categorical spatial processing is observed only when one cannot predict the appropriate frame of reference.

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#### **E. RATINCKX & M. BRYSAERT. Directional Asymmetries in Interhemispheric Transmission Time: The Influence of Stimulus Intensity.**

Although it generally has been assumed that interhemispheric transmission time (IHTT) is identical from the left (LH) to the right hemisphere (RH) and from the right to the left, a meta-analysis by Marzi et al. suggests that IHTT is asymmetrical. Marzi et al. observed consistent faster transfer times from the RH to the LH than in the reverse direction. Different studies indicate that asymmetries in IHTT may be related to visual half field (VHF) advantages. In a simple RT study, Braun et al. observed faster IHTTs from the specialized hemisphere to the non-specialized one, while Nowicka et al. obtained the reverse pattern in an electrophysiological study. It is well known that light intensity influences the direction of VHF asymmetries. Therefore, different signal detection (SD) experiments were run, in which participants had to discriminate light intensity. The results show that IHTT is faster from the RH to the LH than in the other direction, when participants have to respond to bright stimuli, corresponding with a LVF (RH) advantage. When dim stimuli were the targets, a RVF (LH) advantage was obtained resulting in faster IHTTs from the LH to the RH. The results are in line with Braun's model of interhemispheric interaction, which assumes faster callosal relay from the specialized to the nonspecialized hemisphere than in the opposite direction.

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#### **K. YOSHIKAZI. The Effects of Mental Rotation on the Benefits of Bihemispheric Processing.**

The purpose of the present study was to examine the effects of mental rotation on the benefits of bihemispheric processing. Banich suggested that the benefits of interhemispheric interaction increased as the task was more complex. In order to change the task complexity, the rotation angle of the stimulus was manipulated. A pair of normal or mirror-image capital letters ('F', 'R') was tachistoscopically presented in the left, right, and bilateral visual fields. A counterpart of a pair of letters was rotated with 20°, 60°, or 100°. Sixteen right-handed participants were requested to make a judgment if both letters were the same direction (both are normal or mirror-image) or not (one is normal and another is normal image). The results from the reaction times for the correct same responses showed that (1) reaction times were longer with the angle, (2) the bilateral visual field advantage (BFA) was obtained across three conditions of rotation angle, and (3) the size of the BFA in the 100° was bigger than those in the 20° and 60° conditions. Also the results from the proportion of BFA showed that while the size of BFA in the 20° condition was the same as that in the 60° condition, the size of the BFA in the 100° condition was higher than those in the 20° and 60° conditions. These results suggested that the relationship between task complexity and the benefits of bihemispheric processing would be a step function, not a linear function.

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**M. HEATH, E.A. ROY, S.E. BLACK, & D. WESTWOOD. Apraxia: Impaired Pantomime of Intransitive Limb Gestures.**

Limb apraxia represents an inability to perform learned actions that cannot be attributed to weakness, ataxia, sensory loss, poor language comprehension or inattention to commands, and is frequently attributed to left hemisphere damage (LHD). Recent work by Roy has demonstrated that right hemisphere damage (RHD) can also lead to apraxic performance when transitive (tool-based) limb gestures are performed in response to verbal command (pantomime). A further question remaining in the apraxia research relates to the frequency and severity of apraxia associated with the production of intransitive (expressive/communicative) limb gestures. In the present investigation a consecutive sample of LHD ( $N = 57$ ), RHD ( $N = 62$ ) and 20 age-matched controls pantomimed eight intransitive limb gestures. Participants were videotaped and their performance was assessed via a multi-dimensional error notation system. Patients were classified as *apraxic* if their performance fell 2 standard deviations below the mean performance of control participants. The results indicated that an equal proportion of LHD (.68) and RHD (.64) patients were classified as apraxic. Further, the severity of apraxia as assessed by an overall accuracy score generated from the multidimensional error notation system indicated an equal degree of impairment in both stroke groups, although the specific genesis of the disorder differed between LHD and RHD groups. Hence, the present results demonstrate that the frequency and severity of apraxia associated with the pantomime of intransitive limb gestures is equally marked following left or right hemisphere damage. Supported by the Heart and Stroke Foundation of Canada and NSERC.

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**S. BAYARD, N. GOSSELIN, M.E. LAVOIE & M. LASSONDE. Visual Interhemispheric Transfer in a Man With Total Agenesis of the Corpus Callosum (CC) and Anterior Commissure (AC): An Oddball Event-Related Potentials Study.**

A hemispheric difference of latency of the N1 component in visual evoked potentials (EPs) has been suggested to be an excellent index to estimate interhemispheric transfer time (IHTT). Recent studies have also suggested that the P300 component could reflect inter-hemispheric transmission efficacy. In this study, amplitude and latency distribution of the N1 and P3 components were studied with a high-density electrodes system on 10 controls as well as on a 32-year-old man with congenital absence of CC and AC. Lateralized left or right visual oddball tasks that required a right-foot response were used during the experiment. The results replicated classical findings for the NI component in normal controls and no inter-hemispheric differences were observed in the distribution of P3 latencies and amplitudes. The oddball effect was obtained in the participant without CC and AC. However, larger interhemispheric differences of latencies and amplitudes were observed for the N1 component in this subject. Moreover, N1 was not discernible in the more lateral electrodes in the hemisphere contralateral to the one receiving the visual input. Unlike controls, the latencies of the P3 component appeared to be related to the visual stimulation field, while the amplitude seemed to depend upon the side of the motor response and by its relation with the visual stimulation field. These results suggest that the interhemispheric transfer of the N1 component relies more heavily on the integrity of cortical commissures than that of the P3 component. In the congenital absence of CC and AC, hemispheric transfer of the later positive P3 component can be supported by subcortical commissures.

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**C. PERSEGANI, P. RUSSO, M. NICOLINI, C. CARUCCI, M. TORLINI, L.L. PAPESCHI, & M. TRIMARCHI. Sex Differences in Cognitive Lateralization.**

Brain imaging techniques have shown functional differences between men's and women's brains: fewer cerebral asymmetries, with consequently less hemispheric specialization in the female brain, whereas men have a more

asymmetrically functional brain. Our study confirms these data, providing indications of a less pronounced lateralization of hemisphere-linked abilities in women respect to men through a correlation between Preference Test scores (PT), which measures hemisphere preference, with frontal EEG asymmetries in alpha powers. The connection between the hemisphere preference as assessed by PT and the neurophysiological activation of frontal lobes, and the results obtained on the Problem Solving Inventory of P.P. Heppner, support the hypothesis of different sex-related patterns of perception and information processing: women perceive more information, coming rapidly to a synthesis without deep analysis, while men perceive less information but in an analytical way. Subsequently women seem to process information through its analysis and men's information processing leads toward a synthesis.

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**A. FROEHLICH, F. KÜNG, & M. REGARD. Shift of Functional Asymmetry During In-Vitro Fertilization Therapy.**

A model to examine hormonal effects on functional asymmetry is in-vitro fertilization therapy (IVF) as peak concentrations of estradiol are 13 times higher than menstrual cycle fluctuations and progesterone levels remain low. Participants were 10 women who underwent IVF and 10 women on hormonal contraceptives as controls. They were tested twice within 10 days: the IVF group at treatment onset (mean estradiol concentration 113 pM) and at peak level (11330 pM) with two visual-half-field tests, one lexical and one facial decision task. At low estradiol level we found the predicted functional asymmetries, namely, a left hemisphere (LH) advantage for lexical and a right hemisphere (RH) advantage for facial decisions. At peak estradiol levels, LH performance increased for both tasks, resulting in a shift of asymmetry in the facial task. These findings suggest that high levels of estradiol activate the LH and inhibit the RH.

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**H. OTA, T. FUJII, K. SUZUKI, & A. YAMADORI. Dissociation of Body-Centered and Object-Based Representations in Spatial Neglect.**

Previous studies have shown the presence of two types of spatial neglect; body-centered and object-based neglect. These symptoms indicate that the human brain has different processes for each reference frame. It is unknown, however, whether the two frames of reference are represented independently. In the present study, 2 neglect patients were assessed for body-centered and object-based neglect using a new figure cancellation task. Patient K.H. suffered from a right putaminal hemorrhage and showed left unilateral neglect on a line bisection task and a circle cancellation task. Patient T.M. suffered from a cerebral infarction in the right temporoparietal area and showed left unilateral neglect on a line bisection task and a flower-copying task. In a newly developed cancellation task, 20 complete figures, 20 right missing figures and 20 left missing figures were randomly printed on an A3-size paper. Each patient was instructed to circle every complete figure and to cross out every figure with a right or left missing portion. K.H. omitted figures on the left side of the paper irrespective of the type of figure. But for the figures he marked, he correctly differentiated complete figures from incomplete ones. In contrast, T.M. marked figures across pages without showing leftward neglect, but he made more mistakes with figures having a left missing portion. Both patients failed to manifest interaction between the two types of neglect. The results of the present study clearly showed double dissociation between two types of neglect and provided evidence that there are two distinct systems of reference frame.

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**P. AZOUVI, C. SAMUEL, A. LOUIS-DREYFUS, R. KASCHEL, S. OLIVIER, M. TROUBAT, D. ROUAT, & V. CANNIZZO. Rehabilitation of Very Severe Unilateral Neglect by Spatiomotor Cuing: 2 Single-Case Studies.**

*Objective:* Robertson et al. have suggested that voluntary activation of left upper limb in left hemisphere (spatiomotor cuing) could be effective in re-

during neglect. The aim of this study was to assess the efficiency of this treatment, and particularly the generalization to daily-life activities, in cases of severe neglect and dense hemiplegia. *Patients:* Two patients were included in the trial 3 and 7 months after a severe ischemic stroke. Both presented severe left hemiplegia and a disabling unilateral neglect, despite intensive rehabilitation by usual visual scanning training methods. A single-case experimental ABAB design was used to which a follow-up period was added (A = baseline with conventional treatment; B = specific treatment with spatiomotor cuing; each period = 2 weeks). A randomization test was used to assess the presence of a specific treatment effect on two clinical measures of neglect. Transfer to daily-life was assessed by the Catherine Bergego Scale (CBS). *Results:* In both cases, a statistically significant improvement was found for line bisection tests. A parallel improvement was found in daily life with the CBS. *Discussion and conclusion:* Spatiomotor cuing may be used in case of severe hemiplegia and may help in obtaining generalization to daily-life activities.

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**P. AZOUVI, S. OLIVIER, G. DE MONTETY, C. SAMUEL, A. LOUIS-DREYFUS, P. PRADAT-DIEHL, & E. MARCHAL. Behavioral Assessment of Neglect: Factorial Structure of the Catherine Bergego Scale.**

*Objective:* Study the factorial structure of a scale specifically designed to assess neglect behavior in daily-life activities. *Patients and methods:* Ninety-two patients with unilateral right hemispheric stroke were studied in average 18 weeks (*SD*: 40) post stroke onset. Unilateral neglect was assessed by conventional paper-and-pencil tests and by a behavioral scale, the Catherine Bergego Scale (CBS). In the CBS, an occupational therapist rated the presence of neglect on a 4-point scale in 10 situations of daily living. *Results:* Behavioral assessment with the CBS significantly correlated with paper-and-pencil tests, although individual dissociations were found. Factorial analysis of the CBS was done by principal component analysis (varimax rotation). The best model included two factors. The first one (62.7% of total variance) corresponded to six extrapersonal neglect items. The second factor (8.1% of total variance) included four items related to personal neglect. *Discussion and conclusion:* The present results confirm and extend previous data suggesting that the CBS is a valid and reliable scale to study neglect behavior in a rehabilitation setting. They moreover suggest that the scale has two underlying factors, corresponding to extrapersonal and personal neglect. These findings are in accordance with experimental data suggesting possible dissociations between both types of neglect.

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**V. MARK. Directional Bias on Cancellation Tests in Subacute Hemispheric Stroke.**

The cancellation test may demonstrate directional spatial biases following brain injury. The test can be evaluated for directional omission biases (“neglect”) either in 2 different dimensions separately (horizontal vs. radial/vertical), or in the 2 dimensions combined (diagonal measures). Most evaluations of 2-dimensional spatial bias score omissions by quadrant. However, this approach does not indicate the net direction of omissions across the entire array. Additionally, patients with left hemisphere damage (LHD) are seldom tested due to impaired comprehension. This study overcame these limitations by assessing Line Cancellation (LC) and Star Cancellation (SC) from the Behavioural Inattention Test in unselected nonhemorrhagic stroke patients within 6 weeks of onset. *Method:* All patients were first shown the cancellation technique. Eighteen right hemisphere damage (RHD) and 19 LHD patients marked one form of each test. Only pages with 2 or more targets omitted were analyzed. The locations of all omitted targets were converted to *x, y*-coordinates, and average omission coordinates (“neglect centers”) were plotted for individuals and patient groups. *Results:* Ten RHD and 11 LHD patients met criteria for omissions. On LC only RHD patients met criteria. Their neglect centers occurred primarily in the near left quadrant. On SC, the neglect centers of the RHD and LHD patient groups essentially occurred to the left and right of page center, respectively. However, individual RHD neglect centers were more extensively distributed in far and near quadrants than were LHD neglect centers.

*Conclusions:* Cancellation neglect is contralesional, regardless of lesion laterality. However, RHD patients show more extensive radial neglect biases than do LHD patients.

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**I. PAVÃO-MARTINS, C. BENTES, C. LOUREIRO, J. LOBO-ANTUNES, & T. ENVAGELISTA. Neglect as the Presenting Symptom of SSPE in an Adolescent.**

*Introduction:* Subacute sclerosing panencephalitis (SSPE) is a rare disorder, often presenting as a diffuse progressive mental or behavioral impairment. We report 1 case, of late onset, presenting with a visual-spatial neglect which considerably delayed the diagnosis. *Case report:* R.C., a 16-year-old boy, presented a progressive left sided hemiparesis and left sided visuo-spatial neglect. Neglect was evident on writing, crossing out tests, copy of drawings and mental calculation tests. The MRI showed a right parietal lesion which biopsy was inconclusive. Typical (clinical/EEG) features of SSPE were only evident 4 months later. *Conclusions:* Left sided visuospatial neglect and other forms of neglect (motor, extinction, representational) may constitute the initial single manifestation of SSPE. It may suggest a focal lesion (especially when it is associated with focal disturbances in imaging exams) and thus confound the diagnosis, leading to more invasive procedures.

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**S. GEERAERTS, C. LAFOSSE, & E. VANDENBUSSCHE. Orientation Discrimination in Hemineglect Patients: Effect of Distractor Stimuli.**

Orientation discrimination thresholds for gratings were determined in right brain damaged (RBD) patients with or without neglect, left brain damaged (LBD) patients without neglect and controls without brain damage. Five conditions were presented: (1) central grating, (2) left peripheral grating, (3) right peripheral grating, (4) left peripheral grating + contralateral distractor grating, (5) right peripheral grating + contralateral distractor grating. Peripheral gratings were presented at 5° eccentricity on the 45° diagonal of the upper visual field. Central, left and right conditions were presented in blocks of 20 trials. Within such a block, distractor and no-distractor trials were randomized. Stimuli were optimized for size and spatial frequency. Contrast was set at 20 times the contrast threshold measured in a previous experimental session, separately for the 3 visual field positions. Thresholds were determined using an adaptive psychometric method (MUEST). Fixation was controlled with the ASL 210 eye tracking system. Trials with eye movements out of a 3° window were repeated. *Results:* there was a significant trend towards higher thresholds in the contralesional hemifield for both LBD and RBD patients. RBD patients with neglect obtained higher thresholds overall compared to the other groups. Moreover, in the RBD with neglect group, there was a highly significant effect of the right distractor on thresholds obtained in the left hemifield. Thresholds were increased by a factor of almost 4. Thus, we observed strong extinction effects in the neglect group, although subjects were instructed to direct their attention towards the target position and to disregard as much as possible the irrelevant distractor stimulus.

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**C. LAFOSSE, J. BROECKX, & E. VANDENBUSSCHE. Ipsilesional Deviation of the Center of Gravity in Unilateral Hemispatial Neglect.**

Normal static balance indicates that the subject fully controls his center of gravity (COG) over the base of support by minimizing sway of the COG. COG is the point in which the total mass of a body may be considered to be concentrated with respect to the pull of gravity. Because gravity is always acting on the patient’s body mass, the patient must move to correct the position of the COG as gravity pulls it away from his body’s centered midline. In accordance of the hypothesis of Ventre, Flandrin, and Jean-

nerod, and recent research, it is assumed that in patients with hemispatial neglect the localization of the body's sagittal midplane in space is displaced to the ipsilesional side. As the COG position is defined in relation to the midline, we expect that the COG position in neglect patients shows a deviation to the ipsilesional side. In this study we investigated these assumptions in 10 stroke patients with hemispatial neglect due to right brain damage (RBD + N) compared with 6 RBD patients without neglect (RBD - D) and 10 left brain damaged (LBD - N) stroke patients. All patients can stand, have normal weight bearing on both legs and can hold normal balance. All performed a bilateral static stance task using computerized force-plate technology. The results confirm our hypothesis namely that the COG in RBD + N patients is slightly deviated to the ipsilesional side. In both control groups the COG is located normally at the objective body midline. This study highlights the potential applications of gravity-related applications in clinical neuroscience to investigate biased egocentric reference frames in unilateral hemispatial neglect.

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**C. LAFOSSE, M. TROCH, E. KERCKHOFS, L. VEREECK, & E. VANDENBUSSCHE. Hemispatial Neglect, Extinction, Hemianesthesia and Hemiplegia as Possible Determinants of Ipsilateral Pushing in Stroke.**

Ipsilateral pushing (IP) is one of the sequelae of stroke that seriously delays the process of physiotherapeutic recovery. IP is characterized by a pushing behavior over the midline of the body towards the hemiplegic side in any posture, and a resistance against any attempt at passive correction of posture across the midline of the body toward the nonaffected side. At this moment there is a lack of scientific basis in understanding the pathophysiology of IP. The aim of this study is to investigate the relation between severity of IP and sensorimotor functioning, neuropsychological symptoms (hemispatial neglect, somatosensory neglect, extinction, and apraxia), functional outcome and hemispheric lesion localization. Two hundred seven stroke patients (Right Brain Damage  $n = 104$ ; Left Brain Damage  $n = 103$ ) with no prior history of CVA were evaluated on following variables: hemiplegia, somatosensory perception, hemispatial neglect and extinction, apraxia, aphasia and functional outcome (activities of daily life, ADL; upper and lower limb movement). Severity of IP was operationalized on the basis of a 3-point scale dependent in which posture (stand, sit, and the combination of both) IP was manifested. The results indicate a significant relation (univariate ANOVAs with  $p < .05$ ) between severity of IP and severity of hemispatial and somatosensory neglect, extinction, hemianesthesia. Multivariate hierarchical classes analysis showed a clear association between these variables and IP in the right brain damaged patient group. This suggests that IP symptomatology is strongly related with a combined neurological (lesion localization, hemiplegia, somatosensory deficits) and neuropsychological symptomatology (hemispatial neglect and extinction). Understanding of the pathophysiology of IP should incorporate at least neuropsychological models related to visuospatial attention and integration of visuosomatosensory information with motor outcome.

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**D. DEWEY, D. CREIGHTON, S. CRAWFORD, & R. SAUVE. Neurobehavioral Outcomes at 8–12 Months of an Alberta Sample of Very Low Birth Weight Infants (VLBW).**

This study examined whether VLBW infants were delayed in their neurobehavioral development at 8–12 months adjusted age compared to normal birth weight (NBW) infants. One hundred and five VLBW infants ( $M$  birthweight = 987.5 g,  $SD = 228.9$ ) and 154 NBW infants ( $M$  birthweight = 3495.6 g,  $SD = 429.2$ ) were assessed utilizing the Bayley Scales of Infant Development—Second Edition, Mental Development Index (MDI) and Behavior Rating Scale (BRS), the Fagan Test of Infant Intelligence (FTII), the Bayley Infant Neurodevelopmental Screening Test (BINS), the Infant Development Inventory (IDI), and the Uzgiris-Hunt Ordinal Scales of Psychological Development (object permanence scale). Results revealed that more VLBW infants (10.7% vs. 2.6%) scored in the range of

mild and significant delay on developmental testing using the MDI; however, mean MDI =  $s$  were 97.2 for VLBW infants and 96.5 for the NBW infants. Significant differences were found between the VLBW and the NBW infants on the BINS and the test of object permanence with the VLBW infants performing significantly poorer than the NBW infants. Analyses of the IDI revealed that VLBW infants were rated significantly lower than the NBW infants were on the gross motor scale. No significant differences were found in the performance of the VLBW and NBW infants on the BRS, FTII, and the IDI Fine Motor, Language, Self Help, and Social scales. Thus, even though most of the VLBW infants in this sample were developing normally according to their performance on the MDI, there were some noted areas of deficiency.

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**S. SILVENNOINEN, M. KORKMAN, & I. AUTTI-RÄMÖ. Neuropsychological Performance in Children Exposed to Alcohol *in Utero*.**

A comprehensive neuropsychological assessment, including specific measures on attention and executive functions, language, sensorimotor functions, visuospatial processing, and memory and learning, was administered to 27 12- to 14-year-old children exposed to alcohol *in utero*. In addition, intellectual level was assessed. The results indicated that although fetal alcohol exposure had relatively widespread effects on neuropsychological performance, deficits did not occur uniformly on all neuropsychological domains. Observed cognitive deficits included problems of attention, memory functions, and motor learning. In addition, measures on language skills indicated that phonological processing and naming were impaired. Relative strength was noted on visuomotor precision. Evidence of pronounced dysexecutive problems were obtained, suggesting that such problems may be characteristics of these children, affecting academic performance and general adaptation, for example.

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**M.L. RIS, K. DIETRICH, P. SUCCOP, & T. HILL. Early Low Lead Exposure and Antisocial Behavior in Adolescence: Update of a Longitudinal Study.**

The adverse developmental consequences of lead exposure in early childhood have been well documented. Behavioral effects of lead have been less thoroughly studied, although Needleman et al. recently reported that bone lead concentration was positively correlated with ratings of delinquency and aggressiveness for subjects in the Pittsburgh Youth Study. Since 1980, a sample of approximately 300 inner city children has been followed in the Cincinnati Lead Study. Participants were recruited prenatally with approximately 30% having blood lead concentrations equal to or in excess of 25  $\mu\text{g}/\text{dL}$  during the first 5 years, and 80% having at least one blood lead concentration in excess of 15  $\mu\text{g}/\text{dL}$ . A study was initiated in summer, '97 to investigate the remote neuropsychological effects of early lead exposure with this sample, and its relationship to risk for antisocial behavior. Interim analyses on partial samples reported at the Budapest and Durban INS meetings indicated a significant relationship between early lead indices and antisocial behavior in adolescence that was not attenuated after covariate adjustment. Academic abilities (reading and spelling) were inversely related to both early lead levels and antisocial behavior. Preliminary statistical modeling suggested that academic abilities (reading in particular) might partially mediate the relationship between early lead exposure and behavior problems in adolescence. With the completion of the study by summer, 2000, more definitive results will be available.

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**D. NEMETH, C. CREVELING, & T. JENNINGS. Misdiagnosis of ADHD When Alternative Diagnoses Are Warranted.**

The following study explores the potential for misdiagnosis of ADHD in 2 adolescent males (ages 11 and 12) when an alternative diagnosis was warranted. Both adolescents presented to this office with complaints of atten-

tional and behavioral difficulties. While conducting a psychoeducational evaluation, information became available suggesting the need for a more comprehensive neuropsychological evaluation. Following the administration of a comprehensive Halstead-Reitan Battery, a primary DSM-IV, Axis I diagnosis of Cognitive Disorder, NOS, was rendered. The 11-year-old client had undergone 2 cranial surgeries to remove benign tumors. His Neuropsychological Deficit Scale (NDS) Score of 44 and his Halstead Impairment Index (HII) of .43 were suggestive of moderate brain behavior dysfunction, characterized by bilateral cerebral dysfunction involving primarily the frontotemporoparietal regions. The 12-year-old client was observed to exhibit neuropsychological symptomatology (e.g., eye fluttering) and abnormal performances during the testing process. Abnormal EEG findings were also reported. Although his HII of .17 was within normal limits and his NDS score of 39 did not reach the cut-off for brain damaged individuals, the client's NDS score did fall above the mean for controls (30.43) and was suggestive of predominately right hemisphere cerebral dysfunction involving the frontoparietal regions. Considering his superior intellectual functioning (FSIQ = 121), the findings in their entirety could not be considered normal. Cases such as the aforementioned demonstrate the potential for misdiagnosis of ADHD when a client's reported symptomatology is taken at face value without the benefit of a thorough neuropsychological assessment.

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**E. PARREIRA, A. LEVY, J. CAMPOS, & I. MARTINS. Transient Global Aphasia in a Child Following Selective Left Posterior Cerebral Artery Amytal Injection.**

*Introduction:* There has been considerable debate over aphasic syndromes in children, namely whether they are similar to adult syndromes. Several cases from the literature indicate that, in children, posterior lesions produce nonfluent aphasia. We present a case that confirms this: nonfluent aphasia was produced in a child following left posterior cerebral artery (PCA) amytal injection. *Case report:* A 12-year old right-handed girl was submitted to a sodium amytal testing in order to evaluate memory functions prior to epilepsy surgery. This patient had complex partial seizures since the age of twelve months. She had a right temporal seizure focus and right temporal mesial sclerosis. Her neurological and comprehensive neuropsychological evaluation, prior to the test, was normal. Amytal testing was performed in both PCA. Immediately after the injection on the left side, she stopped counting and only recovered spontaneous speech four minutes later. During this period she could only follow 2 simple verbal commands and she could not repeat words. Objects were presented to her to memorize (she did not name them) as well as words and photographs. After recovering speech she produced verbal paraphasias. *Conclusion:* Our patient developed a global aphasia (with muteness and comprehension deficits) after amytal injection on the left PCA. Amytal injection in the PCA mimics occlusion of the PCA. Aphasic syndromes due to left PCA infarction, are well delineated in adults: fluent aphasia (anomic or transcortical sensory). Our case corroborates the notion that in children, contrary to what happens in adults, posterior lesions produce nonfluent aphasia.

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**E. MATUTE, F. LEAL, & D. ZARABOZO. Writing Errors in Spanish-Speaking Children's Narratives: A Comparison of Reading-Disabled and Normal Children.**

Spelling errors in writing have always been recognized as a feature of reading disability, yet reading-disabled children evince writing errors, due to factors other than spelling, at the phonological, visual or semantic level. In order to analyze the distribution of the different errors in this population a group of 60 Spanish-speaking reading-disabled children from second to sixth grade of primary school (12 for each grade) was first matched according to gender, grade, shift, and school type; then a short story was read aloud to them, and they were asked to write a version of it. The writing errors contained in the texts thus produced were analyzed and classified into four major categories: phonological errors (e.g., "m" instead of "b"),

spelling errors (e.g., "v" instead of "b", which in Spanish are equivalent), visumotor errors (e.g., "p" instead of "b") and semantic errors (invented words). The distribution of these four categories is different in the two groups: (1) only the study group makes semantic errors, (2) most visumotor errors are made by the study group, (3) the number of phonological and spelling errors is practically the same in the study group whereas spelling errors more than double phonological errors in the control group, (4) the phonological errors of the control group are less than half those of the study group. Spelling errors of both groups are classified according to the degree of transparency of the phoneme-grapheme relationship in Spanish; phonological errors are explained via distinctive features.

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**A. BOUMA, H. VAN DER VEER, & H. AKKERBOOM. Word Recognition Deficits in Relationship to Phonological Skills in Black, South African Dyslexic Children.**

The present study was designed to investigate the relationship between word recognition deficits and phonological awareness skills in Black, South African dyslexic children. The nature of word recognition tasks was investigated by asking children to read aloud lists of different types of words (regular words, irregular words and nonwords). Moreover, the effect of word length was examined by presenting word stimuli consisting of 4, 5, or 6 letters. Phonological awareness skills were measured by using different types of tasks relying on phonological analysis of words (phoneme segmentation, phoneme deletion and phoneme position). As expected, dyslexics showed particular difficulties with the reading of irregular words and nonwords. Dyslexics exhibited a significant word length effect, irrespective of the type of word stimuli, while the controls did not. Compared to controls, the results revealed that dyslexics showed significant phonological processing deficits. Interestingly, the relationship between phonological processing deficits and reading tasks was significant for each type of word stimuli (regular words, irregular words and nonwords) in the dyslexic group, whereas phonological processing deficits were only related to reading performance of nonword stimuli in the control group. The theoretical implications of these findings will be discussed.

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**P.H.E. VAN VUGT & W. CRETEN. Risk Odds Estimates of 6 Psycholinguistic Effects in the Reading Behavior of Dyslexic and Non-Reading-Impaired Children.**

The dual route model of reading has been used to distinguish various subtypes of (acquired and developmental) dyslexia. The taxonomy relies in part on the eventual presence of psycholinguistic effects (PLEs) due to frequency (F), imageability (I), length (L), word class (W), regularity (R), or lexicalization, i.e., pseudoword effect (P). The present study attempts to determine the diagnostic relevance of the PLEs for developmental dyslexia not otherwise specified (DD). Therefore, an aselect population of 333 Dutch-speaking boys (age 7–12 years) was examined. Neuropsychological assessment included an experimental single-word reading test. Raw scores and reaction times (RT) were analyzed ( $\chi^2$  and ANOVA). If  $p < .05$ , the effect was considered "absent." Risk odds estimates (ROEs) of the PLEs were calculated both for the dyslexic ( $n = 17$ ) and the no-impaired readers ( $n = 316$ ). These ROEs were adjusted for age, handedness, IQ, reading level, and attention. An effect was considered diagnostically relevant if the dyslexic's ROE was at least 3 times larger than that of the not-impaired readers. Our results permit to conclude that (1) RT data do not enhance the diagnostic power of our reading test; (2) F-L-I-R-effects do not contribute to the detection of DD; (3) the relevance of the P effect is in accordance with the phonological deficit model of DD; (4) in DD the W effect can be traced to a very poor reading of function words; (5) the concept of *surface dyslexia* may have to be revised for Dutch-speakers, since we found more non-impaired readers than dyslexics to present with a significant R effect.

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**K.J. OOSTROM, A. SCHOUTEN, A.C.B. PETERS, & A. JENNEKENS-SCHINKEL. Longitudinal Modified Cross-Informant Comparison on Behavior in Newly Diagnosed Epilepsy in Childhood.**

**Aims:** (1) Longitudinal inventory of complaints on behavior in children with nonsymptomatic epilepsy, an underreported segment of the epilepsy population; (2) concordance between behavioral profiles reported by parents and teachers; (3) pinpoint response ambiguity peculiar to this epilepsy population, detected in the responses of parents and confirmed in a pilot study where parents and doctors/psychologists experienced in epilepsy care rate 8 items of the questionnaire as features of seizures rather than of behavior. **Participants:** Seventy-two children with recently diagnosed nonsymptomatic epilepsy (37 boys, 35 girls, age 5–16 years), and 71 healthy control children, matched for age, sex, and education. **Methods and procedure:** Parents and teachers of the children completed the Child Behavior Check List (CBCL) respectively the Teachers' Report Form (TRF), 3 times within 48 hr after diagnosis, prior to start of medication; 3 and 12 months later. **Results:** (1) Both parents' and teachers' reports revealed significant differences between patients and controls on all behavioral problem scales. In 6 children with epilepsy (8.3%) and 1 control child (1.4%) scores on  $\geq 1$  scale(s) met clinical criteria. Significant time effects were found on several problem scales. (2) The obtained level of agreement between parents and teachers was below average compared to large reference samples (mean correlation  $r = .24$ ). (3) Significant differences between patients and controls disappeared by correction for ambiguous items. **Conclusion:** In order to understand the behavioral vulnerability of children, data from multiple sources yield complementary information and instruments should be adapted to particular predicaments associated with the illness.

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**A. SCHOUTEN, K.J. OOSTROM, A.C.B. PETERS, & A. JENNEKENS-SCHINKEL. A Controlled Study of "Learning Where" in School Children With Newly Diagnosed Nonsymptomatic Epilepsy.**

**Aim:** (1) Longitudinal controlled study of "learning where" in school children with newly diagnosed nonsymptomatic epilepsy. (2) Age effects in this novel task. **Background:** Insufficient academic progress is frequent in childhood epilepsy. Data on this specific segment of the epilepsy population are lacking. The basic mechanism of the problems is poorly understood. Location learning ("learning where"), increasingly important, is neglected in childhood memory research. **Participants:** Seventy children with newly diagnosed nonsymptomatic epilepsy (36 boys, 34 girls, age 5–16 years); 70 controls, matched for age, sex, and education. **Methods:** (1) Computerized task requiring learning of locations of 16 highly associative pictures of objects, presented successively in a  $4 \times 4$  array. Dependent variables: learning efficiency, interference, recognition, response time. **Procedures:** Part of a comprehensive neuropsychological assessment which patients and controls underwent thrice: within 48 hr after diagnosis (prior to start of medication), 3, and 12 months later. **Results:** (1) *Immediately after diagnosis* patients had nonsignificantly weaker learning curves. Response times during interference task were prolonged in patients. *After 3 months* the differences between patients and controls remained. Both groups had equal repeat effects. *After 1 year* no differences could be detected between patients and controls. (2) Location learning fits even the younger child's interests. Age but no ceiling or floor effects were present. **Conclusion:** (1) The differences between patients and controls, small but tangible at the start and disappearing over time, are no medication effects. Other influences will be discussed. (2) The location learning task is applicable over a wide range of ages.

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**K. SPRUYT, R. CLUYDTS, & M. KORKMAN. Neuropsychological Performance of Epileptic Children as Assessed With the NEPSY.**

**Objective:** Several studies stress the ambiguous relationship between epilepsy in children, and their intellectual and neuropsychological abilities.

In this study we compared the NEPSY profiles of a group of epileptic children to healthy controls. **Participants and methods:** Twenty-five epileptic (a heterogeneous sample regarding etiology, pharmaca, etc.) and 25 control children aged 6 to 13 years, attending regular school, were assessed with a test battery including a shortened version of the WISC-RN III and the NEPSY. The control group was matched to the educational level of the parents. **Results:** The groups did not differ significantly in Performance [ $t(48) = -1.16, p = > .05$ ] and Total IQ [ $t(48) = -1.49, p = > .05$ ]. The difference in the mean Verbal IQ was marginally significant [ $t(48) = -1.91, p = .06$ ]. In comparison to the control children the scores of the epilepsy group were significantly lower on 4 of the 13 used NEPSY subtests: Immediate Memory for Faces [ $F(1,47) = .016, p = .03$ ], Manual Motor Series [ $F(1,47) = 8.95, p = .01$ ], Verbal Fluency [ $F(1,47) = 3.94, p = .05$ ] and Repetition of Nonsense Words [ $F(1,47) = 3.77, p = .03$ ]. The difference between the test scores of the 2 groups studied was only marginally significant for Design Copying [ $F(1,47) = 8.20, p = .07$ ] and Delayed Memory for Faces [ $F(1,47) = .014, p = .07$ ]. **Conclusion:** Although the epileptic sample was very heterogeneous, it was possible to detect a specific NEPSY profile in these children. This study demonstrated the efficiency and usefulness of the NEPSY in discriminating neuropsychological abilities, even when the 2 groups studied had a comparable mean Total IQ. Children with epilepsy appear to be slow in information processing of complex tasks and are consequently frequently perceived as inattentive and as having a limited memory capacity. The heterogeneity and size of the patient group limited us in looking for a specific NEPSY epileptic profile that can be related to cerebral lateralization.

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**C. LAFOSSE, E. VERRYDT, T. VERCRUYSE, P. BROCK, & E. VAN-DENBUSSCHE. Clinical Neuropsychological Consequences of CNS-Prophylactic Treatment for Acute Lymphoblastic Leukemia.**

As recently as 1968, fewer than 1% of children diagnosed with acute lymphoblastic leukemia (ALL) survived more than a few years. Today, about 75% of these children are anticipated to achieve long-term disease-free survival due to addition of central nervous system (CNS) prophylaxis. Unfortunately, survival has not been won without cost. Prophylactic CNS treatment has been associated with delayed CNS toxicity resulting in devastating neurological consequences. In this study we compared the long term neuropsychological consequences of 16 ALL (8 male, 8 female) patients treated with protocol 58831 (EORTC) with 22 controls matched for age, education, and socioeconomic status. The patient group was divided further in a group ( $n = 10$ ) who received only chemotherapeutic treatment (intrathecal methotrexate; IT MTX) and a group ( $n = 6$ ) who received chemotherapy in combination with 24 Gy cranial irradiation (CRT). Both groups did not differ significantly in age. Neuropsychological investigation consists of assessment of intellectual skills, attention executive functions, learning and memory, motor skills, visuoconstructive skills, psychosocial functioning. The results indicate cognitive impairments approximately 9 years after CNS prophylactic treatment only in the CRT group. These impairments were pronounced in the field of attention and executive function (Trail Making, Visual Search, Tower of London) as well as in the verbal intellectual skills (Vocabulary, Comprehension, Arithmetic). The results are consistent with the literature indicating that CRT has been implicated as the major cause for cognitive dysfunction associated with prophylactic CNS treatment.

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**State of the Art Lecture 1/9:30–10:30 a.m.**

**FUNCTIONAL IMAGING OF VISUAL ATTENTION AND MEMORY**

**Guy Orban**

**Paper Session 1/11:00 a.m.–12:15 p.m.**

**FUNCTIONAL IMAGING AND  
NEUROPSYCHOLOGICAL FUNCTIONS**

**J. RISBERG, B. BAUER ALFREDSON, B. HAGBERG, & L. GUSTAFSON. Right Temporal Activation When Listening to Emotionally Significant Music.**

The cerebral correlates of the emotional and cognitive impact of music are still poorly understood. The aim of the present study was to investigate the cerebral activation when listening to self-selected emotionally significant music. Twelve right-handed healthy participants (6 female and 6 male) with a mean age of 70 ( $SD = 2.5$ ) years were studied. The participants' musical interests, memories, and preferences were evaluated by an interview ending with the selection of a personal piece of music to be played during measurement of the regional cerebral blood flow. All participants preferred classical music, with mainly mood inducing and relaxing mental influence. Three rCBF measurements were made in each participant using the 133-Xe-inhalation method and an equipment with 254 stationary detectors. The 1st measurement was made during silent resting with closed eyes. The 2nd and 3rd recordings were made while the participants listened to their favorite music or, in a counterbalanced order, a standard neutral piece of music. The results showed a highly significant increase of the distribution value (% of global mean) of the right temporal lobe when the favorite music was compared to silence (103.3 and 100.5 resp.;  $p < .01$ ). A temporal asymmetry during listening to the favorite music (103.3 rt/100.8 lt) was also significant ( $p < .01$ ). The standard music showed temporal values between silence and the favorite music (102.0 rt/100.4 lt; n.s.). Prefrontal regions showed a general decrease during music. It is concluded that the right temporal cortex is activated during an emotionally intense musical experience. Correspondence: Jarl Risberg, Department of Psychogeriatrics, CBF-laboratory, University Hospital, Lund SE-221 85, Sweden.

**P.G. SIMOS, J.I. BREIER, J.M. FLETCHER, B.R. FOORMAN, A. MOUZAKI, & A.C. PAPANICOLAOU. Age-Related Changes in Regional Brain Activation During Phonological Decoding and Printed Word Recognition.**

The purpose of this study was to examine age-related changes in spatio-temporal brain activation profiles obtained in the context of real-word and pseudoword reading tasks in 27 adults and 22 children without reading problems. Activation profiles were derived using magnetic source imaging (MSI) a technique that measures, noninvasively, magnetic fields produced as large numbers of brain cells increase their activity levels. MSI is unique among other functional imaging techniques for its ability to provide activation profiles that reflect not only *where* activity occurs in the brain but also *when* this activity occurs in relation to the presentation of an external stimulus. In this way information can be drawn more directly regarding *which* areas participate in reading and also *how* these areas might interact with each other to enable this complex function. In this study, adults showed a distinct spatiotemporal profile during reading of both types of print, consisting of bilateral activation of occipital cortices, followed by strongly left-predominant activation of basal temporal regions and, finally, left hemisphere temporoparietal (including the angular gyrus) and inferior frontal activation. Children, on the other hand, displayed early activation of the occipital cortices, followed by bilateral basal temporal, and nearly concurrent, strongly left predominant, temporoparietal activation. This pattern was apparent regardless of the type of word they were asked to read. The data suggest that the degree of specialization of cortical regions for reading, as well as the pattern of regional interactions that supports this specialization, may change with age.

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**L. BRAGA. Analyzing Cortical Number Processing With the Use of Functional Magnetic Resonance Imaging (fMRI).**

*Objective:* Identify the cortical areas involved in calculation using functional magnetic resonance imaging (fMRI) studies of the frontal, parietal,

and temporal lobes. *Materials and Methods:* Nine right-handed, college-educated, 22–44 year-old participants were studied. fMRI signals were considered relevant based on a  $p = 0.5 \times 10^{-6}$ . While in the scanner, each participant performed 4 calculation tasks presented in oral code, based on the EC301 calculation battery: number comparisons in oral code, cognitive comparison of quantities, mental oral calculation, and simple calculation. *Results:* In all tasks, all participant activated Brodmann's area 46 bilaterally, with greater activation in the dominant hemisphere. Areas 41, 42, and 22 of the temporal lobe were also activated in most cases, as well as area 40 of the temporal lobe. Areas 9 and 10 of the prefrontal lobe also showed statistically significant signals. No significant differences were observed between the different calculation tasks and the cortical areas activated. *Conclusion:* These preliminary results permit the proposition of a theoretical model on the cortical dynamics of number processing in verbal tasks. The following Brodmann's areas were consecutively activated: area 41 (auditive reception), 42 (auditive integration), 22 (auditive association), 40 (parietal area that links the temporal lobe with the prefrontal lobe), and area 46 (the most significant in calculation activities), with support from areas 9 and 10, which are responsible for working memory and attention (functions involved in calculation). These studies may permit the establishment of an early, more accurate post-brain-injury prognosis, leading to improvement of the patient's quality of life.

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**J. RICKER, S. MILLIS, & R. ZAFONTE. An H<sub>2</sub>[<sup>15</sup>O] PET Investigation of Verbal Memory After Brain Injury.**

This investigation studied verbal recall using H<sub>2</sub>[<sup>15</sup>O] PET with 5 severe traumatic brain injury (TBI) outpatients and 4 noninjured controls. Recall was assessed with a list developed for this study and based on clinical measures. Prior to PET scanning, a list of 12 words from 3 categories was presented across 5 trials. During the 1st scan, participants recalled words from the list. Recorded prompts were given every 4 s to cue for responses. Participants stated "next" if unable to recall a word. In the second condition, participants were presented with semantic cues, and asked to provide an exemplar (or say "next"). In a recognition condition, participants were presented with a list containing correct targets and foils. Participants were asked to identify the previously presented words. The final condition was a repetition task used as a subtraction control for receptive and expressive language activations. Procedures were repeated with a parallel list for within-subject averaging. Statistical parametric mapping (SPM96) demonstrated that relative to controls, frontal lobe activations in TBI patients were reduced during recall but enhanced during recognition. In both groups, right hemisphere activation was stronger for recognition as compared to recall. Of note was that the TBI patients demonstrated greater levels of cerebral activation in some regions of interest. Findings are discussed in reference to (1) gross regional activation differences; (2) level of activation differences; (3) brain reorganization and recruitment of intact brain regions; (4) mental effort exerted during cognitive tasks; (5) patients' self-report of memory deficits.

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**Paper Session 2/11:00 a.m.–12:15 p.m.**

**CHILDREN: ATTENTION, PERCEPTION,  
AND COGNITION**

**J. ROVET, E. ASZTALOS, M. MYSAK, G. MIRABELLA, P. ARSENEAU, J. ROVET, & K. PERLMAN. Hypothyroxinemia of Prematurity and Infant Attention.**

Infants born prematurely are at risk for poorer attention regardless of gestational age and associated neurologic complications. Premature birth also

increases the risk of hypothyroxinemia (low thyroid hormone levels) because the maternal thyroid hormone (TH) supply is cut short. Because TH is essential for the development of the neural substrates of attention, we asked whether poor attention in healthy premature infants is related to low postnatal TH levels. In this ongoing study, we are studying preterm infants with no neonatal illness from whom blood samples at 2 weeks of life and expected term are assayed for thyroid hormone levels. Controls are matched full-term infants. At 6 months, infants are tested with the Visual Expectation Paradigm (VExP) and, at 18 months, the Early Childhood Vigilance Task (ECVT). Both tasks are administered via computer and infants' eye movements are monitored. Results indicate TH levels at 2 weeks of life are normal in the preterm group but decline significantly by projected term. On the VexT, preliminary results from 20 preterm and 42 controls show the premature infants made fewer looks, were less able to learn the anticipatory sequence, and had slower and more variable RTs. Looking behavior and RT were significantly correlated with TH levels at expected term but not 2 weeks of life. On the ECVT, results from 13 preterm and 31 controls show that the significantly lower rates of looking by the preterm group were correlated with early TH values. It is concluded that preterm infants do experience TH depletion after birth, and this is associated with significantly poorer attention in infancy.

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**J. ROVET, G. MIRABELLA, M. MYSZAK, P. ARSENEAU, J. ROVET, D. FEIG, & C. KELLY.** **Attention in Offspring of Hyperthyroid Women.** Adequate levels of thyroid hormone are necessary for the development of brain structures underlying attention and memory. Treatment of maternal hyperthyroidism during pregnancy with antithyroid medication may disrupt fetal thyroid function because these drugs cross the placenta easily and can block the fetal thyroid. However, studies assessing offspring outcome typically show normal intellectual development. Instead we asked whether the effects are specific to attention and memory and are evident in infancy. We are presently conducting a longitudinal study of the infant offspring of treated hyperthyroid mothers with testing at 6, 12, and 18 months. Standardized measures and laboratory-based instruments of attention and memory are used. At 6 months, infants are tested with the Visual Expectation Paradigm (VExP) and at 18 months, the Early Childhood Vigilance Task (ECVT). Both tasks are administered via computer and infants' eye movements are monitored. Results indicated the groups did not differ on the Bayley, whereas on the VExP offspring of hyperthyroid women were initially slower and less attentive than controls but subsequently made more anticipatory responses and became hypervigilant. On the ECVT, they were consistently less attentive. Temperament tests completed by mother suggested exposed infants were more difficult overall, highly aroused, and less easily soothed. There were no differences on infant memory tasks. We conclude that exposure to antithyroid medications during pregnancy may predispose the offspring to an attention disorder. It is not clear whether the effects reflect the drug's actions on the thyroid or the brain more directly. Correspondence: J. Rovet, *The Hospital for Sick Children, 555 University Avenue, Toronto, ON M5G 1X8, Canada.*

**I. EMANUELSON & E. DAHL.** **Deficits in Cognition, Perception, and Motor Proficiency in Children With Mild to Moderate Traumatic Brain Injuries.**

*Objectives:* The aim of this prospective study was to investigate problems in cognition, perception and motor proficiency in a group of children 0–15 years of age with mild to moderate traumatic brain injury (TBI). *Material:* For a period of 6 months every child with a TBI is registered monthly. Three months after the injury a follow-up examination is offered. In January, February, and March 1999, 22, 19, and 21 children were registered respectively with mild to moderate TBI from a hospital-based brain injury register. *Method:* The evaluation consisted of a neuropsychiatric examination (the Abilities Index and the EB test) a scoring of motor and sensory functions (the BOTMP) and a questionnaire (PEDI) on functional capacities among the children and the need for support rated by the parents. *Results:* The results for the 1st month were evaluated and showed that the mean age was lower than expected and fewer than expected were positive to a follow-up evaluation (18%). No statistical calculations could be made in this initial state. *Conclusions:* The 1st month of the 6-month study gave an indication of existing invisible motor difficulties and problems in social interaction in this group of children.

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**P. STIERS, R. VANDERKELEN, G. VANNESTE, S. COENE, T. PYSON, & E. VANDENBUSSCHE.** **Frequency of Visual Perceptual Impairment in Children With Physical Disabilities.**

*Purpose:* Recent data show that periventricular leukomalacia, a known cause of motor disability (spastic diplegia) can also give rise to visual perceptual impairments. The aim of the present study was to determine how widespread visual perceptual impairments are in children with physical disabilities. *Methods:* All children ( $N = 96$ ) from an institute for physically disabled children where included whose nonverbal intelligence age equivalent was between 2.75–7.0 years. Their age ranged from 4.94–21.43 years ( $M = 10.5$ ), Total IQ was  $<85$  in 90.6% and  $<50$  in 16.7%. All children were administered a grating acuity task in addition to the visual perceptual battery L94, comprising 6 visual object recognition and 2 visuoconstruction tasks. The score on a task was considered impaired if below the 5th percentile of normal children with a chronological age corresponding to the child's nonverbal age equivalent. *Results:* Visual acuity was reduced in 45.3% of the children, but only 10.4% had low vision ( $\leq 10$  c/deg). Thirty-seven point five percent of the children were impaired on at least one of the L94 tasks, but there was not relationship with type of motor disability. No child was impaired on the visual construction tasks. Grating acuity was significantly correlated with impairment on only one L94-task ( $r = .33, p < .0001$ ). *Conclusions:* We conclude that visual perceptual impairments are relatively frequent in children with physical disabilities, but not more frequent in children with diplegia or cerebral palsy. Any type of early brain damage that can lead to motor deficits has the potential to cause visual perceptual deficits.

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## THURSDAY AFTERNOON, JULY 13, 2000

### Paper Session 3/1:45–3:30 p.m.

#### IMAGING CONTINUED, ASSESSMENT

**S.H. CHEN, D. KAREKEN, P. FASTENAU, G. HUTCHINGS, L. TREXLER, & J. RASMUSSEN.** **Mild Head Trauma: Correlating Persistent Neurobehavioral Sequelae With Regional Cerebral Metabolism and Regional Cerebral Blood Flow.**

This study investigated *in vivo* changes in the regional cerebral uptake of 2- $^{18}$ F]fluoro-2-deoxy-D-glucose (FDG) and change in regional cerebral

blood flow (rCBF) in persons with mild head trauma using positron emission tomography (PET). Patients' persistent reports of cognitive decline following mild head trauma are often not substantiated by structural brain imaging and neuropsychological examination. Physiological imaging of blood flow and metabolism has shown greater promise. In the present study, 5 patients with mild head trauma and 5 matched healthy controls were imaged, using FDG-PET to measure differences in normalized regional cerebral glucose metabolism in the resting state. Participants were also imaged with oxygen-15 labeled water ( $H_2^{15}O$ ) PET to measure group differences in rCBF changes during a spatial working memory task. Neuropsychological testing, behavioral rating of frontal signs, and self-report of

postconcussion symptoms were used to quantify participant complaints and cognitive status. Results indicated no difference between patient and controls in normalized regional cerebral FDG-uptake during resting state. In the activation state, there was a trend for patients to have smaller change in rCBF than controls in 2 regions of interest (ROIs) within the right prefrontal cortical region. Relationships between neuropsychological data and persistent symptom complaints with normalized regional cerebral FDG-uptake and change in rCBF were not substantiated. The findings suggest that a cognitive challenge may be more useful than resting state functional neuroimaging in studying the physiologic changes of mild head trauma. Correspondence: *S.H. Annabel Chen, Medical College of Wisconsin, Department of Neurology, Section of Neuropsychology, 9200 West Wisconsin Avenue, Milwaukee, WI 53226, USA.*

**J.J. MANLY, D.M. JACOBS, S.A. SMALL, P. TOURADJI, & Y. STERN. The Word Accentuation Test Is Associated With Neuropsychological Test Performance Among Spanish-Speaking Elderly in New York City.**

Ability to read irregular words is often used as an estimate of premorbid intelligence among English-speakers. This procedure cannot be used in Spanish-speakers however, because Spanish words are read phonetically. The Word Accentuation Test was developed in Spain as a tool to estimate premorbid intelligence of Spanish-speakers by presenting infrequent accented words without their accent marks. We evaluated Word Accentuation Test (WAT) performance among elderly Caribbean Hispanics residing in New York City. Participants were 155 Spanish-speaking, community-dwelling elderly. All participants were nondemented as independently determined by a neurologist. Average years of education was 6.6 years ( $SD = 4.0$ ; ranging from 0–20 years), average age was 73.5 years ( $SD = 5.4$ ), and 74% were women. Total WAT score was significantly correlated with years of school ( $r = .47, p < .001$ ). WAT score was significantly related to measures of verbal learning, figure memory, verbal abstraction, naming, letter fluency, repetition, comprehension, and visuospatial skill ( $p < .01$  for all) even after accounting for the effects of age, years of education, and sex. Measures of orientation, nonverbal abstraction, category fluency, and retention of verbal material were unrelated to WAT score. Results suggest that the WAT is sensitive to aspects of educational experience, important for successful performance on cognitive measures, which are not captured by years of education. Longitudinal study is needed to determine if WAT performance is resistant to dementia and thus an appropriate assessment of premorbid ability in Caribbean Hispanics.

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**J. DONDERS. Application of the Odds Ratio in Clinical Neuropsychology.**

Standard parametric statistical tests do not translate well into real-world phenomena, such as the probability of a certain behavior (e.g., malingering) given the presence of a specific characteristic (e.g., litigation). In this study, the odds ratio ( $o'$ ) was used to exemplify how this statistic can provide more meaningful information. The sample included 61 patients with mild closed head injury (loss of consciousness  $< 30$  min, post-traumatic amnesia  $< 24$  hr, no intracranial lesions on CT scan), divided into subgroups with (LIT,  $n = 27$ ) and without (NO-LIT,  $n = 34$ ) ongoing litigation for alleged sequelae. As part of a comprehensive neuropsychological evaluation, they all completed a forced-choice memory test (Recognition Memory Test, RMT) for which specific actuarial criteria have been described previously to identify possible malingering. Traditional ANOVA indicated that the LIT group performed significantly worse on the RMT than the NO-LIT group [ $F(1, 60) = 6.01, p < .02$ ], with a medium effect size,  $\eta^2 = .09$ . Yet, that information did not indicate the relative probability of malingering, given the presence or absence of litigation. However, computation of the odds ratio revealed that individuals in the LIT group were more than nine times as likely to yield a performance on the RMT that was not statistically different from chance (i.e., raw score  $< 33/50$ )

than individuals in the NO-LIT group,  $o' = 9.43$  (90% confidence interval: 1.51–59.07). It is suggested that the odds ratio can be useful to neuropsychologists as a complement to parametric statistics.

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**R. J. IVNIK & G.E. SMITH. Diagnostic Accuracy of 4 Approaches to Interpreting Neuropsychological Test Data.**

The diagnostic accuracy of 4 commonly used approaches to interpreting neuropsychological test results were evaluated in a sample of 1079 persons (672 cognitively normal controls and 407 cognitively impaired patients) on whom 2930 evaluations with the complete Mayo Cognitive Factor Scales (MCFS) were available. Most participants had been tested multiple times at 1- to 2-year intervals. The interpretation approaches studied are absolute scores, difference scores between MCFS measures, profile variability, and change scores over test–retest intervals. All dependent measures were “highly statistically significant” (commonly  $p < .001$ ) when diagnostic groups were compared on null hypothesis significance testing analyses (i.e.,  $t$  tests, ANOVA, ANCOVA). In contrast, highly varied accuracy rates were obtained when each dependent measure’s ability to correctly classify individuals was evaluated with regard to overall diagnostic accuracy (i.e., combined sensitivity and specificity). Odds ratios computed at the 95% confidence level were also highly varied and ranged from  $\leq 1.0$  (i.e., chance) to 34.9. The results support the clinical utility of absolute scores and difference scores in data interpretation. Neither profile variability measures, such as range or a Profile Variability Index, nor measures of change over time, such as change scores or the number of statistically “reliable” MCFS changes, were diagnostically useful.

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**A.D. WILLIAMS. Evaluating the Tests in a Flexible Battery Related to the APA Standards and Daubert v. Merrell Dow.**

The presentation reviews several tests used in forensic evaluations in relationship to criteria from the APA Standards for Educational and Psychological Testing, the guidelines for testing in the forensic context by Heilbrun, and the Supreme Court decision in Daubert v. Merrell Dow. The Daubert decision indicated that an assertion must be derived by the scientific method. This presentation reviews the criteria in the Daubert case applied to neuropsychological testing. The presentation uses examples from forensic evaluations dealing with traumatic brain injury. There is a systematic review of available reliability and validity data for specific tests and a discussion of reviews in *Test Critiques* and *Mental Measurements Yearbook*. Many neuropsychologists use screening tests to come to diagnostic conclusions about traumatic brain injury. Several screening tests are discussed related to the APA Standards and sections of various test manuals are referenced. The use of subtests to derive conclusions is explored in the context of standardization issues noted in the APA Standards. The statistical power of some studies is presented related to sample size and effect size. The limitations of tests of “executive functions” are addressed. The sensitivity and specificity of various approaches are presented in the context of an application of Bayesian theory to calculate positive and negative predictive value. There is also a comparison of fixed versus flexible batteries in the context of Daubert, the APA standards, and Heilbrun’s guidelines.

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**J. HERMSDÖRFER, G. GOLDENBERG, C. WACHSMUTH, B. CONRAD, & H. BOECKER. Significance of the Posterior Cortex During the Imitation of Meaningless Gestures: Converging Evidence From Imaging and Apraxic Patients.**

The imitation of meaningless gestures is highly sensitive to reveal limb apraxia and is not prone to language disorders or disturbances of semantic action knowledge. Left (predominantly parietal) brain damage (LBD) fre-

quently impairs the imitation of hand gestures, while finger gestures are susceptible also to right brain damage (RBD). Patients, who fail during imitations, yield comparable impairments during perceptual discrimination and matching of both types of gestures without actual movements. In order to relate clinical findings to brain activation, we collected PET scans of healthy subjects during discrimination of gestures. Participants observed pairs of images of either hand or finger gestures and had to indicate whether they are identical or different. As a control condition participants simply had to indicate whether two portrayed persons were identical or not. Discrimination of hand gestures predominantly activated left posterior brain areas including the inferior parietal cortex (BA40). Finger gestures induced a more symmetrical posterior activation with particular increases in secondary visual association areas (BA19). Anterior activation was mainly limited to the pre-SMA during hand gestures. The results are in accordance with the clinical findings in apraxic patients and underline the significance of the posterior cortex during the imitation of meaningless gestures. However, like the clinical symptomatology, the pattern of activation depends on the characteristics of the task.

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### Paper Session 4/1:45–3:30 p.m.

#### CHILDREN: VISUAL ATTENTION AND NEURODEVELOPMENT

##### A. KALFF, M. KROES, J. HENDRIKSEN, H. VLES, F. FERON, J. STEYAERT, T. VAN ZEBEN, & J. JOLLES. Attentional Functioning as a Predictor of ADHD: Results From a Large-Scale Population Study in Preschool Children.

School-age children with ADHD have several cognitive problems in the attention and executive domains such as inhibition, sustained attention, and goal-directed behavior. Whether these deficits already manifest at preschool age is not clear. The goal of the study was to investigate the developmental profile of attentional functioning of preschool children at risk for ADHD and to specify their attention problems. The present prospective multidisciplinary study involves 1317 children, of whom 360 were selected on the basis of their scores on the Child Behavior Checklist (>90th %ile on externalizing and internalizing behavior). These children were administered an extensive neuropsychological testbattery which included a computerized battery of several attentional measures (Amsterdam Neuropsychological Tasks). One-and-a-half-years later, the results of 3 groups (ADHD, ADHD-like, and control) were compared. MANOVA showed a significant main effect of group [ $F(12, 640) = 2.25, p = .009$ , Pillai's test]. Univariate analyses revealed significant differences on several attention tasks. The ADHD children had slower reaction times and had more errors on a divided attention task than the control group. Also, the ADHD and borderline groups had significant poorer performance on an impulsivity task than the controls. Remarkably, there were no overall differences between the groups on sustained attention tasks. Results show that some, but not all cognitive deficits found in school-aged children with ADHD are present at preschool age.

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##### K. LOCKWOOD, A. MARCOTTE, & C. STERN. Differentiation of Attention Deficit Hyperactivity Disorder Subtypes: Application of a Neuropsychological Model of Attention.

The neuropsychological profiles and pathophysiological underpinnings of specific attention deficit hyperactivity disorder (ADHD) subtypes remain

poorly understood despite being the topic of frequent study. In the present study, participants ( $N = 80$ ) were grouped by ADHD subtype (*predominantly inattentive type vs. combined type*) and gender resulting in 4 age-matched groups (*ADHD-I boys, ADHD-I girls, ADHD-C boys, ADHD-C girls*), each comprised of 20 children. All were clinically diagnosed, and all were free of comorbidity (psychiatric, neurological, learning disability) or prior treatment with psychostimulant medication, thereby lending methodological rigor to the study. Use of a multi-dimensional neuropsychological model of attention offered precision of measurement by not only allowing for systematic assessment of 4 underlying attentional dimensions, but also by including several assessment modalities (auditory-verbal, visual, visuomotor). Results revealed that relative to their counterparts without hyperactivity, participants with ADHD-C had disproportionately lower scores on basic tasks requiring simple focusing and automatic shifting, as well as relative impairment on the attentional component most highly associated with executive control. In particular, boys with ADHD-C committed the largest number of off-task errors, suggesting a higher level of disinhibition. Relative to age-standardized data for the normative population, both groups with ADHD-I and ADHD-C demonstrated significant difficulty on components assessing active switching and vigilance. Stepwise discriminant analysis using variables from all 4 attentional components revealed that a combination of 6 held a high degree of accuracy (80%) in discriminating between children with ADHD-I and those with ADHD-C. Results provide empirical support for *DSM-IV* ADHD subtype classifications, as well as for the utility of a neuropsychologically sensitive model of attention in the differentiation of these subtypes.

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##### H. SWAAB, L. DE SONNEVILLE, P. COHEN-KETTENIS, & H. VAN ENGELAND. Assessment of Sustained, Focused, and Divided Attention in Children With ADHD, ODD/CD, Anxiety and PDD.

Assessment of attention in child psychiatric patients is hampered by the fact that most empirical studies report specific aspects of attention with respect to specific patient groups. Therefore, questions about specificity and diversity of attention problems connected with psychopathology in children could not be answered adequately yet. We report our investigations of sustained, focused, and divided attention of groups of children with different psychopathology, to provide the clinician with a frame of reference with respect to specificity and diversity of these problems. Fifty-two boys with pure ADHD, 29 boys with pure ODD/CD, 29 boys with anxiety or dysthymia, 43 boys with PDD, 24 boys with ADHD and comorbidity of ODD/CD and 14 boys with ADHD and comorbidity of anxiety were selected, plus a control group of 55 normal boys. Attention was evaluated according to the information processing models of Shiffrin and Schneider and Sternberg. Although sustained attention measures are commonly used in detection of attentional problems, most task-parameters indicate attentional aspects which seem to be merely related to the status of psychiatric patient than to specific psychopathology. An exception is the decline of performance during time on-task and the irresponsiveness to feedback, specifically found in ADHD. Focused attention problems were only found in children with complex ADHD. Divided attention problems were found in ADHD as well as in PDD children. It is concluded that all child psychiatric patients are at risk for attention problems and that individual evaluation of these problems is important to indicate severity of psychopathology.

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S. KEMP, U. KIRK, M. KORKMAN, W. HUCKEBA, K. HARRINGTON, & M. MATSON. Effects of Methylphenidate on the Auditory Processing and Auditory and Visual Attention in Children With ADHD. A subset of 20 children diagnosed with ADHD ( $M$  age = 8.4 years,  $SD =$

0.9) from the NEPSY validation sample were administered a series of attentional measures both off and on medication. The current repeated measures study investigated the effects of methylphenidate on tests of simple and complex auditory attention (NEPSY Auditory Attention and Response Set), auditory processing (SCAN: A Screening Test for Auditory Processing Disorders) and visual continuous performance (Conners Continuous Performance Test). Results revealed significant improvement in performance with medication on complex auditory attention (NEPSY Response Set), auditory processing of mildly distorted words (SCAN Filtered Words), rapid processing of dichotically presented speech stimuli (SCAN Competing Words), and on the number of impaired measures on the visual continuous performance task. Improved performance with medication was not observed on the simple auditory attention task or on a measure of word discrimination against a background of competing auditory stimuli. Qualitatively, both omission and commission errors on the complex auditory attention task were significantly reduced on medication. Results will be discussed with regard to diagnostic criteria for ADHD and/or auditory processing disorders, including symptoms common to both conditions.

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**M.L. LORUSSO, A. FACOETTI, & M. MOLTENI. Orienting of Visual Attention and Developmental Dyslexia: Differential Effects of Treatment Programs.**

Several studies in the literature show that dyslexic children are impaired in visual tasks requiring automatic orienting of attention. Shifting of visual attention induced by peripheral cues is studied by means of Posner's covert orienting paradigm. This procedure presents respondents with a spatial cue preceding the presentation of a target stimulus. The spatial cue either alerts the participant to the correct location of the target (valid cue), the incorrect location of the target (invalid cue) or provides no information as to the location of the target (neutral cue). In our study on the efficacy of different intervention programs for dyslexia, we assessed the effects on a series of variables concerning reading and spelling abilities as well as other neuropsychological functions obtained over a 4-month treatment with Bakker's program (14 children) as compared with traditional speech therapy (12 children). A major finding was that children treated with Bakker's visual Hemisphere Specific Stimulation (HSS) program showed significant changes in their attentional inhibition processes, as indicated by increased costs (difference between neutral and invalid cues) for disengaging the attentional focus. As this treatment program also proved to be highly efficient in improving children's reading abilities, the relationship between reading and orienting of visual attention is discussed.

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**G. HORNEMAN & I. EMANUELSON. Neurodevelopmental Evaluation of Infants With Sagittal Cranial Synostosis Pre- and Postcorrective Plastic Surgery.**

Twenty-six infants with cranial sagittal synostosis were evaluated pre- and postcorrective plastic surgery for developmental abnormalities, in order to describe neurodevelopmental level and dysmorphic features. The aim was also to see if the surgical procedure had any detrimental effect on psychological development. The study had a prospective design and the children were evaluated immediately before the operation and four months after the operation. The mean age at operation was 6 months. The methods chosen consisted of a neuropsychiatric examination, a screening for dysmorphic features, a neuropsychological testing procedure (Griffiths' Mental Development Scale for Children) and a qualitative interview with the children's parents. The results revealed that 38% had neurological abnormalities and another 27% had other malformations. Minor dysmorphic features were present in 40% among which 75% were hereditary. There were no statistically significant changes between pre- and postoperative Griffiths' evaluations. There was a trend, however, that the children post-

operatively improved their scores on the social scale compared to the other subscales.

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**Paper Session 5/4:00–5:00 p.m.**

**THALAMIC STIMULATION STUDIES**

**J.A. LUCAS, J. RIPPETH, R. UITTI, A. OBWEGESER, & R. WHAREN. Cognitive, Motor, and Mood-Related Effects of Left Thalamic Stimulation in the Treatment of Parkinsonian and Essential Tremor.**

Delivery of chronic stimulation via indwelling electrodes surgically placed in the ventral intermediate (VIM) nucleus of the thalamus represents a relatively nondestructive and reversible treatment for disabling tremor associated with Parkinson's disease (PD) and essential tremor (ET). The effects of left-sided deep brain stimulation (DBS) on cognition, tremor, and mood were assessed in 15 white patients (23M, 3F) diagnosed with ET ( $n = 11$ ) or PD ( $n = 4$ ). All patients were right-handed, with a mean age of 70.7 years ( $SD = 9.2$ ) and a mean education of 12.1 years ( $SD = 2.8$ ). Patients were evaluated prior to surgery and again three months after placement of a left VIM stimulating electrode. At follow-up, alternate test forms were administered with ("on") and without ("off") stimulation. Cognitive measures included tests of attention, word fluency, executive function, visuoception, and verbal memory. A neurologist evaluated tremor severity. Mood was assessed via self-report inventory. Right arm tremor improved significantly with left VIM stimulation. Repeated measures ANOVA revealed no main effect for time (baseline, on, off) on measures of attention or visuoception. Significant main effects were observed, however, on measures of letter fluency ( $p < .01$ ), semantic fluency ( $p < .05$ ), and the Stroop test ( $p < .01$ ), with poorer postsurgical performance regardless of stimulation condition. Postsurgical learning and memory were similar to baseline when the stimulator was on, but declined significantly when the stimulator was off ( $p < .05$ ). After surgery, patients reported significantly less anxiety with the stimulator active than inactive, but no other mood-related changes were found. Results suggest a possible "microthalamotomy" effect of DBS surgery on specific aspects of cognition. Declines in memory associated with deactivation of the stimulator may be related to greater anxiety under this condition.

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**A.I. TRÖSTER, J.A. FIELDS, & C.I. HIGGINSON. Near-Term Cognitive and Mood State Outcomes After Bilateral Subthalamic Stimulation for Parkinson's Disease.**

Subthalamic deep brain stimulation (DBS) alleviates the major motor symptoms of medically refractory Parkinson's disease (PD), including levodopa-induced dyskinesias. Little is known about this experimental treatment's effect on cognitive functioning or mood state. This study evaluated 16 patients with PD 2 months before and 4 months after electrode implantation. The test battery (selected on the basis of test sensitivity to deficits in PD or after DBS) evaluated attention, executive functions, language, visuo-perceptual functions, memory, and mood state. The patients (8 male, 8 female; 15 dextral, 1 sinistral), on average, were 56 years old, had had PD for 9 years, had 14 years of education, and had average verbal intelligence (estimated VIQ = 104). Postoperative decrements were observed on both the word reading and color-word interference components of the Stroop, with the latter decrement being much pronounced (10 vs. 0.25 items less after surgery). Category, but not letter fluency was reduced after surgery. There was a tendency ( $p = .06$ ) for patients to make fewer perseverative responses and errors on the Wisconsin Card Sorting Test after surgery. Other cognitive functions and anxious and depressive symptomatology were unchanged. Bilateral subthalamic DBS appears relatively safe from a cognitive standpoint. Cognitive decrements after subthalamic DBS may represent

difficulties in timing and sequencing of information processing rather than a general dysexecutive syndrome or motor speech changes.

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**J.A. FIELDS, C.I. HIGGINSON, L. FISHER, & A.I. TRÖSTER. Long-Term Effects of Unilateral Deep Brain Thalamic Stimulation on Cognition and Mood State in Essential Tremor Patients.**

Deep brain stimulation (DBS) of the thalamus effectively alleviates much of the motor disability suffered by patients with essential tremor, but there has been some suggestion that, at least in the short-term, significant declines in verbal fluency may be observed following surgery. Thus, 30 patients undergoing unilateral thalamic DBS were administered tests of cognition and mood to determine if changes were observed in this sample, and then to see if significant gains or losses were maintained over time. All patients were evaluated approximately 1 month before, 3 months after, and again 1 year following surgery. Significant improvements observed at 3 months in visuoperceptual ability (DRS), 1 measure of attention (WMS-R Visual Span Backward), visuomotor and visuoperceptual functions (Grooved Pegboard and Hooper Visual Organization Test), recognition memory and delayed prose recall (CVLT Hits and WMS-R Logical Memory II), and 1 aspect of mood (POMS Tension) were still maintained 12 months following surgery. Gains in Digit Span Forward (WMS-R), visual confrontation naming (BNT), and total words recalled, long-delay free recall, and short-delay free recall of a 16-item shopping list (CVLT) were present only at 12-month follow-up. Though decrements were rare, declines that did appear in lexical verbal fluency and complex attention (WMS-R Digit Span Backward) 3 months following surgery were no longer evident 1 year later. While steady gains reaching significance only at 12-month follow-up may potentially represent practice effects, gains that were initially observed and evenly maintained following long-term follow-up might suggest a positive stimulation effect on cognition. Conversely, it is unlikely that the transient decrements produced were a result of stimulation since they did resolve by 12 months later. It was thus concluded that stimulation of the thalamus may have some cognitive as well as motor benefit for essential tremor.

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**Paper Session 6/4:00–5:00 p.m.**

**TOXIC ENCEPHALOPATHY**

**R.B. NES, K. SUNDET, & I. REINVANG. The Diagnostic Potential of ERP in Subjects Referred for Assessment of Toxic Encephalopathy.**

Extensive exposure to toxic solvents may cause brain damage. Since toxic encephalopathy (TE) frequently occurs in the absence of pathological CT/MRI findings, diagnostic confirmation relies heavily upon results from neuropsychological assessment. The diagnostic procedure has been suggested highly vulnerable to malingering and other functional impairments. Cognitive ERP may provide a potential tool in the differential diagnostic process. We report data on 24 male patients referred for evaluation of possible TE, and 24 healthy controls without a history of solvent exposure. ERP-data from a standard auditory oddball paradigm were recorded. The TE group was assessed with a comprehensive neuropsychological test battery, including measures of symptom validity. Due to significant differences in age and education, covariance analyses were conducted. Results indicate that more than 60% of the referred patient group evidenced impaired cognitive functioning. Furthermore, the impaired group was characterized by decreased ERP amplitudes and trend-level signs of reduced P3 latency scores. ERP parameters did not differ substantially between patients with high and low symptom validity indicators. We conclude that

ERP may represent a valuable supplement in the differential diagnostic evaluation of TE, but emphasize the need for larger groups in order to establish valid cut-off scores for deviant ERP responses.

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**R. BAST-PETTERSEN & D.G. ELLINGSEN. Neurobehavioral Performance Among Workers Exposed to Manganese.**

The aim of the study was to investigate potential nervous system effects from occupational exposure to manganese in Norwegian ferromanganese and silicomanganese alloy plants. One hundred male exposed workers (*M* age 44.1 years, *SD* 9.0) were compared with 100 referents (*M* age 44.2 years, *SD* 9.0). The exposed subjects were employed at 3 ferromanganese and silicomanganese alloy plants. The referents were recruited from 2 plants: 1 ilmenite smelter and 1 plant producing silicon metal. The 100 referents were chosen based on matching for age in pairs. The participation rate was 91% for both groups. The workers were tested with a neurobehavioral test battery comprising motor tests, tests for immediate memory, tests for attention and psychomotor speed, general intellectual ability, hand-eye coordination and reaction time. The workers were interviewed on health status and life style, and they answered 2 symptom questionnaires. Exposure assessment was based on measurements of manganese in air, whole blood, and urine. The data collection was finished in June, 1999. Results are not yet available, but the data analysis is in progress, and neurobehavioral test results will be presented at the conference.

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**R.O. HOPKINS, L.K. WEAVER, & E.D. BIGLER. Longitudinal Outcome Following Carbon Monoxide Poisoning: Psychological Changes.**

*Background:* Prior research has shown that carbon monoxide (CO) poisoning can cause psychological/emotional changes that do not correlate with severity of exposure, including depression and anxiety. The purpose of this study was to assess longitudinal psychological outcome following CO poisoning. *Methods:* Consecutively CO poisoned patients, who were seen at LDS Hospital from January 1995 to February 1999, were administered a battery of standardized questionnaires to assess psychological status. Follow-up interviews occurred at 6 weeks (*n* = 178), 6 months (*n* = 176) and 12 months (*n* = 164) post-CO exposure (14 patients were not due for 1 year follow-up). Accidental exposure = 144 and suicide = 34 and there were 64 female and 114 male participants. All patients completed the Fashingbauer Short Form MMPI, Symptom Checklist-90-Revised (SLC-90-R), Beck Anxiety Inventory (BAI) and Beck Depression Inventory (BDI). *Results:* At 6 weeks 51% of patients reported psychological changes, 44% at 6 months and 40% at 1 year. At all measurement intervals those patients who report psychological changes had significantly higher scores (*p* = .05–.001) on the MMPI, SCL-90-R, BAI, and BDI, compared to patients who did not report changes. *Conclusions:* Individuals who were exposed to CO experience a high rate of psychological changes: including symptoms of depression, anxiety, irritability and decreased frustration tolerance, that persist to 1 year postexposure. It is recommended that CO poisoned individuals who experience affective changes be referred to the appropriate health care provider(s) for diagnosis and treatment.

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**Presidential Lecture/5:00–6:00 p.m.**

**FUNCTIONAL NEUROIMAGING:  
WHAT IT CAN DO FOR NEUROPSYCHOLOGY**

**Martha Denckla**

## FRIDAY MORNING, JULY 14, 2000

Poster Session 2/9:00 a.m.–5:00 p.m.

**BRAIN INJURY—VARIATIONS IN SEVERITY,  
TIME SINCE INJURY AND OUTCOME/APHASIA,  
ALEXIA, AGRAPHIA, NAMING, AND STUTTERING/  
NEUROPSYCHOLOGY IN PSYCHIATRIC,  
NEUROLOGICAL, AND NEUROSURGICAL DISORDERS**

**S. MAJERUS, M. VAN DER LINDEN, & A. SHIEL.** *Wessex Head Injury Matrix and Glasgow/Glasgow–Liège Coma Scale: A Comparison and Validation Study.*

The Wessex Head Injury Matrix (WHIM) appears to be a very sensitive and functional behavioral assessment tool for altered states of consciousness. This study was designed (1) to develop and validate a French version of the WHIM; (2) to compare the WHIM to the widely used Glasgow Coma Scale (GCS) and its extension, the Glasgow–Liège (GLS). The 3 scales were used to assess 23 brain-injured patients in coma, defined as an initial GCS score of less than or equal to 8 for at least 1 h. They were followed longitudinally until death or recovery. Concurrent validity of the WHIM is good: Spearman correlation between the WHIM and the GCS/GLS scores is 0.94 ( $p < .001$ ). Interrater agreement for the WHIM items assessed using Kappa was satisfactory: a mean Kappa of 0.84 was observed for 20 assessments carried out by 2 independent raters on video recordings of 5 patients. Test–retest reliability was excellent: Spearman correlation between the WHIM scores assessed on 2 different occasions for the same 5 patients was .981 ( $p < .001$ ). A distribution analysis of GCS, GLS, and WHIM scores indicated that the WHIM was more sensitive to assess the vegetative state, the minimally conscious state, and patients with a relatively good recovery. The GLS was more sensitive than the WHIM to assess deep coma as the GLS additionally assesses brainstem reflexes. Finally, analysis of our data using the paired preferences technique confirmed the validity of the hierarchical WHIM item ordering as a function of a sequence of recovery.

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**J. HASEGAWA & T. HATTA.** *Influences of Arousal Level With Aversive Stimulus on the Orienting Response.*

The influence of arousal level induced by aversive stimulus on the orienting responses was investigated using Posner's cue–target detection task. Participants responded to the visual target presented on the CRT either in the left or the right field. In order to control arousal level, the aversive stimulus (white noise of 92 dB) was simultaneously given with a cue stimulus preceding the target. The experiment included 3 within-subjects factors, cue–target location (same and different), noise presentation (noise and nonnoise), and cue–target delay intervals (100 ms, 150 ms, and 300 ms). The skin conductance responses (SCRs) and reaction times (RTs) were measured as dependent variables. SCRs in the noise condition (white noise with cue) were larger than in the nonnoise condition. Overall RTs of the noise condition were faster than in the nonnoise condition. In the nonnoise condition, RTs of valid cue trials (cue and target appeared at the same location) were faster than those of invalid cue trials (cue and target appeared in the opposite visual field). That is, a cue validity effect was observed in the nonaversive condition. On the other hand, in the noise condition of the shortest cue–target delay (100 ms SOA) showed no cue validity effect. These results implicate that high arousal level managed by aversive stimulus failed to produce a cue validity effect. This suggests that physiological structures related to arousal levels induced by emotional stimulus could influence the cognitive system such as the orienting response.

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**C. SEEGMULLER, C. KLEITZ, A. DE SAINT MARTIN, E. HIRSCH, C. MARESCAUX, & M.N. METZ-LUTZ.** *Cognitive Development in Benign Focal Epilepsies of Childhood.*

Benign focal epilepsy of childhood (BFEC) is the most common form of epilepsy, in children from 3 to 12 years of age. As far as the epilepsy is concerned, its prognosis is always favorable. However, recent clinical data suggest that children affected by BFEC are more likely to show learning difficulties and behavioral disturbances than their peers. We report here the preliminary findings of a prospective study of 32 children affected with BFEC. The study examines the cognitive development through neuropsychological evaluation repeated every 6 months while electro-clinical investigations measured the severity of epilepsy. Our results strengthen the conclusion of recent neuropsychological studies stressing the correlation between epilepsy and cognitive performances. The cognitive deficits appeared to affect more significantly nonverbal than verbal functions. They were significantly correlated to the frequency of seizures and spike-wave discharges and to the lateralization of the epileptic focus in the right hemisphere. Moreover, in presence of active BFEC with increased frequency of interictal epileptic discharges during sleep, cognitive functions like attention control, response organization, and fine motor speed that are under the control of frontal lobes were impaired independently of the lateralization of epileptic focus. These results suggest that epilepsy not only disturbs cognitive functions that normally depend on the cortical area involved by the generation of epileptic discharges, but may also impair cognitive functions subserved by cortical areas distant from the epileptic focus. They also suggest that the maturing cognitive functions are particularly susceptible for interference with epilepsy.

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**K. MICHIELS, K. BEECKMANS, C. KIEKENS, & I. BRANDTS.** *Cognitive Deficits Associated With a Locked-In Syndrome Following a Pontine Infarction: A Single Case Study.*

A 41-year-old woman (V.G.) was initially diagnosed as having a total locked-in syndrome (LIS) due to a pontine infarction. An MRI showed an isolated lesion in the left pontine region. There was no evidence of any other brain pathology. V.G. underwent a neuropsychological examination 6 months after onset of illness. At the moment of evaluation, the diagnosis was that of an incomplete LIS because she made a moderate recovery. Intelligence, speed of information processing, audiovisual and visuospatial long-term memory, visuospatial abilities, language, and executive functions were found to be within normal limits. Concerning attention, V.G. achieved a normal result for focused attention. However, she was mildly impaired on the oral version of a test that evaluates divided attention. This finding could probably be attributed to the patient's reduced articulatory speech production. With regard to working memory, V.G. showed a slightly worse performance for auditory–verbal working memory in comparison to her performance for visuospatial working memory. Concerning auditory–verbal working memory, V.G. showed a markedly better visual memory span in comparison to her auditory memory span. A theoretical explanation for this finding was based on the working memory model. It is assumed that the reduced auditory memory span in V.G. is the result of a defective articulatory rehearsal system (ARS) due to a reduced use of covert articulation, which makes it difficult for the ARS to hold auditive information within the short-term storage system. This condition may be the cause of a smaller amount of to-be-remembered auditory–verbal items that can be processed.

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**K. BEECKMANS, P. VANCOILLIE, & K. MICHIELS. Neuropsychological Deficits After a Thalamic Infarction: A Report of 2 Cases.**

The neuropsychological performance of a 41-year-old woman (L.S.) and a 46-year-old man (G.K.) with a thalamic infarction was studied 2 and 7 months postinjury, respectively. An MRI revealed an isolated anterior medial and bilateral thalamic lesion in L.S. and a focal lesion in the anterior medial region of the right thalamus in G.K. There was no evidence of any other brain pathology. Regarding attention, our patients showed problems with sustained attention (L.S. and G.K.) and divided attention (G.K.). An intellectual deterioration, a reduced speed of information processing, an impaired focused and alternating attention, a retrograde amnesia, a disorientation in person, time, and place, a topographical disorientation, spontaneous confabulation, visuospatial disabilities, executive dysfunctions or personality changes could not be documented. Both patients showed an anterograde amnesia. Implicit memory, audioverbal and visuospatial short-term memory appeared normal. Concerning long-term memory for the auditory-verbal and visuospatial modality, our patients scored out of the normal range on total immediate recall tasks, short-term, and long-term delayed recall tasks. G.K. displayed a full-blown amnesic syndrome because his recognition memory was also impaired. L.S. did not demonstrate a profound amnesic syndrome. Our results support the hypotheses which state that (1) certain anterior medial thalamic structures play a specific role in memory functioning, and (2) various memory deficits, associated with the localization, laterality, and extent of the anterior medial lesion, can be seen in patients with a thalamic infarction.

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**J. ANDRIKOPOULOS. Lack of a Practice Effect on the Symbol Digit Modalities Test in Mild Head-Injury Litigants.**

This study evolved from an observation suggesting mild head injury litigants believed to be feigning cognitive impairment coded disproportionately fewer items on the oral portion of the Symbol Digit Modalities Test (SDMT) relative to the written. Consecutive patients seen for testing following a mild head injury or concussion were separated into a *low performance group* (LPG;  $N = 26$ ) and *high performance group* (HPG;  $N = 26$ ) based on level of test performances. A borderline performance (below the 8th %ile) on at least 2 neuropsychological tests (excluding SDMT) was used to separate the groups. SDMT scores were converted into standard scores ( $M = 100$ ,  $SD = 15$ ). Difference scores were calculated by subtracting the written from the oral raw score. The HPG performed significantly better than the LPG on both the written (HPG:  $M = 100.15$ ,  $SD = 14.41$ ; vs. LPG:  $M = 71.19$ ,  $SD = 19.81$ ;  $p > .001$ ) and the oral SDMT (HPG:  $M = 100.96$ ,  $SD = 13.56$ ; vs. LPG:  $M = 70.42$ ,  $SD = 16.81$ ;  $p > .001$ ). The main difference between the written and oral subtests for the groups was significant (HPG:  $M = 6.88$ ,  $SD = 5.21$ ; vs. LPG:  $M = 3.46$ ,  $SD = 3.70$ ;  $p < .01$ ). The present findings suggest patients who may feign cognitive impairment have a smaller discrepancy between their written and oral SDMT scores. To understand the influence of litigation, it would be ideal to use an outpatient mild head injury group not in litigation. As encountered in other studies, no patients meeting this criteria were referred during the data collection period. Alternatively, using a severely head injured control group would have artificially lowered the written score due to psychomotor slowing.

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**J. ANDRIKOPOULOS. Level and Pattern of Cognitive Impairment in Head-Injured Litigants Without Loss of Consciousness.**

Eighty consecutive litigants who had denied loss of consciousness following a mild concussion were separated into a *low motivation group* (LMG;  $N = 36$ ) and *high motivation group* (HMG;  $N = 44$ ) based on level of test performances. Patients with 3 borderline scores (below the 8th %ile) on at least 3 neuropsychological tests were assigned to the LMG. A 3rd group consisted of 40 consecutive patients with a moderate-to-severe closed head injury (CHG) who were not in litigation. There were no statistically significant differences between the LMG and the CHG on Logical Memory I

& II, Visual Reproduction I, Token Test & Visual Naming (from the Multilingual Aphasia Examination), Judgment of Line Orientation and Verbal IQ. Compared to the CHG, the LMG performed significantly better on Visual Reproduction II, Controlled Oral Word, the Facial Recognition Test, Grooved Pegboard, Finger Tapping, Performance IQ, and Full Scale IQ. The HMG performed significantly better than the LMG and CHG on all measures. The present findings suggest (1) as many as half of head injured litigants without a loss consciousness may show a level of impairment out of proportion to the severity of their injury; (2) the tests failed by severely head injured patients relative to mild concussed litigants are those that have been shown in the literature to be the most sensitive to the effects of head injury (tests of perceptual abilities, frontal lobe functioning, and psychomotor dexterity and speed).

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**S. STAPERT, J. DE KRUIJK, P. HOUX, J. RUTTEN, A. TWIJN-STRAS, & J. JOLLES. Neuropsychological Performance of Patients With Increased Serum Levels of Protein S-100 After Mild Traumatic Brain Injury.**

Mild traumatic brain injury is associated with long-lasting neuropsychological symptoms in a minority of patients (15–30%). A biological marker predicting outcome following mild traumatic brain injury is still unavailable. The aim of this study is to determine whether serum concentrations of protein S-100 following mild traumatic brain injury are a useful prognostic predictor for neurocognitive performance. Protein S-100 is synthesized in all parts of the central nervous system. In 40 patients blood samples were taken within 6 hr after the trauma for measurement of S-100B in serum. Patients had to meet criteria for mild traumatic brain injury (Glasgow Coma Score 14–15, Post-Traumatic Amnesia < 1 hr and/or loss of consciousness < 15 min). The research protocol specified completion of neuropsychological assessment within 2 weeks after injury and follow up at 3 and 6 months postinjury. The test battery consisted of simple and complex attention tasks, and a verbal learning test. The highest concentration of S-100B found in a control participant ( $0.32 \mu\text{g/L}$ ) was used as a cut-off score for elevated levels after injury. In 16 patients increased levels of protein S-100 were found. Eight of these patients could be matched with 10 mild traumatic brain injury patients with S-100B levels lower than  $0.32 \mu\text{g/L}$  (age, sex, and level of education). Preliminary data analysis show no differences in neurocognitive performance between these 2 patient groups. These findings suggest that increased serum levels of S-100 have no prognostic value for longlasting neurocognitive abnormalities.

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**M. NORRIS & M. HAINES. Medical Patients Feigning Closed Head Injury: Expanding Simulated Malingering Research.**

Investigations of indices that may identify malingering of cognitive deficits have been primarily based on simulation studies in which college students are asked to feign deficits resulting from a head injury. However, students are a sample of convenience, which may reduce the external validity of simulation studies. This study examined simulated malingering in medical patients. Compared to college students, patients receiving care at a veteran's hospital are more similar to the population at risk for head injuries and litigation in terms of age, education, and cognitive skills. Participants included 20 patient malingerers, 20 brain-injured patients, 20 patient controls, 27 student malingerers, and 30 student controls. Measures included the Rey Auditory Verbal Learning Test (RAVLT), Trail Making Test, and a forced choice version of the Test of Nonverbal Intelligence. As expected, the patient malingerers were substantially more distinguishable from brain-injured patients than the student malingerers. Patient malingerers performed significantly worse than brain-injured patients on multiple measures including the RAVLT total score, primacy recall, RAVLT recognition, Trails A & B, and the forced-choice measure. In contrast, no individual indices distinguished student malingerers from brain-injured patients. Combining indices increased predicted group status. None of the patient malingerers were misclassified as brain-injured patients, whereas

11% of the student malingerers were misclassified as brain-injured patients. These results offer 2 important conclusions. First, multiple indices are needed to produce significantly better classification than single measures of malingering. Second, malingering research should include samples that are closer in demographic background to the at-risk population. Correspondence: Margaret Norris, Psychology Department, MS 4235, Texas A&M University, College Station, TX 77843-4235, USA.

**K. VERGER, A. ALVAREZ, J.M. SERRA, D. BARTRÉS-FAZ, J.M. MERCADER, & C. JUNQUE. Hippocampus Volume Atrophy In Adolescents With Severe Traumatic Brain Injury and Its Relationship With Memory Impairment.**

Hippocampal atrophy is a very frequent finding in necropsy studies of traumatic brain injury (TBI). Memory impairment is the most frequent sequela of TBI, probably due in part to hippocampal neuronal loss. Advances in MRI acquisition and posterior analyses allow reliable measures of the hippocampus. The purpose of the present research is to relate hippocampal atrophy with declarative memory impairment in severe TBI adolescents who suffered lesions during infancy. Twenty-four patients ages 15–23 years with severe head injury composed the sample. MRI was acquired following a research protocol obtaining 149 contiguous slices in the transversal plane. 3D reconstructions were obtained using ANALYZE. We measured the hippocampal volume in the coronal plane. Volumes were corrected by brain volume. Hippocampus volume correlated with Glasgow coma scale score ( $r = .38, p = .034$ ). Left hippocampal correlated with memory for objects ( $r = .39; p = .033$ ), memory for location ( $r = .37, p = .038$ ) and total score in the Rey's Auditory Verbal Learning Test (AVLT;  $r = .35, p = .048$ ). Groups with ( $n = 11$ ) or without memory impairment ( $n = 13$ ) in RAVLT differed in both right and left hippocampal measures (right hippocampal:  $t = -2.67, p = .007$ ; left hippocampus:  $t = 3.3, p = .002$ ). No differences emerged after the comparison between impaired and nonimpaired patients in the memory phase of the Rey's complex figure. In conclusion, deep coma was related to hippocampal atrophy, and patients with verbal learning impairment exhibited higher atrophy in both hippocampi. No effects were observed for visual memory assessed using Rey's complex figure. The lack of accuracy of this test in detecting hippocampal dysfunction agrees with the data from epileptic patients.

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**K. FOLLESØ. A Long-Term Follow-Up Study of Industrial Workers With Toxic Encephalopathy.**

This paper presents a long-term follow-up study of industrial workers with a diagnosis of painter's syndrome (toxic encephalopathy). Between 1985 and 1987, 24 industrial workers exposed to toxic solvents were referred to the community hospital of Fredrikstad, Norway. All displayed a variety of symptoms typical of painter's syndrome, such as memory and attention deficits, fatigue and emotional instability. At the time of referral, their average age was 46 years, and the average time of exposure to toxins was 16.7 years. All 24 underwent thorough investigations, including neurological exam, neuropsychological assessment and different radiological methods. Twelve of the 24 met the diagnostic criteria of toxic encephalopathy. In 1999, these 12 workers were contacted for a reexamination. Two had developed additional medical diseases, and were excluded from the study. Eight of the remaining 10 participated in the follow-up study. They underwent the same neurological and neuropsychological assessment as in 1985–87. In addition they were asked to determine whether the subjective symptoms of the painter's syndrome had increased or decreased over the last 10 years. The results show that the patients' neurological condition had remained unchanged. When controlled for age, their cognitive functions were fairly unchanged as well. The subjects report that the subjective symptoms of the painter's syndrome had increased over the years. Applying the 1985 criteria, 6 out of 8 subjects in the 1999 study would satisfy the diagnosis of toxic encephalopathy. The remaining 2 displayed nonclinical cognitive deficits.

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**D. HOOFIEN, A. GILBOA, E. VAKIL, & P. DONOVICK. Traumatic Brain Injury (TBI) 10–20 Years Later: A Comprehensive Follow-Up Study of Psychiatric Symptomatology, Cognitive Abilities, and Psychosocial Functioning.**

Few outcome studies of severe TBI follow patients beyond a decade post-injury. The present study reports the results of a comprehensive follow-up of 76 TBI patients, at an average of 14.1 ( $SD = 5.5$ ) years postinjury. Five mental and functional domains were extensively evaluated by means of standardized scales and neuropsychological tests: *Psychiatric symptomatology*: A high level of distress was found with particularly high scores on measures of hostility, depression, and anxiety. Fourteen percent of the sample suffered from PTSD by DSM-IV criteria. *Cognitive abilities*: Compared to only moderately compromised intellectual and memory functioning, significant deficits in learning capacity and psychomotor speed were revealed. *Vocational*: Forty-six (60%) of the patients were employed at the time of follow-up, with 34 (45%) working in unskilled professions, including 18 (24%) in sheltered or volunteer jobs. *Family*: Relatives reported a high sense of burden and a moderately high psychiatric distress with high scores on measures of anxiety and hostility. *Social*: Social functioning was assessed to be at the low average range by both the respondents and their family members. The patients' diminished social functioning was also revealed in that 24 (31%) of the sample reported having no friends at all. *Conclusions*: This study highlights the clinical and epidemiological importance of very long-term follow-up of severe TBI in a variety of life domains. Our results indicate a long-term differential effect of severe TBI, with seriously affected psychiatric symptomatology, family, and social domains as compared to cognitive and vocational functioning, which were found to be moderately influenced.

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**A. RAPPAPORT. Physical and Cognitive Deficits as Predictors of Return to Work After Stroke.**

Although it is often assumed that stroke only affects people who are no longer of a working age, it occurs in approximately 3–4% in persons between the age of 15 and 45. While rehabilitation professionals measure outcome in terms of measures of independent functioning, successful rehabilitation from the patient's point of view is reached when there is a return to previously undertaken activities. Many consider employment as the most important outcome. A review of the literature shows that variables used to predict success in returning to work have mainly involved physical and neurological indicators, though more recently there has been an interest in the use of neuropsychological tests. The current paper compares and contrasts 2 cases, a 22-year-old woman with a left occipital-parietal infarct and a 37-year-old man with a left parietal intracerebral hemorrhage. Attempts were made to return both to work—one successfully, the other not. The employment outcomes did not match clinical predictions. These unexpected results are discussed taking into account physical disability, cognitive deficits as well as personality (motivational) factors. It is concluded that physical, neurological, and even neuropsychological variables are not always enough to predict outcomes.

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**F. LARØI & S. JANSSEN. Treating Families of Individuals With Traumatic Brain Injury: Presentation of a Clinical Case Approached From a Structural Therapy Perspective.**

The majority of brain injured patients are left with permanent and adverse impairment as a result of their injury (e.g., physical, cognitive, emotional, behavioral). However, a traumatic brain injury may also have a great impact on the family as a whole. This may include, for example, changes in the family's organizational structure, communication patterns, or balance of family needs. In spite of this, treatment strategies for these problems are only slowly being recognized. Brain-injured patients have traditionally received treatment aimed at alleviating the primary effects of their injuries, that is, cognitive and physical aspects, but the important secondary reactions to the injury, including familial reactions, have not been adequately

addressed in rehabilitation programs. Furthermore, when these reactions have been addressed, they have usually been approached from a “family support” perspective (counseling, education, family training) and not from a “family therapy” perspective (where the goal is to bring about behavioral change in a disturbed marital or family unit by essentially psychological methods). The aim of the following paper is to illustrate how family therapy approaches can be used in treating families of individuals with brain injury, in particular, structural interventions. A clinical example will be presented where structural interventions were utilized with a brain injury patient and his family. Other interventional approaches from family therapy will also be mentioned. Finally, the need to broaden rehabilitation strategies in brain injury rehabilitation will be discussed, including the potential for interdisciplinary interaction between neuropsychologists and family therapists.

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**A. SHUTTLEWORTH-JORDAN, A. DICKINSON, R. ANCER, I. REID, S. RADLOFF, & I. JAKOET. The Percentage of Individuals With Cognitive Test Deficit and Postconcussive Sequelae Following Participation in Rugby: Alarm Bells From the RU-SARFU Rugby Head Injury Study.**

This paper reports on a study conducted in collaboration with the South African Rugby Football Union (SARFU) comparing professional rugby players ( $N = 26$ ) and professional cricket controls ( $N = 21$ ). Neuropsychological tests (incorporating verbal and visual memory, verbal fluency, visuo-perceptual tracking, and hand motor dexterity), and a questionnaire tapping postconcussive symptomatology, were administered. In a previous report, Reid et al. analyzed the neuropsychological test data of the rugby and cricket groups, each in comparison with normative data. In contrast, the present analysis comprises *direct comparisons between the rugby and cricket, forward and backline groups, with respect to the percentage of individuals with objective cognitive deficit and self-reported postconcussive symptomatology*. On testing, rugby players revealed a significantly higher percentage of deficit relative to controls in visuo-perceptual tracking, speed of information processing and attention, and strong indications of impairment in verbal and/or visual memory. Results from the self-report questionnaire supported the objective test findings in that a significant proportion of rugby players (relative to controls) reported problems with sustained attention and memory, as well as lowered frustration tolerance, anxiety, and depression. It was noted that rugby forwards were the most susceptible to signs of cognitive deficit and postconcussive symptomatology, indicating that players who have the greatest exposure to repeated mild head injuries are at high risk of exhibiting signs of neuropsychological impairment. The specific *number* of individuals affected within groups is taken into account via the present analysis. This provides insights worthy of concern that are obscured in standard group mean comparisons.

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**P. COPPENS, S. HUNGERFORD, A. YAMADORI, & S. YAMAGUCHI. Crossed Aphasia: A Global Analysis.**

Crossed aphasia (CA) is defined as an acquired language disorder following right hemisphere damage in a right-hander. This disorder is rare but case studies have regularly appeared in the literature since 1877. It was first believed that all CA cases were nonfluent, but following more CA case descriptions, researchers realized that the CA symptomatology was not homogeneous. Recently, 2 major categories were recognized within the CA population: mirror-image and anomalous. One approach to the study of CA has been to apply strict exclusion criteria in the attempt to describe a few cases of “pure” CA. This approach rejects cases with a history of familial sinistrality or any of the possible idiosyncratic causative factors, such as early right-ear deafness, illiteracy, or bilingualism. Our preferred approach is to include as many CA cases as possible and to examine the possible symptomatology differences. The present analysis contains 162

cases including the cases published in Japanese, not previously available to English-speaking professionals. This extensive analysis yields valid results on the frequency of specific symptoms or characteristics (authors disagree on age and sex distribution in CA). It further allows for a comparison of subgroups within the CA population (e.g., whether mirror-image or anomalous CA patients present similar symptoms or whether the presence of familial sinistrality affects the symptom complex). Finally, a suggested battery of measures for CA cases is proposed.

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**A. ESPOSITO, F. FABBRO, C. COLSON, M. EL HAJJAJI, & G. DEMEURISSE. Dysexecutive Syndrome, Obsessive–Compulsive Disorders (Arithmomania), and Crossed Aphasia With Predominantly Subcortical Lesions.**

We report the case of a 78-year-old right-handed French-speaking woman, without history of left-handedness who, after a cerebrovascular accident involving the right caudate and putamen, the right subcortical white matter and parietal cortex, developed a polymorphic clinical picture characterized by (1) behavioral disorders including arithmomania as well as changes classically associated with frontal brain injury (social disinhibition, aggression, utilization behavior, perseverations of ideas and gestures); (2) dysexecutive cognitive disorders: disorders of organization and planning, lack of initiative; (3) language disorders: nonfluent aphasia with anomia, echolalias, perseverations, semantic paraphasias, normal repetition and moderate comprehension disorder; (4) left spatial unilateral neglect. The SPECT showed on the right side a hypoperfusion involving the parietal cortex and deep-seated structures including lenticular nucleus and caudate nucleus. In absence of frontal cortex injury, we considered that damage to the basal ganglia, especially the caudate was responsible for the occurrence of behavioral and cognitive dysexecutive disorders as well as for the occurrence of obsessive–compulsive disorders. The language disorders displayed by our patient were consistent with a crossed subcortical aphasia giving evidence of an anomalous lateralization of language.

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**M. OTSUKI, Y. SOMA, O. IIZUKA, K. NAGANO, H. MORIWAKI, K. NAGATSUKA, & H. NARITOMI. Clinico–Anatomical Investigation of Pure Alexia Utilizing the Specificity of Japanese Characters.**

The syndrome of letter-by-letter reading (LBLR) is usually regarded equivalent to the classic pure alexia originally described by Dejerine. However, there still remains controversies regarding the relationship between the classic pure alexia and the syndrome of LBLR, since the patient reported by Dejerine was unable to read even a single letter. We studied the mechanism of pure alexia in 7 Japanese patients with pure alexia due to cerebral infarction utilizing the specificity of Japanese characters, Kana (phonograms) and Kanji (syllabograms). The patients underwent tasks of reading aloud and reading comprehension of single characters, words, and sentences respectively of Kana and Kanji. The results indicate that there are 2 types of alexia. One is the same as the classic pure alexia: the patients cannot read even a single character. The other is similar to the syndrome of LBLR: the patients could read each character but had the difficulty in reading words. In this type, the reading ability was not affected by the spatial arrangement of characters. This indicates that the reading disturbance is not attributable to primitive visual perception. The disturbance is also not attributable to spelling impairment for the following reasons. Each Kana character has only 1 unchangeable pronunciation, which accords to the name of each Kana. Therefore, Kana reading is automatically accomplished by using LBLR strategy without spelling knowledge. The patients showed no difference in reading difficulty between meaningful words and nonsense words. We speculate that the disturbance of the latter type alexia occurs at the level of converting plural characters simultaneously into phonemes.

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**R. STARRFELT, A. GADE, C. GERLACH, & H. UDESEN. A 2nd Case of the 3rd Alexia in Pure Form.**

We present a patient (J.M.) with severe alexia and agraphia in the absence of aphasia, and with intact reading and writing of numbers. J.M., a right-handed 18-year-old man, presented with alexia and agraphia after concussion. CT and MR were normal. J.M. is impaired in identifying, writing, and copying letters. His reading and writing of numbers are normal, as is his written arithmetic. Object naming is within normal range, and his copying and drawing of figures and objects are good. In a single letter identification task, J.M. was able to identify only 13/29 uppercase letters and 18/29 lowercase letters. He is almost completely unable to read words, and we have not observed any whole-word reading. Rather, J.M. uses a slow and laborious letter-by-letter strategy when trying to read words, including his own name, and misidentification of letters is frequent. His naming to oral spelling is good, as is his oral spelling of dictated words. In writing, letters are partly superimposed on each other, making the words virtually unreadable. There are no obvious spelling errors, but some letters are poorly formed. By contrast to his reading, J.M. was able to identify written numbers (1–7 digits) quickly and correctly. He is also able to write numbers and perform written calculations without difficulties. This pattern of performance closely resembles that described by Anderson, Damasio, & Damasio. Their patient, presumably the only one on record with this syndrome, had a lesion in Exner's area in the left premotor cortex.

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**S. MAJERUS, F. LEKEU, & M. VAN DER LINDEN. Deep Dysphasia in the Context of Primary Progressive Aphasia: A Cognitive Neuropsychological Case Study.**

Patient C.O. age 75, complained of increasing difficulties in lexical retrieval and in understanding conversations and written texts since 1994. A neuropsychological follow-up between 1994 and 1998 confirmed progressive worsening of oral naming and verbal fluency; nonverbal cognitive functions and daily activities remained preserved, suggesting a diagnosis of primary progressive aphasia. A language investigation performed between August, 1998 and March, 1999 revealed severe difficulties in repetition, characterized by a lexicality effect, with better repetition for words than for nonwords [2/44 vs. 28/44;  $\chi^2(1) = 34.19, p < .001$ ], and an effect of concreteness, with better repetition for concrete than abstract words [3/30 vs. 20/30;  $\chi^2(1) = 20.37, p < .001$ ]; 10% of errors were semantic paraphasias. This pattern of repetition performances is compatible with deep dysphasia. Additionally, we observed characteristics of deep dysgraphia, regularization errors in reading, difficulties in oral word comprehension, and a severely impaired verbal short-term memory, with a pointing span of 2 words. A detailed cognitive analysis further revealed (1) difficulties in phoneme identification and rhyme judgment tasks for orally presented words and nonwords; (2) difficulties in detecting grammatical class for orally presented words in a lexical decision task; (3) important difficulties in 2 oral and written naming tasks, containing images of nouns varying in word frequency and length, and images of concrete and abstract verbs; frequency and concreteness effects were significant. The repetition disorder is interpreted within a cognitive framework proposing 3 repetition pathways. Our results are compatible with impairments at the level of a nonlexical route, a lexical–nonsemantic route and a lexical–semantic route. Correspondence: *Steve Majerus, Neuropsychology Unit, University of Liège, Boulevard du Rectorat, 3 (B33), Liège 4000, Belgium.*

**G. LEAL, I. PAVÃO-MARTINS, & V. OLIVEIRA. Aphasia Following Dissection of the Left Carotid Artery.**

*Introduction:* Carotid dissection is responsible for strokes in young adults. The pathogenesis of cerebral infarction in that setting is multiple (hemodynamic, embolic, thrombotic) and different from other causes of stroke in adults. *Objectives:* To study the prevalence, the main features, and the outcome of aphasia following dissection of the left carotid artery. *Participants:* Thirty-seven patients examined in a hemodynamic laboratory, during the last 6 years, with the diagnosis of carotid dissection were reviewed and evaluated. Sixteen percent had no language disturbances, 43% were apha-

sic, 10% had dysarthria, and in 29% there was no data concerning language impairment in the acute stage. Among those with aphasia in the acute stage, the most common diagnosis was global (62.5%) followed by Broca (18.75%) and transcortical aphasia (12.5%). Fluent types of aphasia were rare (only 1 anomic aphasia). Assessment was made with the Lisbon Aphasia Battery. *Conclusions:* Although infrequent, aphasia is often severe in the acute stage of carotid dissection in young adults with stroke. A preliminary evaluation of the follow-up suggests that recovery may be more complete than in other types of ischemic stroke.

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**L. FARRAJOTA, M. GUERREIRO, E. BAETA, & I. PAVÃO-MARTINS. Long-Term Outcome of Alexia Without Agraphia: Memory, Reading, and Behavioral Impairment.**

The purpose of this study is to characterize the long-term outcome of patients with the syndrome of pure alexia due to left hemisphere stroke. We evaluated, at our Laboratory, during the last years, 34 patients with pure alexia (12 female and 22 male) with a mean age of 73 years, all assessed in the first 3 months. This follow-up study is taking place and includes language and memory assessment by the Lisbon Aphasia Battery; Weschler Memory Scale; California Verbal Learning Test. It also includes a questionnaire for evaluation of behavioral changes and daily living activities. Results will be presented and discussed.

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**K.I. TAYLOR, D. WENIGER, M. REGARD, & P. BRUGGER. Task Effects on Hemispheric Differences in Semantic Processing.**

Lexical decision tasks (LDTs) are often employed to study semantic processing in the left and right hemispheres (LH and RH, respectively). However, semantic decision tasks (SDTs) may be more suited to detect subtle hemispheric differences in semantic processing since they explicitly require the retrieval of semantic knowledge. We administered a unilateral LDT and SDT (category matching) to 20 healthy men to investigate the influence of task on sensitivity to semantic information. Both tasks employed the same target stimuli and exposure time (120 ms). “Go” stimuli were either closely or distantly semantically related as established by independent raters. “No-go” trials were word/nonword pairs (LDT) or 2 words from different categories (SDT). A repeated measures analysis of variance revealed the following main effects: more correct and faster responses to lexical decisions, closely associated word pairs and right visual field (RVF)/LH presentations than to semantic decisions, distantly associated word pairs and left visual field (LVF)/RH presentations, respectively. Separate analyses of reaction times for each task revealed a single main effect of visual field for the LDT and a single main effect of semantic distance for the SDT. *Post-hoc* tests indicated that semantic distance only affected LVF/RH RTs in the LDT but affected both LVF/RH and RVF/LH RTs in the SDT. These results suggest that task demands influence hemispheric patterns of semantic processing and that SDTs are better suited than LDTs to measure semantic processing in the cerebral hemispheres.

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**E. BAETA, A. JERÓNIMO, & V. ARAÚJO. Category Fluency: Age, Gender, and Education Effects.**

*Background:* Speech fluency tasks are simple, brief tests used to disclose cerebral dysfunction. Several reports showed that younger and educated people have better performance. *Objective:* Evaluate the performance, on 2 category-specific tasks, in a healthy Portuguese population. *Population:* One hundred volunteers (61 F:39 M), without neurologic diseases ages between 15 and 45 years (*M* age 30.110 ± 9.176) and mean education of 11.880 ± 4.066. *Methods:* Each time they were asked to name as many as possible words of each category (food articles and animals), as they could, in 1 min. *Results:* Results correlated in both categories with age and edu-

cation. Older people and those with more years of schooling produced more food articles (age:  $p = .013$ ; schooling:  $p = .000$ ) and more animal names (age:  $p = .017$ ; schooling:  $p = .005$ ). Comparing subclasses, significance is obtained in the following: *spices* (age:  $p = .048$ ), *vegetables* (age:  $p = .016$ ), *fish* (schooling:  $p = .015$ ), *mammals* (age:  $p = .007$ ). Gender interacted with food article naming: women tended to name more farinaceous foods ( $p = .007$ ) and sweets ( $p = .012$ ). *Conclusions:* Our results show that age, gender, and education are important factors when interpreting results on semantic speech fluency. More literate people produce more fluently names of a certain semantic category. Females prefer to name certain kind of food articles. Compared with other studies, our population is younger. This can explain a different result in terms of age influence.

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**P. MARIËN, B.A. PICKUT, S. ENGELBORGHES, & P.P. DE DEYN. Phonological Agraphia Following a Focal Anterior Insular Infarction.**

Following a unique infarction restricted to the left anterior insula and the adjacent part of the intrasylvian frontal opercular cortex, an 83-year-old right-handed patient developed a severe oral output disorder that rapidly evolved from an apraxia of speech to mere mutism. After rapid and nearly complete recovery of the expressive language symptoms, an isolated phonological agraphia characterized the aphasic profile. Three months after the onset of neurological symptoms this highly selective disturbance of the spelling system had completely receded and a discrete phonological alexia associated with slightly disturbed nonword repetition (phonological agraphia) became apparent. The anatomoclinical findings in this first representative of pure and nearly isolated phonological agraphia with a subsequent word-class-specific repetition and reading disorder complement previous neuroanatomical and neurolinguistic accounts of phonological agraphia and alexia. The anatomoclinical data obtained from this patient not only seem to enrich current insights in the anatomical locus for both phonological written language syndromes; they also seem to contribute to a further delineation of the insular role in phonologically mediated aphasic manifestations.

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**T. CLAES, P. FERY, & A. CONTENT. Can Surface Dyslexia and Surface Dysgraphia Cooccur Without Orthographic Representations Impairment?**

Although many models of reading and spelling suppose the existence of an orthographic input lexicon and an orthographic output lexicon, some authors have argued that a single orthographic system might subserve visual word recognition and production. We report the study of an anomic patient (C.L.) with acquired surface dyslexia and dysgraphia, who shows a striking dissociation between recognition and spelling. Comparison of oral reading and spelling performance revealed high intramodality but low intermodality consistency. C.L. showed no semantic impairment with spoken and written words. Orthographic lexical decision was normal and C.L. was able to provide appropriate definitions for printed homophonic words, although his spelling of the same homophonic words was severely impaired. When presented with his own misspellings and correctly spelled words in a lexical decision task, C.L. scored at chance level for his misspellings, but was able to select the correct spelling with nearly perfect accuracy in a spelling preference forced-choice task. We argue that these results support the existence of 2 separate orthographic lexicons.

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**A. FACOETTI, M.L. LORUSSO, & M. TURATTO. Visual Attention in Developmental Dyslexia: Orienting and Focusing.**

The present study looked at visual-spatial attention in dyslexic and normally reading children. The performances of the two groups were investigated using two different paradigms. In Experiment 1 we analyzed the distribution of processing resources both inside and outside the focus of visual attention by simply recording reaction times in the detection of a

white dot target projected at different eccentricities from the fovea. The 2 groups of children differed significantly in the distribution of their attentional resources. The eccentricity of the stimulus was significant only in normally reading children—who showed a normal gradient—as it influenced their detection speed, whereas no effect was found in dyslexic children, who exhibited a diffused distribution of visual processing resources inside the visual field. In Experiment 2 we studied orienting of visual attention. Shifting of attention by peripheral cues was studied by means of the covert orienting paradigm. Results showed that dyslexics had a specific disability in the shifting of attention caused by a peripheral cue. Our results support the suggestion that visual selective attention deficits in disabled readers may be due to a specific difficulty in orienting and focusing of visual attention. Consistently with the Magnocellular theory of dyslexia, a slow or altered processing of object location (due to a deficit in the transient pathway) might hamper selective visual attention, interfering with the process of spatial focusing and thus with rapid and correct decoding of a written text.

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**V. MATECHA, P. KULISTAK, M. KUBICEK. Triumfov and Luria in the '40s Static and Dynamic Model of Clinical Neurosciences.**

Two clinical neuroscientists were practicing in the Soviet Union in the early '30s and '40s. A.V. Triumfov, neurologist, represented a static localization concept, and A.R. Luria, one of the promoters of neuropsychology, representing a modern functional dynamic trend. The static concept has been taught here within a framework of neurology without any substantial changes until now, although it is known that it is of no general validity. From the aspect of a theory of neuronal networks, the model by Luria—the model of three basic cooperating systems in both healthy and ill individuals—the anterior, posterior, and deep system—seems to be right. Using the very simplified concept, we elaborated a working project to be used in the practice of neuropsychological rehabilitation—cognitive-motoric-vegetative model, to be applied in TBI in particular. A cognitive component is represented by the frontal part of the frontal lobe, which determines a strategy of behavior, the middle premotoric part, determining a tactics and transformation of the given type of behavior, including movements, and the posterior frontal part, which is engaged in movement execution. The sensorimotor component is situated in the posterior parietal cortex. The vegetative component is the oldest with respect to evolution, it is situated in archicortex of the temporal lobes. It is of special importance in the form of hippocampo-frontal formation in basic cognitive processes of attention and memory.

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**R. PUEYO, M.M. MATARIN, E. SORO, C. BASIL, & P. VENDRELL. Receptive Language in Severe Cerebral Palsy.**

In cerebral palsy, several patients did not achieve sufficient oral production to use this communicative way. Bishop et al. found that in a group of young cerebral palsy patients the presence of dysarthria or anarthria influenced receptive vocabulary. The aim of this investigation is to study several compounds of receptive language in a sample of quadriplegic patients with cerebral palsy. The sample was composed of 21 participants (14 male, 7 female) aged between 6 and 38 years. The Peabody Picture Vocabulary Test-Revised (PPVT-R) was selected for assessment of receptive vocabulary. The Screening Test of Spanish Grammar (STSG) and the short version of the Token Test (TT) were used to detect receptive grammatical deficits. The latter is especially sensitive to subtle language comprehension deficits. Raven's Colored Progressive Matrices (CPM) served as a measure of general cognitive abilities. Nine patients with oral speech were compared with 13 patients without oral speech. The subgroups were similar in age ( $U = 48.5, p = .36$ ), and general cognitive functions ( $U = 37.5, p = .24$ ). We did not find significant differences in any receptive language test (PPVT-R:  $U = 55, p = .82$ ; STSG:  $U = 52.5, p = .69$ ; TT:  $U = 57, p = .92$ ). We found significant intercorrelations be-

tween language tests that ranged from .61 to .81 and also with Raven's CPM test. In summary we were unable to find effects of the absence of oral language on language comprehension neither for vocabulary nor for grammar. The degree of language evolution seems to be more related to global cognitive deficit than articulatory ability.

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#### **K.R. LAWS. Gender Differences in the Category-Specific Naming Performance of Normal Subjects: Implications for Familiarity.**

A Gender  $\times$  Category interaction for picture naming has been reported in studies of Alzheimer's patients and normal controls, with men showing better naming of nonliving things and women better naming of living things. Such findings have important implications for understanding how individual differences in familiarity might contribute to category effects. Voice-onset response times (RT) were recorded from normal male ( $N = 16$ ) and female ( $N = 16$ ) participants when naming line drawings (32 living and 32 nonliving items matched across category for concept familiarity, visual complexity, and name frequency). A robust Gender  $\times$  Category interaction occurred across both participants and items [ $F(1,30) = 8.2$ ;  $F(1,62) = 6.5$ , respectively;  $ps < .01$ ]. Men were faster than women to name nonliving things [ $t(30) = -2.0$ ,  $p = .05$ ]; there was a trend for women to name living things faster than men [ $t(30) = 1.6$ ,  $p = .12$ ]; finally, women were faster to name living than nonliving things [ $t(15) = 3.3$ ,  $p = .005$ ]. No other effects were significant across both subject and item. To examine the influence of familiarity, ratings for familiarity with "item appearance" were obtained from 20 men and 20 women. This revealed higher ratings by women than men [ $F(1,62) = 94.0$ ,  $p < .001$ ], but no category effect or Gender  $\times$  Category interaction (both  $F_s < 1$ ). Like previous studies, there was a Gender  $\times$  Category interaction; however, gender-related familiarity differences failed to map onto gender-related error differences. These results suggest that current modes for measuring familiarity either fail to tap individual differences or that the role of familiarity in category effects may have been overemphasized.

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#### **M. NUNES, M. GUERREIRO, A. REIS, I. PAVÃO-MARTINS. Naming and Literacy: The Influence of Age.**

*Introduction:* It is well known that functional illiteracy is associated with specific difficulties in naming bidimensional representation of objects. However, it is not known if this is due to a lack of environmental exposure or the nondevelopment of a written language system. *Method:* We evaluated 99 healthy individuals with the complete Snodgrass and Vanderwant battery of 260 line drawings and selected the 128 images that elicited a response agreement  $>90\%$ . *Results:* There were 31 men and 68 women whose age ranged from 40 to 72 years; participants were divided into 3 groups of education: 0–4 years of school (33%), 5 to 11 years (34%), and more than 11 years (32%) of school. The scores obtained in the Snodgrass test varied according to the age and education of participants but not with sex. Older individuals with lower degree of education had significantly lower scores than those with high levels of education. This difference was not significant in younger age groups. The results suggest that the environmental exposure is probably more relevant for the treatment of visuospatial information than the acquisition of a written language code.

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#### **K.R. LAWS. A Nonliving-Thing-Naming Difficulty in Normal Subjects: A Domain-Specific Evolutionary Explanation.**

Some accounts of category-specific disorders for living things highlight the fact that they have lower name frequency, lower concept familiarity, and greater visual complexity than nonliving things. This implies that deficits for living things are an exaggeration of the normal tendency. How-

ever, the performance of normal controls on artifact-matched sets of items remains unexamined. Thirty-nine normal participants were asked to name line drawings of 25 living and 25 nonliving things that were matched across category for concept familiarity, name frequency, and visual complexity. A speeded presentation (20 ms) paradigm was used to degrade input in a manner that might be considered analogous to a degradation of input to structural descriptions and so, encourage errors. Analysis across participants and items revealed significantly worse naming of nonliving items [29 vs. 1.1:  $F(1,38) = 43.1$ ,  $p < .0001$ ; 7.6 vs. 2.8:  $F(1,48) = 4.0$ ,  $p < .05$ ]. Indeed, 38/39 made more nonliving than living thing errors. Contrary to expectation, normals showed worse nonliving naming. A credible explanation stems from the domain-specific evolutionary view of category-specific disorders. This speculates that specialized neural systems have evolved only for the processing of animate things and plants. These are more likely to be localized and therefore damaged. Conversely, living things might be afforded some processing advantage in the normal brain. This would explain both the greater incidence of living thing deficits in patients and the better performance of normal participants with living things.

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#### **P. COPPENS, S. HUNGERFORD, & P. NICHOLAS. A Case of Acquired Stuttering: Neurogenic, Psychogenic, or Malingering?**

Acquired stuttering has been associated with stroke, traumatic brain injury, and progressive neurological disorders including extrapyramidal disorders and AIDS. A few cases have been linked to adverse drug reactions, or to psychological trauma (conversion disorder). We describe the case of a woman who started displaying very disfluent speech at the age of 29. She displayed multiple repetitions of 80% of syllables spoken. She has a complicated history of possible causal factors including: head injury, possible natural gas poisoning, use of psychiatric medications, life stress, and mental disorders including depression. Differentiating between psychogenic origins, neurogenic origins, and malingering was further complicated by potential litigation. We describe this patient's acquired disfluencies quantitatively, as well as their phonemic, lexical, and syntactic topography. Results of attempts to influence the disfluencies with delayed auditory feedback, masked speech, singing, and other methods will be reported. We describe the differential diagnosis process regarding this case, and in reference to previous cases presented in the literature. In addition, we report how specific stuttering therapy influenced the symptomatology.

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#### **M. MATARÓ, M. ARIZA, D. ESCUDERO, J. SANCHEZ, J.M. MERCADER, & C. JUNQUÉ. Ventricular Volume and Cognitive Dysfunction in Primary Sjögren's Syndrome.**

Sjögren syndrome is an autoimmune disease associated with psychiatric manifestations (depression and anxiety) and subtle cognitive impairment. Resonance magnetic (RM) frequently shows hyperintensities on T2 weighted images. Neuropsychologically, patients show memory, attention as well as cognitive slowness. The purpose of our study is to relate MRI findings with cognitive deficits. We assessed a sample of 14 female patients with Sjögren syndrome and 15 matched control females with headache. Neuropsychological test included Rey's auditory verbal learning test and memory of Rey's complex figure. Visuospatial function was assessed by Benton's Line Orientation. Reaction time, attention, and mental processing speed were examined by the Continuous Performance Test (CPT). For prefrontal functions we selected verbal fluency, Stroop Test, and Wisconsin Card Sorting Test. Magnetic resonance study was performed in a 1.5 T Sign General Electric, and consisted of a 3D acquisition with a spin-echo of two echoes sequence, and a T2 (spoiled grass) sequence. We obtained volumetric measures of ventricular system and total brain volume using the program ANALYZE AVW 1.0 running on a Sun station. Patients differed from controls in the volume of ventricular system ( $M = 23959 \pm 10560$  for patients,  $12546 \pm 6164$  for controls,  $U = 25.0$ ,  $p = .0005$ ). Patients differed from controls in depression ( $p = .001$ ), anxiety ( $p = .008$ ), fatigue ( $p = .000$ ), and reaction time in the CPT test ( $p = .041$ ). Regres-

sion analysis showed significance for the CPT omissions variable (multiple  $R = .82, p = .000$ ). Our findings provide further evidence for the central nervous dysfunction in Sjögren disease.

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**M.A. JURADO, M. PEREZ, C. JUNQUÉ, P. SALGADO, J. VALLEJO, & J. GRAFMAN. Temporal Ordering Performance in Obsessive-Compulsive Disorder (OCD) Patients.**

*Introduction:* Neuropsychological study of OCD patients provided some evidence of prefrontal dysfunction, but temporal ordering has not been explored. *Methods:* Twenty-eight patients with OCD and 28 normal controls matched for sex, age, and years of education were administered a temporal ordering task that has been found impaired in prefrontal lobe damage patients. The temporal ordering task consisted of word lists that had high, medium, or no semantic interrelation. Participants had to reproduce the sequential order of the previously presented list. Time expended in the task was registered. The temporal order variable was the sum of the distance between the actual position of the word in the list and the estimated position. *Results:* A two-way ANOVA (Group  $\times$  List) with repeated measures was carried out to compare temporal ordering performance across the three lists. The main effect of group was statistically significant [ $F(1,54) = 5.08, p = .028$ ] and indicated poor achievement in OCD patients. We also found a significant between-list effect [ $F(2,108) = 42.33, p = .000$ ] but the Group  $\times$  List interaction was not significant [ $F(2,108) = 0.82, p = .441$ ]. Controls as well as patients were most successful in sequentially ordering words from the most semantically interrelated list. A similar analysis was performed to compare time required to complete the task but no differences between groups were found. *Conclusions:* OCD patients showed poor performance in a temporal ordering task subserved by prefrontal cortex but poor accuracy was not caused by slowness.

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**M.M. SITSKOORN, D.R. VAN RIJ, N.J.A. VAN DER WEE, & R.S. KAHN. Dissociable Levels of Inhibitory Control Between Patients With Schizophrenia and OCD?**

*Background:* Prefrontal cortex dysfunction might result in different forms of perseveration. It is suggested that these different forms result from loss of dissociable levels of inhibitory control due to dysfunction of distinct neurochemical processes and anatomically regions within the prefrontal cortex. Animal neuromodulation studies support this hypothesis. Whereas loss of inhibitory control at the level of a cognitive set (i.e., set-shifting) has shown to be sensitive to disruption of the dopaminergic but not the cholinergic innervation of the prefrontal cortex, the reverse has been demonstrated for loss of inhibitory control at the level of stimulus-response associations (i.e., reversal learning). Furthermore, although animal reversal learning has been associated with the orbitofrontal cortex (OFC), shifting between sets has primarily been associated with the dorsolateral-prefrontal cortex (DLPFC). On the basis of presumed DLPFC and dopaminergic dysfunction in schizophrenia and OFC and cholinergic dysfunction in OCD, a dissociation between the 2 levels of inhibitory control is hypothesized. *Method:* Thirteen schizophrenic- and 25 matched OCD patients, all medication naïve, participated in this study. One task requiring inhibition at the level of stimulus-response associations (alternation task), and 1 requiring inhibition of a previously used cognitive set (WCST), were administered. *Results:* Groups differed significantly in inhibition at the level of stimulus-response associations (OCD more impaired than schizophrenia;  $p < .001$ ), but not at the level of a cognitive set. *Conclusion:* Our findings do not support the hypothesis of dissociable levels of inhibitory control between schizophrenia and OCD patients. Instead, a selective disturbance in inhibition at the level of stimulus-response associations was found in OCD patients.

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**A. ALEMAN, K.B.E. BÖCKER, R. HIJMAN, R.S. KAHN, E.H.F. DE HAAN. Modality-Specific Vividness of Mental Imagery in a Hallucinating Patient With Schizophrenia.**

It has been hypothesized that hallucinations may be associated with vivid mental imagery. In a cognitive neuropsychological case-study design, we studied a 41-year-old patient (Mr. A.) with schizophrenia who experienced ongoing auditory-verbal hallucinations. Performance was measured on 6 behavioral tasks of imagery and perception (3 visual and 3 auditory; matched for difficulty) and compared with the performance of 5 age-matched patients without hallucinations. Performance on imagery conditions was compared relative to performance on the perception condition of each task. Mr. A. showed substantial higher imagery scores on all 3 auditory tasks, compared to the 3 visual tasks. In contrast, none of the 5 matched controls revealed performance differences between the 2 modalities. The results support the hypothesis of a relative increase in vividness of mental imagery specific to the modality of hallucination in hallucinating patients with schizophrenia.

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**T. KONDEL, A. MORTIMER, & S. HIRSCH. Is There Really an Amnesic Syndrome in Schizophrenia?**

It is well documented that schizophrenic patients exhibit memory difficulties. Recent studies have claimed that the pattern of memory deficit in schizophrenia resembles the classic amnesic syndrome, and that this memory impairment is disproportionate to any generalized intellectual impairment. We examined memory performance in 91 schizophrenic patients (DSM-III-R criteria) on the Rivermead Behavioural Memory Test, along with measures of estimated premorbid and current IQ (NART and Quick Test) and the Mini-Mental State Examination. The RBMT revealed strong evidence of memory impairment (over 55% had severe-to-moderate memory impairment and only 5% had normal memory). However, contrary to previous studies, we found that the memory impairment was significantly related to IQ impairment (NART IQ-Quick IQ:  $r = -.38, p < .0001$ ) and MMSE scores ( $r = .67, p < .0001$ ). When patients were classified by RBMT scores, ANOVAs revealed significant differences in IQ decline and MMSE scores between those with *severe, moderate, poor, and normal* memory. Finally, classification of patients as *normal, moderately, or severely demented* on the basis of their MMSE scores, also revealed significant memory differences between these groups. Although these groups differed in age ( $M_s = 36, 55, 67, \text{ and } 68$ , respectively), covarying for age had no effect. All of the findings reported here were, therefore, independent of patient age. Thus, when schizophrenics are memory impaired they invariably show intellectual impairment. We found that any memory deficit in schizophrenia is a consequence of a general intellectual deficit and the disorder is therefore, not characterized by an amnesic syndrome.

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**M. ALEGRET, P. VENDRELL, F. VALLDEORIOLA & E. TOLOSA. Visuospatial Deficits in Parkinson's Disease: A Qualitative Analysis of Benton's Line Orientation Test.**

The Benton's Line Orientation judgment is one of the tests most frequently used to assess visuospatial function. The purpose of the present work is to study qualitative errors in Parkinson's disease (PD) following the method described by Ska et al. Previous results using Benton's Line Orientation are contradictory in respect to visuospatial impairment in PD. This is probably due to the small size of the sample assessed. We administered the Line Orientation test to 55 PD patients and 32 normal controls, matched by age, sex, and education. Because of the statistical significance of standard deviations we selected nonparametrical tests. Mann-Whitney comparisons were used. Patients significantly differed from controls in the total number of errors ( $z = -2.43, p = .015$ ). After the analyses of errors we found several qualitative differences between groups. Parkinsonian patients showed a greater proportion of errors in the horizontal line ( $z =$

$-2.98, p = .003$ ), vertical line ( $z = -3.21, p = .001$ ), complex intraquadrant ( $z = -4.41, p = .000$ ), and interquadrant oblique ( $z = -2.28, p = .023$ ). By contrast, PD patients showed fewer simple intraquadrant errors than controls ( $z = -2.10, p = .035$ ). These data indicate that PD is associated with a noticeable visuospatial impairment in both quantitative and qualitative points of view. Patients performed errors involving an incorrect identification of both oblique lines without maintaining the initial spacing, of 1 horizontal or vertical line and a displacement of 1 line from 1 quadrant to the other quadrant. Normal participants tend to confuse subsequent lines within the same quadrant. These data provide further evidence for the existence of visuospatial deficits in PD.

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#### **K.R. CHOUDHRY & A.J. SAINT-CYR. Free Recall and Category Fluency in Parkinson's Disease: Evidence for Negative Priming Effects.**

Script generation was investigated in individuals with Parkinson's disease (PD) and in normal controls (NC), using familiar activities of daily life. Five different activities ranging in degree of familiarity were studied. Twenty-two medically treated, early stage PD patients, matched for age, IQ, and education with controls were assessed on free recall and category fluency in all 5 activities. Individuals with PD were unimpaired in generating events necessary for these 5 activities. PD patients did not differ from NC in the number of actions evoked and mean evocation time. However, impairment was observed in the PD patients when they were asked to generate words for each activity. Familiarity of the category did not account for this deficit. These findings suggest that PD patients experience negative priming effects in category fluency.

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#### **H. SMEDING, N. STARK, & B. SCHMAND. Is Recognition of Facial Affect Impaired in Parkinson's Disease?**

Recent studies have shown that subcortical structures are involved in the recognition of emotion. Patients with lesions of the amygdala have difficulties in recognizing fear. Patients with Huntington's disease are impaired in the recognition of disgust. In patients with Parkinson's disease (PD), another condition of the basal ganglia, contradictory results have been found. In the present study we compared the performance of nondemented patients with PD ( $N = 15$ ) and healthy controls ( $N = 9$ ) on two computer tasks of facial affect. In the 1st task participants had to identify whether or not faces expressed one of 6 basic emotions (happiness, sadness, anger, fear, disgust, and surprise). In the second task participants had to judge whether or not two faces expressed the same emotion. These tasks are comparable to tasks used by Ekman and Friesen. We found that PD patients were impaired in the matching of emotions on 2 faces. There was no significant difference between patients and controls in the identification of a single emotion, although PD patients scored overall somewhat lower than controls. Although also on tasks of executive functioning PD patients scored lower than controls, the impairment in matching of emotions could not be explained by impairments in executive or visuospatial functioning nor by mental slowness. There was no relation with disease severity as measured by the Hoehn and Yahr score nor with depression. We conclude that PD patients show a subtle impairment of facial affect recognition.

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#### **J. LEMIERE, E. VANDENBUSSCHE, M. DECRUYENAERE, G. EVERS-KIEBOOMS, D. VAN GOOL, & R. DOM. Neurological and Cognitive Follow-Up of Patients With Huntington's Disease and Asymptomatic Gene Carriers.**

*Aim:* Extensive research has focused on neuropsychological deficits in patients with Huntington's disease (HD). However, little is known about the

deterioration of these symptoms. A longitudinal study of HD patients and asymptomatic gene carriers (ASG) was conducted to evaluate neurological and neuropsychological functioning. *Methods:* The study sample consists of HD patients ( $N = 15$ ), asymptomatic gene carriers ( $N = 11$ ), and noncarriers (ASNG,  $N = 10$ ). Age, premorbid IQ, and gender were not statistically different at Time 1. These groups are evaluated by means of the Unified Huntington's disease rating scale (UHDRS, motor part) and a broad set of neuropsychological tests. This study is a 1-year follow-up study. *Results:* The total score on the UHDRS is statistically different at Time 1 and 2 (ANOVA,  $p = .001$ ). A Time  $\times$  Group effect is present (ANOVA, repeated analysis,  $p = .01$ ). A group effect is found for the major part of neuropsychological tests at Time 1 and Time 2 (ANOVA,  $p = .05$ ). There is only one significant difference between ASG and ASNG at Time 1 and 2 significant differences at Time 2 (ANOVA,  $p = .05$ ). A Time  $\times$  Group effect is found for these 2 tests (ANOVA, repeated analysis,  $p = .05$ ). *Conclusions:* A 1-year follow-up of HD patients, ASG, and ASNG revealed a significant increase of motor symptoms in the HD group. Our results suggest that minor cognitive problems and changes in ASG are present.

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#### **M. DRAKE, R. ALLEGRI, P. HARRIS, & A. CARRÁ. Pattern of Memory Impairment in Multiple Sclerosis.**

*Background:* The presence of cognitive impairment during the course of Multiple Sclerosis (MS) has been recognized since Charcot's description in 1868, but the profile of memory impairment has been described only recently. A retrieval failure has often been reported as the primary cause for the long-term episodic memory deficits. *Objectives:* to investigate memory deficits in MS patients, analyzing the particular pattern of performance on episodic memory tasks. *Material and methods:* Twenty-five patients with MS, and 25 normal participants matched for age and educational level were evaluated. As part of a wider neuropsychological evaluation, the episodic memory assessment consisted of a modified version of Signoret's protocol (logic memory—immediate and delayed, serial learning of a list of 12 words, delayed free recall of the list, semantic cued recall, recognition trial and digit span forward and backward). As measures of semantic memory we used the Boston naming test and a task of verbal fluency. Patients were classified by disease type as relapsing-remitting, secondary progressive or primary progressive. *Results:* MS patients exhibited worse performance in serial learning and serial recall tasks than controls. In the recognition trial, as well as in tests of semantic memory, both groups showed similar results. *Conclusions:* MS patients were found to be significantly impaired in almost all tests of episodic memory. Although the classical subcortical pattern is found (impaired performance on delayed free recall with normal performance on recognition trial) our findings suggest a more inclusive pattern of memory deficits in MS than had been previously described.

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#### **A. SCHLOSSER & JC. SANZ DE LA TORRE. Neuropsychological Assessment of Multiple Sclerosis.**

The neuropsychological assessment of patients with multiple sclerosis (MS) may be diagnostically useful to provide a cognitive profile of the patient, to observe the spread of the deficit, and to identify the peculiar areas that are more or less affected, in order to plan a long-term management and treatment. In this article, we present 3 cases of cognitive dysfunction associated with MS. Two patients were assessed in a Norwegian neurology department and 1 patient in a Spanish psychiatric hospital. The Norwegian patients were a 45-year-old woman and a 41-year-old man who experienced difficulties at their work. Recent magnetic resonance imaging (MR) showed extensive changes indicating demyelination. The Spanish patient was a 54-year-old woman, who was diagnosed 6 years ago. MR showed many lacunar infarcts in the periventricular region with left predominance, and in the protuberance with signs of corticosubcortical atrophy. We performed neuropsychological assessment of the main cognitive areas: orientation, attention, memory, general intelligence functioning, lan-



guage, arithmetic, visual–spatial functioning, motor, executive functioning, and personality. The Norwegian patients also received a validity test. The results obtained point out serious alterations in the information processing speed, learning and long term memory, motor, executive functioning and personality. These results go in a concordant way with the results reported in the consulted bibliography. The resemblance of the cognitive deficit related to a pattern of subcortical dementia is noted as well. Finally, we emphasize the importance of the transcultural point of view in these kind of studies.

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**V.F. MAUTNER, S.D. THAKKAR, L. KLUWE, & R.A. LEARK. Treatment of Attention Deficit Hyperactive Disorder in Neurofibromatosis Type 1.**

This study examined 129 consecutive patients (93 children, 36 adults) referred for evaluation of neurofibromatosis, type 1 (NF1). All of these patients were diagnosed with NF1 according to the NIH criteria. Of these 129 patients, 49.5% (46) of the 93 children and 36.1% (13) of the adults were also diagnosed with Attention Deficit Hyperactive Disorder (ADHD) meeting the criteria as described by DSM–IV. Of those 59 patients diagnosed with ADHD, 27 gave informed consent to be included in our study. A neurologist made the diagnosis of ADHD, in addition the diagnosis was confirmed by use of a questionnaire based upon the DSM–IV criteria. All patients were administered (1) a measure of sustained attention, a continuous performance test, the Test of Variables of Attention (TOVA), and (2) a measure of intelligence (HAWI–K). Participants were divided into 2 groups, dependent upon IQ score (less than 85 and 86 upward). Then, patients were administered methylphenidate in 2.5 mg dosage increments. Paired *t* tests demonstrated significant pretest to posttest differences dependent upon methylphenidate dose for variables of the TOVA. The study suggests that methylphenidate may be an effective treatment aid for NF1 patients who demonstrate problems with attention. Discussion of relationship to social and cognitive changes is given.

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**M.J.E. VAN ZANDVOORT, A. ALEMAN, L.J. KAPPELLE, & E.H.F. DE HAAN. Cognitive Functioning Before and After a Lacunar Infarct.**

The outcome of a lacunar infarct is thought to be relatively good compared to other types of stroke. However, subtle but distinct disturbances in cognitive functioning and an inability to regain the premorbid level of functioning have been reported for these patients. The lack of information on the premorbid level of cognitive functioning is often a problem in interpreting subtle findings at poststroke neuropsychological examination. In this case study we had the unique opportunity to examine a 73-year-old man before and after he suffered from a single lacunar stroke in the right corona radiata. Distinct impairments in cognitive functioning on the most demanding tasks could be documented (WAIS Block Design, Trailmaking task, Verbal Fluency, EAT Visual Elevator). These types of demanding tasks resemble daily life activities which rarely involve just 1 single cognitive ability at a time. Therefore, the data documented in this unique case suggest the possibility that the incapability to regain a premorbid level of functioning after a lacunar infarct in spite of good physical recovery could be related to subtle changes in cognitive functioning.

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**V. MICHIELS, V. DE GUCHT, R. CLUYDTS, & B. FISCHLER. Attention in Chronic Fatigue Syndrome: Evidence for Deficits?**

*Objective:* In this study we evaluate specific aspects of attention in patients with chronic fatigue syndrome (CFS): (1) Is there evidence for an impaired phasic arousal modification in patients with CFS as compared to healthy controls? (2) Do patients with CFS show slowed information processing independent of motor speed as compared to controls? *Participants:* Twenty-nine outpatients with CFS and 22 healthy controls matched for age, sex, intelligence, and education were included in this study. CFS

patients met the Oxford CDC criteria as well as the International CFS Study Group criteria for CFS. *Results:* Modification of phasic arousal level was measured using a simple reaction time paradigm with varied preparatory interval (PI) duration. Patients with CFS were significantly slower than healthy controls on the three PI trials (1 s, 2 s, and 3 s). But no significant interaction between Group  $\times$  PI Duration was found [ $F(2,96) = 0.08, p = .92$ ]. For Sternberg's memory scanning task a significant group effect (overall response speed) and Group  $\times$  Set Size interaction effect (slope) was found at  $p < .0001$  [ $F(1,44) = 24.55$ ] and  $p < .001$  [ $F(3,132) = 7.65$ ], respectively. The CFS group had a mean slope of 109 ms/probe, which was 73% slower than that of the healthy controls (63 ms/probe). *Conclusion:* CFS patients do not simply experience difficulty in all aspects of attention. They are able to modify their phasic arousal level as needed to the same extent as the healthy controls, in this experiment. Patients with CFS have a slowness in cognitive processing independent of motor involvement.

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**Symposium 1/9:00–10:45 a.m.**

**FUNCTIONAL TRANSCRANIAL DOPPLER ULTRASONOGRAPHY IN NEUROPSYCHOLOGICAL RESEARCH: LIMITATIONS AND POSSIBILITIES**

**Organizer and Chair: Guy Vingerhoets**

**G. VINGERHOETS. Functional Transcranial Doppler Ultrasonography in Neuropsychological Research: Limits and Possibilities.**

High temporal resolution of cerebral circulatory dynamics was introduced by transcranial Doppler ultrasonography (TCD) in 1982. TCD is a noninvasive diagnostic tool to assess the hemodynamic characteristics of the major cerebral arteries in normal and pathological conditions. The first study that described intracerebral hemodynamic changes during different cognitive tasks and thus introduced functional TCD was published in 1989. It was not until 1992 that simultaneous bilateral TCD measurements were made technically possible and the first study using this technique was published in 1994. By now approximately 30 fTCD studies have been published, almost exclusively by European researchers. The aim of this symposium is to present this relatively new technique to an international forum of neuropsychologists, and to critically evaluate the limits and possibilities of its measurements in basic and clinical neuropsychological research. The 1st speaker will introduce the underlying technology, describe the methods ofinsonation, illustrate the specific signals of different cerebral arteries, and provide some data on blood flow velocity values. The 2nd speaker will critically review the reliability and methodological caveats of fTCD in experimental and clinical context. The 3rd speaker will focus on the cognitive paradigms used in fTCD and illustrate this with recent experimental data. The last 2 speakers will illustrate some clinical applications of fTCD. The 4th speaker will discuss the technique and validity of language lateralization by fTCD. The 5th speaker will describe the use of fTCD in cognitive rehabilitation.

Correspondence: *Guy Vingerhoets, Department of Psychiatry and Neuropsychology, University Ghent, De Pintelaan 185/4K3, B-9000 Ghent, Belgium.*

**M. DEPPE & E. RINGELSTEIN. From TCD to fTCD.**

Transcranial Doppler ultrasonography (TCD) is a totally noninvasive, well established, and easily applicable technique for the measurement of the cerebral blood flow velocities (CBFV) of the basal arteries. The technique has an excellent temporal resolution and provides continuous information about cerebral perfusion changes. The assessment of CBFV modulations associated with functional cortical activation by TCD has been designated as functional TCD (fTCD). fTCD has become an important complementary technique to functional imaging techniques like positron emission to-

mography (PET) and functional magnetic resonance imaging (fMRI). Beginning with the traditional employment of TCD for the diagnosis of cerebral artery stenoses the presentation will lead to the analysis techniques for the assessment of hemispheric language dominance by fTCD. Correspondence: *Michael Deppe, Department of Neurology, University of Münster, Albert-Schweitzer-Str. 33, D-48129, Münster, Germany.*

**G. VINGERHOETS & N. STROOBANT. Reliability and Methodological Caveats of Functional Transcranial Doppler Ultrasonography.**

The examination of blood flow velocity (BFV) changes in the basal cerebral arteries during the performance of cognitive tasks is a relatively new application of transcranial Doppler ultrasonography (TCD). This inexpensive and noninvasive method claims to provide insight into the cerebral organization and lateralization by interpreting asymmetric changes in BFV induced by specific cognitive tasks. The ground for the assumption of a relationship between mental activity and blood flow velocity is critically reviewed. Both practical and scientific advantages and disadvantages of fTCD are considered. The reliability of the method is still unsatisfactorily demonstrated and appears task-dependent. Special attention is devoted to the (low) spatial and (high) temporal resolution of the technique. A review of the fTCD studies published in international journals reveals important methodological differences between study designs that sometimes may explain contradictory results. Major methodological issues regarding subject selection (especially age, sex, and handedness), group size, presentation, and response mode, procedural aspects and choice of baseline measurement will be addressed. The relevance of quantitative and qualitative performance measures and psychological parameters (motivation, anxiety, fatigue) is discussed. Some methodological guidelines for future research and possible clinical applications are provided.

Correspondence: *Guy Vingerhoets, University Hospital Ghent 4K3, De Pintelaan 185, B-9000 Ghent, Belgium.*

**N. STROOBANT & G. VINGERHOETS. Hemispheric Asymmetry in Transcranial Doppler Measured Velocity During Cognitive Tasks.**

Transcranial Doppler ultrasonography (TCD) permits the assessment of cognitively induced cerebral blood flow velocity (BFV) changes. The aim of the present study was to investigate the change in the flow pattern of the middle cerebral artery (MCA) distribution during mental tasks. In addition, we evaluated the influence of age, sex, IQ, and quality of performance on the relative BFV changes. Simultaneous bilateral TCD monitoring of BFV in the MCA was performed in 90 normal right-handed volunteers during 13 verbal and visuospatial tasks and their preceding rest periods. All tasks showed a bilateral increase in absolute BFV compared to their preceding rest phase. Five verbal tasks showed a significant BFV acceleration in favor of the left side. Verbal paradigms that required more active or creative processing of the material (such as sentence construction or word fluency) elicited the most lateralized acceleration. Five visuospatial tasks revealed a significant right hemispheric BFV shift. Tasks that combined visuospatial attention and visuomotor manipulation showed the most asymmetric response. Older volunteers (>50 years) showed higher relative BFV changes, but lateralization was not influenced by age. Sex, IQ, and performance quality did not reveal significant effects on BFV change. Bilateral TCD is a noninvasive technique that has the potential to examine cognitively induced lateralization of BFV acceleration and thus offers specific functional information of scientific and clinical value.

Correspondence: *Nathalie Stroobant, University Hospital Ghent, 4K3, De Pintelaan 185, Ghent, East-Flanders 9000, Belgium.*

**S. KNECHT. Validity of Functional Transcranial Doppler Ultrasonography (fTCD).**

fTCD can assess event related changes in cerebral blood flow velocities and—by comparison between sides—provide a measure of hemispheric perfunctonal lateralization. To test the validity of this measure for language lateralization we compare indices of lateralization obtained by fTCD during silent word generation with the gold standard for the assessment of hemispheric dominance, the intracarotid amobarbital procedure (Wada Test) in 15 epilepsy patients. Additionally we compared indices of language lateralization by functional magnetic resonance tomography imaging (fMRI) and by fTCD in 13 healthy participants. Finally, we assessed the reproducibility of language lateralization by fTCD by follow-up examinations 1 hr to 1 year after the initial examination in 10 individuals. The correlations of fTCD with the Wada test and fMRI were found to be excellent ( $r = .92, p < .0001$  and  $r = .95, p < .0001$ ). The reproducibility was high (Pearson product-moment correlation coefficient  $r = .95, p < .0001$ ). Taken together these data demonstrate that fTCD can provide a valid and robust measure of language lateralization in individual participants.

Correspondence: *Stefan Knecht, Department of Neurology, University Hospital Münster, Albert-Schweitzer-Str. 33, D-48129 Münster, Germany.*

**M. SILVESTRINI, M. MATTEIS, E. TROISI, F. VERNIERI, M. BRAGONI, & C. CALTAGIRONE. The Use of Functional Transcranial Doppler in Cognitive Rehabilitation.**

Transcranial Doppler ultrasonography (TCD) allows for continuous measurement of flow velocity of the basal cerebral arteries giving information on the dynamic adjustment of cerebral perfusion related to functional neuronal changes. Several studies have demonstrated a correlation between cognitive activation and cerebral blood flow modifications both in healthy participants and in patients with brain lesions. This property has been successfully used to study the cerebral localization of functional activity and the cerebral reorganization that occurs during recovery after a brain lesion. By using different mental tasks during a TCD monitoring of flow velocity changes in the middle cerebral arteries of patients with cerebral vascular lesions, it is possible to individuate specific patterns of flow velocity changes that correlate with the severity of deficits and with the potentiality of functional recovery. In particular, a significant bilateral increase of flow velocity during the performance of mental tasks requiring the prevalent activation of 1 hemisphere in normal conditions seems to be a reliable predictor of recovery. Because of its high temporal resolution as well as low cost and lack of invasiveness, the TCD should be considered for use in monitoring the evolution of a cognitive deficit and the influence of different kinds of therapeutic approaches.

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**Paper Session 7/9:00–10:45 a.m.**

**INFORMATION PROCESSING, AMNESIA, AND MEMORY**

**R. PAUL & R. COHEN. Impaired Information Processing and Learning Efficiency in Myasthenia Gravis.**

Myasthenia gravis (MG), a disorder that involves antibody-mediated destruction of peripheral nicotinic receptors, may also affect central nicotinic systems. While MG patients frequently complain of cognitive difficulties, few studies have adequately addressed cognition in MG. We administered the Digit Span task, Symbol Digit Modalities Test (SDMT; oral version), and California Verbal Learning Test (CVLT) to individuals with generalized MG and age- and education-matched control groups. MG patients exhibited significant deficits on the SDMT and they recalled fewer words across the 5 learning trials, and on the short and long delay free recall. Significant differences were not found on the recognition trial or the retention index. MG patients also performed as well as control subjects on Digits Forward and Digits Backward. Significant relationships were not found between disease duration, disease severity, and average dose of prednisone and performance on the cognitive measures for the patient group. These findings suggest that MG patients exhibit significant difficulties with focused attention involved in the rapid processing of novel information and verbal learning efficiency. By contrast, their performance on a less effortful measure of attention (Digit Span) and their ability to retain verbal information were not impaired. Pharmacological blockade of nicotinic re-

ceptors results in impaired information processing and memory. These findings suggest that central nicotinic receptors may be affected in MG.  
Correspondence: Robert Paul, 6 Lark Road, Greenville, RI 02828, USA.

**R.L. TATE, A. PFAFF, & L. JURJEVIC. Recovery of Memory Functioning During Emergence From Posttraumatic Amnesia: Patterns of Performance on the Rivermead Behavioural Memory Test.**

Although impaired memory is a hallmark feature of posttraumatic amnesia (PTA), very little is known about the recovery process as the patient emerges from PTA. The natural recovery of memory function was examined in 30 patients undergoing rehabilitation after traumatic brain injury. Parallel forms of the Rivermead Behavioural Memory Test were administered on 4 occasions early posttrauma: soon after admission (Time 1), when the patient was able to recall simple memory items (Time 2), 3 days following emergence from PTA (Time 3), and 1 month later (Time 4). There was significant improvement in Profile Scores between each test occasion. On emergence from PTA, the Profile Score was 10.8 (*moderate impairment range*). One month later, the score improved to 14.8, although it was still in the *moderate impairment range*. Marked individual differences were observed at each test occasion, with scores as early as Time 2 predicting scores at Time 4 ( $r = .50, p = .005$ ), as well as duration of PTA ( $r = -0.57, p = .001$ ). Two subgroups were identified showing differential recovery. Although their Profile Scores did not differ statistically at Time 3 (both in *severe range*), one subgroup ( $n = 8$ ) showed dramatic improvement at Time 4, with a Profile score of 18.5 (*poor range*), the other ( $n = 8$ ) showed no improvement, their score remaining in the severe range (9.6). These results are discussed in the context of long-term outcome differences between the subgroups. Overall, the findings demonstrated that on emergence from PTA memory was still impaired, and remained so at follow-up 1 month later.

Correspondence: Robyn L. Tate, Rehabilitation Studies Unit, Royal Rehabilitation Centre, Sydney, P.O. Box 6, Ryde, NSW 1680, Australia.

**A. PFAFF, R.L. TATE, & L. JURJEVIC. Examining Recognition Memory During Posttraumatic Amnesia: A Comparison of 2 Procedures.**

Accurate measurement of the duration of posttraumatic amnesia (PTA) after traumatic brain injury is important: it provides an index of injury severity and is one of the best predictors of recovery. Yet it has been demonstrated that recorded duration of PTA varies according to the scale used. We hypothesized that this was due to different methods of measuring anterograde memory used in PTA scales. This was examined in the present studies, comparing the Oxford and Westmead procedures, wherein novel foils (Oxford) or the same foils (Westmead) are used in daily testing of recognition memory. In Study 1, 24 inpatients undergoing rehabilitation were examined daily during PTA. They were randomly allocated to the Oxford or Westmead procedure. No significant differences were found in the number of days to learn the items. Inspection of the data identified some patients with long duration of PTA who experienced disproportionate difficulty with the Westmead procedure. This observation was tested in Study 2, using single-case methodology in a brain-injured patient. The experiment took place during the course of his prolonged PTA, employing an ABBA design (A = Westmead; B = Oxford). Significantly fewer days were required to learn the items with the Oxford procedure. Taken together, these results suggest that patients with prolonged PTA are susceptible to procedural differences in measuring recognition memory. The use of the same foils exacerbates difficulties in identifying targets, thereby serving to artificially lengthen the recorded duration of PTA.

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**R. KNOTT & W. MARSLEN-WILSON. What H.M.'s Medial Temporal Lobe Lesion Reveals About Phonological Memory.**

Studies of the anterograde amnesic patient, H.M., have provided some of the most striking evidence that damage to medial temporal lobe structures can disrupt the acquisition of new memories. We extend these observations to a new domain—phonological memory. We report previously unpublished data on H.M. that demonstrate the dramatic impact of H.M.'s

medial temporal lesion on his retention of phonological information. H.M.'s ability to recall immediately lists of content words was compared to 3 span-matched groups: alcoholic Korsakoff patients, head-injured but nonamnesic controls, and non-head-injured controls. In comparison to the span-matched controls, both H.M. and the Korsakoff patients performed significantly worse at recalling lists only 1 or 2 words beyond span. Most saliently, however, H.M.'s recall was characterized by a distinctive pattern of phonologically related item errors. As a group, the Korsakoff patients showed a similar, but less marked pattern. Previous studies have proposed that a marked pattern of phonological errors in immediate serial recall can be linked to semantic and/or lexical deficits. H.M. nevertheless continued to show good online comprehension of content words. We interpret H.M.'s errors in terms of the failure of processes that normally help to consolidate new phonological memories.

Correspondence: Raymond Knott, MRC Cognition and Brain Sciences Unit, 15 Chaucer Road, Cambridge CB2 2EF, UK.

**G.J. KINSELLA, B. ONG, & R. JAMIESON. Impact of Aging on Remembering to Remember.**

*Background:* The most frequently reported errors of memory in daily life are those that involve forgetting to do things, or prospective remembering (ProR). An accurate account of the effects of normal aging in ProR is essential to provide a standard against which pathological changes can be assessed. Age differences have been reported for event-based ProR tasks where working memory demands are high. *Aims:* The research was designed to further develop the theoretical framework for evaluating impact of age in prospective remembering in everyday life. The aims in this study are to assess age-effects in performance of a prospective remembering task when the variables of distinctiveness of cue and the number of different target events (load) are systematically manipulated. *Methods:* The sample consisted of 29 younger adults (ages 18–34 years) and 29 older adults (65 years and older). Participants were assessed by a shared-task paradigm adapted from those used in recent studies. The purpose of the task is to determine whether, under varying conditions, participants can carry out prospective remembering while being concurrently engaged in a background task. *Results and discussion:* Results demonstrate significant age-differences when the target event cue is nondistinctive and the load is high. Performance differences are associated with problems in organizing the load during a divided attention task. Results are discussed in terms of aging of working memory. The advantages and disadvantages of the study methodology for research on prospective remembering in aging will be considered.

Correspondence: Glynda Kinsella, School of Psychological Science, La Trobe University; Bundoora, Victoria 3079, Australia.

**M. PERDICES & M. MORGAN. Changes in Memory Function During Cerebral Arterial Occlusion by Balloon Angiography.**

Surgical management of patients with internal carotid artery or vertebrobasilar artery aneurysms may involve clipping the aneurysm, bypassing the aneurysm with a venous graft, or clipping/embolizing the affected artery proximal to the aneurysm. A risk associated with the latter procedure is that unless there is adequate collateral blood supply, permanent occlusion of the artery may cause significant ischemia affecting the cerebral structures formerly irrigated by that vessel. Selection of the appropriate surgical intervention is guided by, among other things, assessment of the risk of ischemia. This can be tested by using balloon angiography to occlude the artery for 20 min. Neuropsychological assessment, EEG recording and SPECT scan are performed during the occlusion. The neuropsychological protocol focuses on assessment of memory, cognitive flexibility and language. Intraocclusion neuropsychological tests results are compared to a preocclusion assessment. Results of the procedure on 3 female patients (2 = left ICA aneurysm; 1 = basilar artery aneurysm) are described. No intraocclusion EEG changes were recorded for any of the patients. In 1 patient, no changes in neuropsychological performance were evident on comparison of pre- and intraocclusion measures. SPECT scan on this patient revealed mild ischaemic changes in the ipsilateral hemisphere, which had also been evident preocclusion. In the other 2 patients,

neuropsychological assessment revealed notable decrements in verbal memory function (particularly rate of acquisition and active short-term recall), while language and cognitive flexibility were unaffected. The neuropsychological changes were associated with ischemic changes found on SPECT scan.

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State of the Art Lecture 2/11:15 a.m.–12:15 p.m.

## GENOTYPE/BEHAVIORAL PHENOTYPE MAPPINGS VERSUS GENOTYPE/COGNITIVE PHENOTYPE

Annette Karmiloff-Smith

### FRIDAY AFTERNOON, JULY 14, 2000

#### Paper Session 8/1:30–3:30 p.m.

#### BRAIN INJURY, SEQUELAE, AND INTERVENTION

##### S. McDONALD & S. FLANAGAN. Perception of Emotion After Severe Traumatic Brain Injury.

A significant proportion of people with severe traumatic brain injury suffer ongoing psychosocial deficits. Researchers and clinicians interested in this facet of disability have been mainly concerned with documenting the impact of behavioral change on psychosocial function. Much less attention has been paid to the notion that poor psychosocial function in severe TBI may reflect reduced capacity to read important social cues such as the emotional state of others. In this study, 10 TBI ( $M$  age = 37.7) who had suffered a severe TBI (PTA,  $M$  = 4.8 weeks) in the recent past ( $M$  time posttrauma = 8.6 weeks) were compared to 51 non-brain-injured participants ( $M$  age = 21.9) on a task in which they were asked to classify the emotion of actors in 28 video vignettes. Seven emotion categories were represented (*happy, sad, angry, anxious, revolted, surprised, neutral*). In each case, the actors induced the real emotion before enacting the script that was, in itself, ambiguous and open to numerous interpretations. These vignettes thus represented more realistic stimuli than still photographs usually used for this kind of research. The controls obtained a mean accuracy score of 22.9/28. Five of the TBI individuals were within the 95% confidence limits of the normal population while 5 were well below. Both normal and TBI participants had more difficulty with positive—neutral emotions compared to negative emotions. The TBI group had the greatest difficulty judging anxious and neutral emotions. Interestingly, poor performance was not related to slowed information processing, working memory, facial recognition, or conceptual reasoning skills.

Correspondence: *Skye McDonald, School of Psychology, University of New South Wales, Sydney 2052, NSW, Australia.*

##### S.Z. STAPERT, P.A.M. HOFMAN, P.J. HOUX, J.R. DE KRUIJK, J.T. WILMINK, & J. JOLLES. Mild Traumatic Brain Injury: Absence of Correlation Between Cognitive Measures and MRI Evidence of Brain Damage.

Mild traumatic brain injury is the most common form of closed head injury. These injuries classified as mild are characterized by a lack of demonstrable focal neurological deficit and a clinical course of apparent recovery. However, a minority of patients (15–30%) report persistent post-concussional symptoms at 6 months after injury. The persistent complaints are considered a syndrome and include symptoms such as headache, dizziness, and difficulties with memory and concentration. These lingering cognitive symptoms suggest permanent damage following brain injury. The aim of this study is to assess the relation between initial MR imaging and neurocognitive performance at 6 months postinjury. The protocol specified completion of brain MRI study and neuropsychological assessment within 5 days postinjury. Neuropsychological follow-up was conducted at

2 and 6 months after injury. Patients presenting with uncomplicated mild traumatic brain injury (Glasgow Coma Score > 13, Loss of Consciousness < 20 min, Post Traumatic Amnesia < 6 hr) were included. Twelve patients ( $n$  = 21) had an abnormal MRI scan, with lesions in the frontal and temporal area. Patients with positive MR imaging were compared to their nondamaged counterparts on neurocognitive measures on verbal memory, simple- and complex-attention tasks. Data analysis showed no difference in neurocognitive performance between the 2 groups at follow-up. Eight patients reported subjective cognitive complaints at 6 months post-injury, and 1 patient met criteria for postconcussional syndrome. These data show no relation between initial MRI abnormalities and neurocognitive performance.

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##### S. GAUGGEL, B. PELESKA, & R. BODE. Relationship Between Cognitive Impairments and Rated Activity Restrictions in Stroke Patients.

The relationship between cognitive impairments and activity restrictions was investigated in 87 stroke patients. Cognitive impairments were measured with a short version of the Performance Test System, the Auditory Verbal Learning Test, and 2 subtests of the Test Battery for Assessing Attentional Disorders. Activity restrictions, measured by the Competency Rating Scale, were scored by a staff member and each patient. Statistical analyses revealed significant correlations ( $r$  = .23–.48) between scores in the cognitive tests and the activity ratings made by staff members. In contrast, correlations between ratings made by patients and cognitive tests were much lower ( $r$  = .04–.31). There was also little agreement between the staffs' ratings and the patients' own ratings ( $r$  = .36). Multiple regression analyses indicate that cognitive impairments account for 28.9% of the variance in the activity rating made by the staff members. The coefficient of determination was slightly higher when age, time since onset of illness, and depression scores were included as predictors ( $R^2$  = .373). Our findings suggest that cognitive impairment is moderately related to activity restrictions. These findings provide partial support for a hierarchical structure of the "International Classification of Impairment, Activities and Participation" model of the World Health Organization.

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##### A. SHIEL, D. HENRY, J. CLARK, D.L. McLELLAN, J.P.S. BURN, & B.A. WILSON. Effect of Increased Intervention During Rehabilitation on Outcome After Brain Injury.

Rehabilitation after brain injury is time-consuming and costly. Although there is a belief that increased rehabilitation leads to better outcome there is little evidence to support this. The aim of this study was to evaluate the effect of increased intervention on cognitive, functional, and social outcome after brain injury. Sixty patients, ages 16–68 years, were recruited from 2 centers and randomly allocated to an *intensive* or to a *routine* treatment group. Fifty-two had a traumatic brain injury (TBI) and 8 an ac-

quired brain injury (ABI) caused by infection, anoxia, or subarachnoid hemorrhage. Randomization was stratified for age and severity of injury. Twenty-nine participants were randomized to the intensive group and 31 to the routine group. Additional therapy provided included cognitive, communication and social interventions as well as self-care and community integration skills. A battery of tests of cognitive function, dependency, and handicap were administered at discharge and 1 year later. Data were analyzed for differences between groups and between groups within centers using Mann Whitney and Kruskal–Wallis tests. Results showed that, although there were no significant differences between the groups in tests of cognitive function, participants in the intervention group were significantly more independent at discharge ( $p < .001$ ). Correlations between cognitive function measures on tests and rated on FIM/FAM were low. The results suggest that increased intervention affected dependency and handicap tested on measures of dependency but not cognitive function as measured on standard neuropsychological tests.

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#### L. MAILHAN, P. AZOUVI, J.L. TRUELLE, & A. DAZORD. Quality of Life 2 to 6 Years After Severe Traumatic Brain Injury (TBI).

**Objective:** To assess satisfaction with life of severe TBI patients and their families. **Patients and methods:** Fifty patients hospitalized in a rehabilitation department after severe TBI from 1993 to 1995 were included. Quality of life was assessed by the Subjective Quality of Life Profile (SQLP). Patients rated their satisfaction on a 5-point scale for 39 items related to various domains (e.g., interpersonal relationships, leisure and vocational activities). These data were compared to ratings made by a close relative. Quality of life data were compared to impairments, disability, and handicap. **Results:** Patients' satisfaction was globally low, particularly for items related to cognitive functions, physical abilities and self-esteem. Family ratings of patients' satisfaction were parallel but lower than patients' ratings. Patients' satisfaction was significantly correlated with motor impairments, anxiety level, basic and advanced ADL, vocational status, and the Glasgow Outcome Scale score. **Discussion and conclusion:** Severe TBI patients 2 to 6 years postinjury demonstrated a relatively poor satisfaction with life. Satisfaction appeared to be affected by the presence of motor rather than cognitive impairments, and was significantly related to functional and vocational status.

Correspondence: Philippe Azouvi, Department of Neurological Rehabilitation, Raymond Poincaré Hospital, 92380 Garches, France.

#### B. SUFFIELD. Day Treatment and Supported Employment Outcomes After Traumatic Brain Injury.

**Purpose:** Assess effectiveness of a milieu-oriented day treatment/supported employment program in assisting brain injured persons' return to work. **Participants:** One hundred eight consecutive discharges; 107 were receiving some form of financial compensation. None were productive at referral. **Procedure and data analysis:** Demographic, injury, and treatment-related variables were contrasted with productivity data supplied by job coaches. **Results:** Of 108 clients, 80 (74%) completed the program and progressed to supported employment. Others withdrew or were administratively discharged (16%), were referred to other treatment or assessment (5%), or pursued quality-of-life programming (4%). Ninety-seven percent of persons progressing to supported employment went on to work, volunteer work experience, or school. At follow-up ( $M = 1,129$  days postdischarge), 57% were still productive. Preinjury to follow-up wage differences averaged \$3.33 per hr, but 26% had no wage change, and 13% had wage gains. Fifty-one percent were working full time. Most clients did not change their class of work, but most had job separations, averaging 49 days between jobs. For persons returning to work, the costs of the program could be recouped within 2 years. Despite active job coaching, 29% of program completers were nonproductive at follow-up. Age at and severity of injury, initial disability, and length of stay did not predict follow-up work status. Gender, education, lags between day treatment and work experience, availability of a preinjury job, and preinjury wage did. **Conclusions:** This type

of neurorehabilitation produced durable outcomes for many persons with TBI, despite financial disincentives. Demographic and process variables appear to affect outcome.

Correspondence: B. Suffield, Columbia Rehabilitation Centre, Suite 300, 4520 16th Avenue, NW, Calgary, AB T3B 0M6, Canada.

#### L. SIERT. Return to Work After Brain Injury: A Support-Person Model.

**Introduction:** The essence of this project is to enlist the services of a colleague (the support person) to assist a brain injured person upon his return to work. The support person knows the organization and demands of the workplace and is thus in a better position to help the former patient cope than anybody from the outside. Importantly, the employer is reimbursed for the number of hours spent in the project by the support person. Support was provided for a period of 6 to 18 months. **Methods:** The Ministry of Social Affairs established the project as a 4-year trial period (1995–1998) in a collaboration with Center for Rehabilitation of Brain Injury (CRBI) and Frederiksborg County. **Results:** Seventy participants have been referred to the project. Of 36 accepted, 25 have completed the project. Eleven are now in nonsubsidized jobs and 13 are in subsidized jobs. One participant is in education and 11 are currently without jobs. The project has demonstrated the importance of providing all involved with information on an ongoing basis. Communication must be open and frank, and other employees must know the arrangement. Information and supervision on brain injury in general and on individual characteristics of the brain injured person, who is the central person, are important for both the support person, the returnee, and the workplace. **Conclusions:** With the encouragement of employees to take responsibility, and with ongoing neuropsychological information and supervision to those involved, a support-person model can increase the possibilities for return to work of brain injured persons. Interdisciplinary teamwork in this model is important.

Correspondence: Lars Siert, Njalsgade 88, University of Copenhagen, Centre for Rehabilitation of Brain Injury, Copenhagen 2300, Denmark.

#### T.W. TEASDALE & Aa.W. ENGBERG. Suicide Following Traumatic Brain Injury: A Population Study.

Although the potential risk of suicide following a traumatic brain injury is recognized clinically, there have been only few and mainly very small-scale studies which have investigated incidence rates. From a Danish population register of hospitalizations covering the years 1979–1993, patients were selected who had suffered either a concussion ( $N = 110,289$ ), a cranial fracture ( $N = 6,573$ ) or, more severely, a cerebral contusion or traumatic intracranial hemorrhage ( $N = 8,529$ ). All cases of deaths by the end of the study period were identified. In the 3 diagnostic groups there had been 717 (0.65%), 44 (0.67%), and 87 (0.83%) cases of suicide, respectively. Comparing the 3 groups, Cox regression analyses for proportional hazards indicated that there is a relatively elevated risk for suicide following cerebral contusions and/or traumatic intracranial hemorrhages among men (hazard ratio = 1.4) but not among women. For such men, the suicide risk is related to duration of hospitalization, but not to time since injury. It is concluded that men who suffer a relatively severe traumatic brain injury are thereafter at a greater risk of suicide.

Correspondence: Thomas W. Teasdale, Department of Psychology, University of Copenhagen, Copenhagen, 2300, Denmark.

### Paper Session 9/1:30–3:30 p.m.

#### APHASIA, DYSLEXIA, AND TRAINING

##### P. MARIËN, P. PAQUIER, & P. DE DEYN. Crossed Aphasia in a Dextral Child.

Though its reported incidence has changed dramatically over time, it was only recently recognized that acquired crossed aphasia in dextral (CAD) children represents a highly exceptional neurobiological phenomenon. Since 1975, only 4 cases have been reported. We describe in a 3-epoch time-

frame model the aphasiological and neurocognitive manifestations in an additional case and focus on its anatomoclinical configurations. In our propositus a right parietal corticosubcortical hemorrhagic lesion caused a sub-global aphasic syndrome that during the course of the acute phase rapidly evolved to an adynamic output syndrome with relatively severe auditory-verbal comprehension deficits. In the subsequent lesion phase, a full-blown expressive and modality-specific receptive agrammatism (preserved reading comprehension) was found in association with adynamia of self-generated speech, hypertonic dysarthria, and dysprosodia. Language assessments performed 3 months post-onset disclosed a substantial linguistic improvement but prominent dissociations on the syntactic level remained. Lesion phase neuropsychological investigations disclosed a unilateral, left-sided agnostic syndrome consisting of astereognostic, fingeragnostic, and autotopagnostic symptoms. Reassessment of neurocognitive functions after 10 years only revealed a discrete residual anomia, confined to visual confrontation naming. As the first representative of childhood CAD with an anomalous lesion-aphasia profile, our propositus provides new evidence to enrich the discussion on the lateralization and intrahemispheric organization of language functions.

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**P. MARIËN, L.A. VIGNOLO, P. PAQUIER, & P.P. DE DEYN. Acquired Crossed Aphasia in Dextral Children Reviewed.**

In contrast to the estimated low incidence of crossed aphasia in dextral adults ( $\pm 1\%$ ), crossed aphasia in children has been considered a common finding for almost a century. However, reviewing the literature on crossed aphasia in dextrals (CAD) and its related topics from 1975 onwards, we surprisingly only encountered 5 children with sufficiently documented CAD in a corpus of 168 cases (3%). Critical analysis rendered 2 of the reported cases ambiguous and hence not suitable to draw sound conclusions. The common aphasic pattern of the limited number of convincing childhood CAD representatives consists of an initially severe expressive and receptive language syndrome characterized by speechlessness and severe auditory-verbal comprehension defects. In its further course this syndrome seems to evolve rapidly to a predominantly adynamic output disorder that may be of long and even persistent duration. A variety of residual semantic deficits might be found as (final) outcome variables after longitudinal follow-up. In 2 of the 3 cases, agrammatic features, repetition disturbances, phonematic paraphasias (subsequent), reading and writing disorders, prosodic disturbances, and dysarthric features occurred. Aside from sequelae in the domain of written language, none of these symptoms persisted after longitudinal follow-up. In this review, the neurobehavioral manifestations of the three representative childhood CAD cases are compared with adult CAD and acquired childhood aphasia. In the light of our findings, which support the position of innate cerebral specialization for language, the long-standing controversy as to whether lateralized hemispheric specialization for language is innate or develops progressively during maturation, is discussed.

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**V. VAN MALDEGHEM, P. PAQUIER, H. VAN DONGEN, & J. VAN BORSEL. Spontaneous Conversational Speech in Acquired Childhood Aphasia After Resection of a Temporoparietal Tumor: A Case Study With a 12-Year Follow-Up.**

We report on a patient who acquired a fluent aphasia when she was 9 years of age. Spontaneous conversational speech (SCS) characteristics were analyzed in the acute period and 12 years postonset. Videotaped and audiotaped recordings were rated according to several variables, such as mean length of utterances (MLU), type-token ratio (TTR), and speech rate. In the acute period, word-finding difficulties resulted in the use of circumlocutions, superordinate substitutions, verbal and literal paraphasias, and "conduites d'approche." Her speech was fluent, logorrhic, and empty. MLU and TTR did not differ significantly between the acute period and the follow-up assessment. At follow-up, mild but lasting word-finding difficulties (including strategic adaptations), a lasting lack of cohesion (pronominal coreference),

and pragmatic difficulties (inadequate responses, presupposition, and topic maintenance) were found. These findings contradict the traditional views on the clinical picture of acquired childhood aphasia (ACA), which claim that ACA is invariably nonfluent, and characterized by a rapid and complete recovery of language function. The word-finding difficulties are discussed in relation to adulthood aphasia. Some parallelisms are suggested.

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**A.M. HOGAN, E.B. ISAACS, F.J. KIRKHAM, & F. VARGHA-KHADEM. Intellectual and Language Outcome After Unilateral Middle Cerebral Artery Ischemic Stroke in Children.**

This study was carried out to test the hypothesis that hemispheric specialization is not present during early childhood but gradually emerges over time. Forty-five children with MRI confirmed unilateral middle cerebral artery infarct and 14 sibling controls underwent neuropsychological investigations. Language scores were obtained for patients, and IQs (Wechsler Scales) were obtained for both patients and controls. The mean age at stroke was 6 years and the mean interval between stroke and evaluation was 2 years and 5 months. Although mean verbal and performance IQs were within the normal range, the latter was significantly lower compared with the mean of the sibling controls. There was no effect of hemispheric side of lesion on IQ when patients were grouped according to age at stroke (5 years vs. 6 years), although there was a trend for verbal IQ to be selectively spared after a right hemisphere stroke in older children. Performance IQ was lower in children with more extensive infarcts involving both cortical and subcortical structures, compared with children with damage restricted to the basal ganglia, irrespective of hemispheric side of injury. Cortical involvement did not significantly reduce verbal IQ or either language measure. Overall, expressive and receptive language scores were significantly below the population mean. Once again, there was no effect of hemispheric side of stroke on language ability, although older children obtained significantly lower scores on both measures. Our results suggest that hemispheric specialization begins to appear after the age of 5 or 6.

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**J. ROBERTSON. Differentiated Intervention in Dyslexia: A Neuropsychological Approach.**

Historically intervention research in dyslexia is rare. This abstract reports two studies on British pupils according to the theoretical background of the neuropsychological model of Bakker. This concerns the contributions of the right and left hemispheres to effective reading. Developmentally early reading is mediated by the right hemisphere (specialist for visual spatial function) and advanced reading by the left hemisphere (usually specialist for language). This normal developmental process was demonstrated by ERP studies on children of 7 and 8 years. The balance of hemispheric activity transfers from the right to the left hemisphere when alphabetic symbols become familiar. If this process is interrupted two subtypes of dyslexia result: the P-type (perceptual) and the L-type (linguistic). The former is arrested at the visual perceptual stage and the latter has transferred prematurely to the linguistic stage. Differentiated intervention (hemisphere specific stimulation, HSS, and hemisphere alluding stimulation, HAS) can aid both. Two British studies were carried out: 1 study according to the theory (HSS;  $N = 6$ ) and 1 challenge study (HAS;  $N = 37$ ) on both subtyping and intervention. Results (over 3 testing occasions) supported the validity of the original L- and P-subtype classification and revealed a *mixed* subtype, who showed a qualitatively different response to differentiated intervention. The results supported neuropsychological intervention as a legitimate alternative intervention method for some individuals. Results of follow-up testing indicated that participants showed sustained improvement in diverse aspects of reading even after direct intervention ceased. This addresses the documented problems of long-term retention.

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**L. BRAGA. Family Participation in the Rehabilitation of the Child With Traumatic Brain Injury.**

*Objective:* Evaluate if children with traumatic brain injury (TBI) present better motor and cognitive outcomes during the period of 1 year when treated exclusively by professionals compared with children predominantly treated by the family under the supervision of a team. *Materials and methods:* A study was conducted with randomized controlled trials using the evidence-based approach. One hundred eighty children, 5–10 years old at the study's onset, with injuries that had occurred 6 months–2-1/2 years earlier, were randomized and submitted to 2 different treatment approaches during 1 year. Group A: 74 children predominantly rehabilitated by the family. The parents underwent intensive training and performed the activities at home with the child, returning to the hospital biweekly for new orientations. Group B: 71 children who, during 1 year, attended daily rehabilitation sessions at the hospital and were exclusively treated by professionals. All children were assessed by the Weschler Intelligence Scale for Children and the SARAH Scale of Motor Development before and 1 year after starting treatment. *Results:* Two-sided chi-square and Mann-Whitney and logistic-regression assessments revealed that the children in Group A obtained better outcomes in the motor and cognitive development scales than Group B ( $p < .05$ ). The parents' educational levels showed no statistically significant bearing. *Conclusion:* The children with TBI who received development and cognitive stimulation from the family under the supervision of a specialized team presented better progress than those treated exclusively by professionals. These results point to a new perspective in the rehabilitation of these children based on family participation.

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**Panel Discussion/4:00–5:00 p.m.****DEVELOPMENT IN EUROPEAN NEUROPSYCHOLOGY****Paper Session 10/4:00–5:00 p.m.****NEUROPSYCHOLOGICAL SEQUELAE IN MEDICAL AND TOXIC CONDITIONS****R. COHEN, R. PAUL, D. MOSER, & H. WILKINSON. The Relationship Between Emotional and Attentional Sequelae of Bilateral Anterior Cingulotomy.**

Recent functional neuroimaging have shown that the anterior cingulate cortex (ACC) activates under a variety of task conditions. We previously demonstrated impairments of attention–intention and self-initiated behavior and disruption of autonomic habituation following bilateral anterior cingulotomy among patients treated for chronic intractable pain. In the present study, we examined the relationship between changes in emotional experience/behavior and alterations in intentional functions following cingulotomy. Pre- and postcingulotomy, patients ( $N = 18$ ) completed the MMPI–2, Profile of Mood States (POMS) and a questionnaire on functional effects of their pain, along with a battery of neurocognitive tasks. Baseline analysis revealed significant emotional distress with clinically significant elevations across most POMS subscales, and on several MMPI–2 subscales, without a significant difference between cingulotomy and control participants, or significant cognitive deficits in either group. Postcingulotomy, patients exhibited significant reductions on the POMS–Tension and Anger Scales and on the MMPI–Scale 7, compared both with respect to their baseline status and the control group. Their responses on the Pain Inventory indicated mild improvement in pain ratings, but marked changes in the extent to which their pain effected their lives. Cingulotomy produced greatest alterations in attention–executive functions of intention and self-initiated behavior. Regression analyses revealed that changes in POMS–Tension ratings were strongly associated with deficits in self-initiation ( $R = .76, p < .01$ ). Besides affecting intentional functions, bilateral ACC damage reduces the intensity of affective experience associated with pain. These

emotional changes appear to be strongly linked to the intentional affects of cingulotomy. Additional research on the relationship of affective and intentional functions of the ACC is indicated.

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**T. J. FERMAN, J.A. LUCAS, B.F. BOEVE, J. RIPPETH, G.E. SMITH, N.R. GRAFF-RADFORD, R. PETERSEN, E. KOKMEN, M.H. SILBER, R. SHORT, & R. J. IVNIK. Lewy Body Dementia Differs From Alzheimer's Disease in Neurocognitive Performance, Age, Sex, and Collateral Report of Possible REM Sleep Behavior Disorder.**

Dementia plus 1 or more of 3 features (visual hallucinations, extrapyramidal signs, fluctuating alertness/cognition) is needed for the diagnosis of Lewy body dementia (LBD). REM sleep behavior disorder (RBD) consists of lost muscle atonia and dream enactment behavior during REM sleep. Prior findings revealed neurocognitive differences between patients with Alzheimer's disease (AD) and a group with dementia and polysomnogram-confirmed RBD who satisfy clinical criteria for LBD. The current retrospective study examines whether cognitive differences between LBD and AD are replicable in a new sample with additional measures, and whether there is support for the hypothesis that dream enactment behavior is a clinical feature of LBD but not AD. AD ( $N = 112$ ) and LBD ( $N = 45$ ) groups significantly different in men (34% AD vs. 84% LBD), and  $M$  age (77 years AD vs. 72 years LBD) but not education ( $M = 13.5$  years) or DRS total score ( $M = 108$ ). Polysomnograms were not available to verify RBD, but collateral report of dream enactment behavior significantly differed between groups (5% AD vs. 90% LBD). The LBD group performed significantly better on the Boston Naming Test, Logical Memory, CVLT free recall and recognition than the AD group but worse on Letter Fluency, Block Design, Picture Completion, and Trail Making Test A. Findings replicate prior results. Compared to AD, LBD is associated with better naming and memory but worse letter fluency, visual scanning, and perceptual organization. Data also provides evidence that dream enactment behavior during sleep is more frequently observed in LBD than AD.

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**L. KRABBENDAM, M. MARCELIS, J. JOLLES, & J. VAN OS. Cognitive Performance and MRI Brain-Structure Volumes in Patients With Schizophrenia and Their 1st-Degree Relatives.**

First-degree biological relatives of patients with schizophrenia have a risk of developing schizophrenia about 10 times that of the general population. Neuropsychological dysfunctions are part of this vulnerability. These dysfunctions can be identified more clearly in relatives than in patients, because no confounding effects of the illness are present. In the present study, cognitive performance and MRI brainstructure volumes in patients with schizophrenia and their adult relatives was investigated, in comparison to controls from the general population. Participating in the study were 50 patients with schizophrenia, 50 1st degree relatives of patients with schizophrenia, and 50 healthy controls. The groups were matched on age, sex, and education. Diagnosis was made with the computer program OPCRIT, which generates diagnoses of a range of operational systems for psychotic illness. The neuropsychological assessment was directed at memory, attentional span, speed of information processing, and cognitive flexibility. Multivariate analysis of variance (MANOVA) of the cognitive performance showed a significant main effect of group [ $F(12,284) = 4.66, p = .00$ , Pillai's test]. Pair-wise analysis of the significant univariate group differences indicated that the patients performed significantly worse than the control participants on all measures. The patients had a significantly poorer performance than the relatives on several tests of speed of information processing and cognitive flexibility. The relatives had a significantly poorer performance than the controls on tests of memory and speed of information processing. Results indicate that these neuropsychological parameters can be considered indicators of vulnerability to schizophrenia.

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**K.I. BOLLA, F.R. FUNDERBURK, & J.L. CADET. The Effects of Cocaine With and Without Concomitant Alcohol Abuse on Neurobehavioral Performance in Abstinent Cocaine Users.**

We investigated the effects of alcohol and cocaine use on a variety of neuropsychological performance tests at 2 points in the recovery process. Fifty-six individuals who met the diagnostic criteria for cocaine dependence and who had used cocaine during the past 24–48 hr volunteered to perform a battery of neuropsychological tests on two separate occasions during a period of enforced abstinence. The sample was predominantly African American (85%) and male (80%). In addition to cocaine, approximately half of the participants consumed more than 10 alcohol-containing drinks per week. Neuropsychological performance was assessed at 3 days of abstinence and again at 28–29 days of abstinence. Hierarchical regression analysis was used to examine the data for person-specific effects (age, sex, and IQ) as well as linear and quadratic components of the alcohol and/or cocaine dose-response relationship on neurobehavioral performance. Three measures of executive function and a measure of manual dexterity showed significant alcohol dose-related effects, while measures of attention and verbal mem-

ory showed significant dose-related effects of cocaine. In general, these effects continued to be seen after 28 days of abstinence, with some evidence for more substantial cocaine dose-related effects on Stroop Color-Word and RAVLT Delayed Recall performance. The results highlight some of the longer-lasting neurocognitive effects that must be taken into account when planning treatment services for individuals with cocaine dependence—with or without concomitant alcohol abuse.

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**Birch Lecture/5:15–6:15 p.m.**

**THE BRAIN IN SLEEP**

**Robert Poirrier**

**SATURDAY MORNING, JULY 15, 2000**

**Poster Session 3/9:00 a.m.–12:15 p.m.**

**NEUROPSYCHOLOGY IN PSYCHIATRIC, NEUROLOGICAL, AND NEUROSURGICAL DISORDERS, CONTINUED NEUROPSYCHOLOGICAL ASSESSMENT/EXECUTIVE FUNCTIONS/DEMENTIA AND AGING**

**B. STEINBERG, L. BIELIAUSKAS, & L. BENTIVEGNA. Untreated Phenylketonuria and Comorbid Tourette Syndrome: An Adult Case Study.**

Phenylketonuria (PKU) is an inherited metabolic disorder that may cause severe impairment in neurocognitive and emotional functioning in untreated patients. Tourette syndrome (TS) is a psychiatric disorder that produces multiple motor and vocal tics and is frequently associated with obsessive-compulsive symptoms and attention deficit disorder. Both PKU and TS have been linked to dysfunction in frontal-subcortical circuits and have been associated with abnormalities in monoaminergic neurotransmitter systems. After reviewing extant information regarding the anatomy and physiology of these disorders, we present the clinical history and neuropsychologic assessment results for a 41-year-old man with untreated PKU and comorbid TS. Although this patient's data were largely consistent with group profiles that have been reported in the PKU and TS literatures, he demonstrated low-average intellectual functioning and has been able to maintain employment throughout adulthood. We discuss these findings in relation to the putative substrates of each disorder and consider the possible relationship between them.

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**R. COHEN, R. BOLAND, R. PAUL, K. TOSHIMA, T. FLANNIGAN, & C. CARPENTER. HAART Effects on CD4 and HIV-Associated Neurocognitive Function in Women.**

The relationships between viral load, CD4 count, and the influence of HAART therapy on cognitive and psychosocial function in HIV-positive individuals has important clinical implications. In the current study, a total of 135 women enrolled in the CDC HERS study with CD4 counts < 100 received a psychosocial and substance abuse assessment, and administration of Color Trail Making, verbal fluency, Grooved Pegboard, and a 4-word

list learning task every six months for a minimum of 1 year. At Visit 1, a strong relationship between neuropsychological dysfunction and CD4 level was found ( $r = .77$ ), with color sequencing errors and verbal fluency performance accounting for the variance in CD4 level. When depression severity on the CESD was entered as an additional variable, neuropsychological performance still accounted for the majority of variance in CD4 levels, though CESD accounted for an additional 20% of the variance. Neuropsychological performance was not retained as one of the predictors of CESD status, as CD4 levels and severity of drug use accounted for most of the variance in CESD. Patients on HAART therapy exhibited much stronger neuropsychological performance compared to those on alternative therapies, and CESD and drug history did not contribute to this effect. The present results demonstrate that CD4 levels in patients who have AIDS with CD4 < 100 are directly associated with neuropsychological status, suggesting that severity of immunocompromise affects brain function. Furthermore, the introduction of HAART therapy appears to improve cognitive functions in this cohort, suggesting that the neuropathological changes in these patients may be reversible.

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**S. CAÑIZARES, J. BLANCH, M. SALAMERO, A. ROUSAUD, T. BOGET, F. GARCIA, & J.M. GATELL. Peripheral Viral Load at Asymptomatic Stage of the HIV Infection and Attention and Psychomotor Speed.**

*Objective:* To study the association between peripheral viral load and some cognitive domains related to mild cognitive impairment at the asymptomatic stage of the HIV infection. *Participants:* The sample was composed of 46 volunteers HIV seropositive patients recruited from an infectious disease department (age  $M = 35 \pm 6.7$  years; estimated IQ =  $105 \pm 16$ ). All participants were asymptomatic at the testing time (CDC A<sub>1</sub>). Thirty-one percent of the patients were receiving antiretroviral polytherapy. *Procedure:* The neuropsychological assessment comprised attention, psychomotor and cognitive processing speed through digit span, digit symbol (WAIS subtests) and the performance time on the Trail Making Test (TMT). The difference score between Trail Making Test Part B and Part A was used as a mental processing speed measure. *Statistical analysis:* Pearson correlation coefficients and ANOVAs with covariate were performed to control for the effect of the antiretroviral treatment. The number of participants ensures a power of 95% for  $\alpha = .05$  to detect  $r = 0.5$ . *Results:* No significant Pearson correlation coefficients were found between peripheral viral



load and any of the cognitive measures assessed. When the effect of the antiretroviral therapy was controlled the absence of any significant relation still remained. *Conclusions:* There is no relationship between peripheral viral load and attention, psychomotor and mental processing speed measured by complex tasks. It is suggested that if the relation between viral load and cognitive performance does exist, it must be determined through more direct measures such as CSF viral load and measures of reaction time.

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**M.P. HUY, P.H. LU, & G.T. SOUHEAVER. MMPI-2 Profile Code-Type Frequencies in Male VA Chronic Pain Patients Awaiting Neurosurgery.**

The purpose of this research was to study the utility and validity of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) with chronic pain patients. Subjects were 134 male VA chronic pain patients who were tested as candidates for neurosurgery. Current research has suggested that chronic pain patients consistently exhibit elevations on scales 1 and 3 of the MMPI-2. However, secondary elevations and code-type frequencies are less well studied. Code types of 13/31 have traditionally described patients with somatic complaints that were either directly caused or exacerbated by psychological factors. The results indicated 3 common code types that accounted for 63% of the cases. Our findings were 46% of the MMPI-2 profiles had a code type of 13/31, 9% had a single elevation on Scale 1, and 8% had a code type of 12/21. Further analysis revealed the K scale was significantly related to scale D. The implications of the D and K scale relationship on chronic pain patients' MMPI-2 profiles were discussed. Correspondence: *Melissa Huy, 13500 Chenal Parkway #314, Little Rock, AR 72211, USA.*

**A. AGUADO, B. LOBO, R. BLANCO, A. NOVELLI, E. VERA & F. GOSALBEZ. Effect of Cardiac Surgery on Cognitive Functions.**

Until recently, most heart surgery has been assisted by an oxygenator pump bubble (OPB), and it is unknown whether the exclusion of OPB changes significantly the probability of observing neuropsychological deficits. Here we present data from the neuropsychological examination of two groups of patients undergoing heart surgery of comparable complexity and duration, performed either with (Group A) or without OPB (Group B). Each group included 10 people of similar educational level (between 13–15 years of school) and age ( $54.17 \pm 4.45$  and  $51.8 \pm 3.42$  years as  $M \pm SD$  for A and B respectively). A 3rd Group C, with 10 healthy volunteers matched for age and education to those of Group A and B, was included. All patients were examined neuropsychologically before (1–2 days) and after (7–8 days) surgery. Neuropsychological assessment included the following tests: Rey Complex Figure (RCF), Symbol Digit, Digits forward and backward, Stroop, Rivermead, Hooper Visual Organization, and Yesavage Depression Scale. We observed that Group A preoperative performance in Symbol Digit, Stroop, and both immediate and delayed reproduction of RCF, were significantly (average comparisons,  $p < .05$ ) reduced with respect to Group C. After surgery, Group A performance in both immediate and delayed Taylor's figure was significantly improved. We also observed a significant postoperative improvement of group A performance in the Hooper test. Group B preoperative performance in any of the tests we used was not significantly different from that of Group C, and no changes were observed after surgery. We conclude that heart surgery in the absence of OPB can be performed safely.

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**M.J. KRUIZINGA, A.N. BRAND, F.L. MOLL, R.G.A. ACKERSTAFF, & L.J.P. VAN DOORNEN. The Effects of Carotid Endarterectomy on Cognition.**

Carotid endarterectomy (CE) is a surgical procedure carried out to clear atherosclerotic plaque from one of the carotid arteries. The purpose is to prevent future cerebral ischemic attacks by restoring the blood flow to the

brain and removing a major source for microemboli. This study evaluates the effects of CE on cognition. Patients are being tested 1 day preoperatively and 2 days and 3 months postoperatively with a neuropsychological test battery including tests of memory, attention, psychomotor function, and lateralized functioning. The patients are being compared with a surgical and a healthy control group. Preoperative cognitive status of the patients is being evaluated to establish the effect of carotid stenosis on cognition. The available literature is inconclusive about the effect of CE on cognition. About half of the studies finds an improvement of cognition after CE, the rest of the studies, however, find no differences or even worsening of cognition. Improvement of cognition can be the result of two factors: (1) a general sense of improved well-being, in case no lateralization effect would be expected (2) improved blood supply, in which case a lateralization effect could be expected. Worsening of cognition is a result of microembolism during the surgical procedure. These factors will be evaluated in this study. Stress might influence the preoperative performance of patients and this additional factor will be investigated in this study. Preliminary results of this study will be presented at the meeting.

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**S. ÄYSTÖ. Relation of Neuropsychological Functioning and Adaptive Behavior in Mental Retardation.**

A battery of neuropsychological and cognitive tasks were presented to a sample ( $N = 258$ ; 115 women, 143 men; age range: 1–64 years) of persons with mental retardation and with different etiologies (genetic 65, other than genetic 97, unidentified 90, not yet confirmed 6). The level-of-retardation was *subnormal* (13), *mild* (87), *moderate* (92), *gravis* (37), and *profound* (23). Adaptive functioning correlated significantly with all investigated neuropsychological tasks, but maladaptive functioning only with few neuropsychological tasks. Each one of the neuropsychological tasks as functional entities (such as praxis, agnosias, receptive and expressive functions, higher cortical functions) predicted considerably the sum score of adaptive functioning (range 72–75%) but not maladaptive functioning (range 3–8%). Compared to cognitive tasks, the neuropsychological tasks were much better in predicting adaptive behavior of persons with mental retardation. The results emphasize the importance of neuropsychological approach in assessing the adaptive functioning. The possibilities of neuropsychological rehabilitation in improving the adaptive functioning of person with mental retardation are discussed.

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**S. VAN EERDENBRUGH, P. PAQUIER, M. VAN MOURIK, H. VAN DONGEN, & J. VAN BORSEL. Token Test Norms in Children between 6 and 16 Years of Age.**

The 61-item version of the Token Test was administered to 300 Dutch-speaking normal school children whose ages ranged from 6 to 16 years. Age influenced the performance on the Token Test, whereas sex was not a factor of importance. We present mean scores, standard deviations, and percentile scores per age group. We also examined 38 children with an acquired aphasia. From this group, 27 (71%) children scored below the 5th percentile. These norms improve the usefulness of the Token Test for screening of developmental language difficulties. Moreover, these data can be used in follow-up studies of children with an acquired aphasia.

Correspondence: *Philippe F. Paquier, Dept Neurol Neuropsychol, Univ Hosp Erasme ULB, 808 route de Lennik, B-1070 Brussels, Belgium.*

**J. DONDEERS, J. J. ZHU, & D. TULSKY. Cluster Analysis of the WAIS-III Standardization Sample.**

The purpose of this investigation was to determine the presence of representative profile subtypes in the standardization sample of the Wechsler Adult Intelligence Scale-3rd Edition (WAIS-III,  $N = 1,250$ ). Standard scores ( $M = 100$ ,  $SD = 15$ ) on the Verbal Comprehension, Perceptual Organization, Working Memory, and Processing Speed factors were submitted to two-stage cluster analysis. In the first stage, Ward's minimum variance

was used as the clustering method, squared Euclidean distance as the similarity measure, and multiple statistics (semipartial  $R^2$ , pseudo  $t^2$ , and pseudo  $F$ ) as criteria to determine the optimal number of clusters. The second stage involved  $k$ -means iterative partitioning to correct for initial fusion and allocation errors. Reliability was confirmed with a split-sample replication. Five subtypes were found. Three clusters were characterized by differences in level of performance across all factor indices (ranging from below average, to average, to above average). The other two clusters were differentiated by distinct patterns of performance, with relative efficacy on the Processing Speed index being the most prominent distinction. The clusters did not differ significantly in age [ $F(4, 1,245) = .87, p > .10$ ]. This confirms their representativeness across the age range of the standardization sample. The clusters did differ significantly in level of education, [ $\chi^2(16) = 317.89, p < .0001$ ]. This suggests that educational background should be taken into account when interpreting WAIS-III data. This cluster solution may help clinicians determine the relative uniqueness or significance of WAIS-III profiles obtained with individual patients in neuropsychological practice.

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**B. LOBO, A. AGUADO, R. BLANCO, J. ALVAREZ, A. NOVELLI, & E. VERA. Sensitivity of Comprehension Subtest of WAIS to Prefrontal Damage.**

The Wechsler Adult Intelligence Scale (WAIS) has traditionally been considered an adequate indicator of postrolandic brain damage. However, abilities intrinsically associated to frontal lobe function are not assessed by this scale in a satisfactory way. The *Comprehension* subtest of WAIS could be an exception to this rule. This subtest evaluates aspects such as the ability to judge specific behaviors as adequate, logical, and suitable. These abilities are selectively affected in prefrontal lobe disfunction. We investigated the correlation between prefrontal lobe dysfunction and performance in this subtest. Two groups of patients with anatomically documented frontal lobe lesion and postrolandic brain damage were studied. Each group included 5 patients of similar educational level (between 6–8 years of school) and with a mean age of  $38.60 \pm 14.63$  years. Despite the heterogeneity of the lesions, for both groups we observed a significant correlation between poor performance in the *Comprehension* subtest of the WAIS ( $p < .05$ ) and poor performance in the WCST ( $p < .05$ ) and Stroop Test ( $p < .01$ ). According to our data, we suggest that intellectual abilities as tested by the WAIS could be divided into a prefrontal and a postrolandic component. The *Comprehension* subtest of the WAIS would need to be improved for the classification of patients with frontal lobe lesions according to neuropsychological and anatomical criteria. Additional items related to impulsive and social judgment may be helpful.

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**M. LEVAV, L.M. FRENCH, & A.F. MIRSKY. Effects of Generalized and Focal Seizures on the Rey–Osterrieth Complex Figure Test: A Family Study.**

We present lifespan data for the Rey–Osterrieth Complex Figure Test (ROCFT), based on the Bernstein–Waber Developmental Scoring System (DSS). The 237 participants (76 male and 161 female), age range 5–71 years, comprised families of 60 healthy controls and probands with childhood absence (CAE), juvenile myoclonic (JME), or temporal lobe (TLE) epilepsy, and their relatives. The ROCFT scoring system includes organization, style, accuracy and errors in 3 conditions: *copy* (C), *immediate* (I) and *delayed recall* (D). The ROCFT did not discriminate between controls and probands, or among probands, except that the latter made more errors in the I condition. However, the pooled relatives of probands scored significantly lower than probands in the C style score, the I and D organization scores, and total numbers of errors in all conditions (ANCOVA comparisons). The JME relatives had lower I and D organization scores than the other relatives. Level of education was positively related to scores in the C, I, and D conditions, regardless of age, diagnostic group, or sex.

The style score of the C condition, predicted I [ $F(4, 231) = 11.2, p < .00001$ ] and D [ $F(4, 225) = 8.8, p < .00001$ ] organization scores. Age was positively correlated with performance in the 5–10 years and negatively in the 60+ years groups. Although the sensitivity and specificity of the ROCFT remain to be established, the results suggest that familial effects of some seizure disorders (in particular JME) may be manifest in cognitive impairment among relatives of the probands.

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**J. DSURNEY, N.A. DEFILIPPIS, & M.H. ROSENFELD. The Neuro-behavioral Interview: A Validation Study.**

The authors developed a neurobehavior screening examination based upon Luria's method as presented by both Luria and Christensen. The instrument can be administered in less than 20 min using no special apparatus. This 43-item instrument assessed each of the 17 areas outlined by Luria, with a variety of complex and simple procedures included that the authors felt captured the essence of each area. Although the instrument is designed for qualitative evaluation of a patient's abilities, a 3-point rating scale is included. This study evaluated the ability of the instrument to discriminate organically impaired from neurologically intact psychiatric patients. A group of brain damaged patients ( $N = 21$ ), diagnosed radiographically, were administered the instrument as were a group of psychiatric patients ( $N = 36$ ) with a variety of diagnoses and no evidence of brain damage. An ANOVA revealed a significant differences between the mean quantitative scores of the 2 groups. Means were 60.29 for brain damaged and 75.66 for psychiatric groups ( $p < .001$ ). Classification using a cutoff score of 70 yielded a false positive rate of 16.7 and a false negative rate of 23.8. However, qualitatively, brain damaged patients scoring at or above the cutoff score showed evidence of significant problems in one or more areas. Thus, the combined use of both methods of interpretation led to a significantly reduced false negative rate. The average administration time for the instrument was about 18 min. There was a significant difference in age, brain damaged mean = 56.48, psychiatric mean = 35.02. However, age was not significantly related to test scores. Nonetheless, possible age factors might have played a role and the authors are engaged in further research on normal, aged populations to address this issue.

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**K. ERDAL. Knowledge of Neuroscience and Motivation for Malingering Predict Performance on the California Verbal Learning Test.**

Malingering of neuropsychological impairment in order to obtain compensation has been extensively studied; however, malingering for other motivations, such as attempting to avoid blame for a motor vehicle accident (MVA), has been relatively unexplored. Introductory psychology ( $N = 66$ ) and advanced neuroscience students ( $N = 23$ ) were randomly assigned to groups that required them to malingering a head injury on the California Verbal Learning Test (CVLT) either to try to obtain compensation for injuries incurred in a MVA, to try to avoid punishment for causing a MVA, or for no given reason. A  $2 \times 3$  MANOVA revealed main effects for student group and for instructed motivation on 4 CVLT subscores. Univariate tests revealed a main effect for student group on the CVLT subscores of Trials 1–5 (sum), List B, Short-Delay Recall, and Long-Delay Recall, in that the advanced neuroscience students performed more poorly than the introductory psychology students. There was a main effect for motivation on the CVLT subscores of List B, Short-Delay Recall, and Long-Delay Recall. That is, those who were trying to obtain compensation performed more poorly than both those who were trying to avoid blame and the controls. The motivation for malingering appears to have an impact on the magnitude of dissimulation, in that people are more excessive in their malingering for tangible gain than to avoid blame. This is supported by the behavioral attribution and decision-making literatures. It also appears that those with more knowledge about the brain particularly overemphasized the impact of a true head injury. This is consistent with research which has found that those with knowledge of true traumatic brain injury sequelae malingering more

flagrantly than those who do not have knowledge of the consequences of head injury.

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**D.H.K. SHUM & J.G. O'GORMAN. Development and Validation of the Shum Visual Learning Test.**

Appropriate stimuli for a test of visual memory are those that are unfamiliar, relatively complex, and not easily verbalisable, and an appropriate testing procedure is one that does not confound assessment of visual memory with visuoconstructive abilities. All commonly used tests of visual memory (e.g., the Benton Visual Retention Test, the Visual Reproduction subtest of the Wechsler Memory Scale–Revised, the Rey–Osterrieth Complex Figure Test) can be criticized for failing to meet 1 or more of these criteria of appropriateness. Shum and his colleagues proposed that visual memory can be validly assessed through recognition testing of previously presented Chinese characters. For individuals who have not studied the Chinese language, Chinese characters are visual–spatial patterns of strokes, lines, or dots that fulfil the criteria for appropriate stimuli for the testing of visual memory. This paper discusses the development of the Shum Visual Learning Test and discusses its psychometric properties including test–retest reliability, criterion-related and construct validity. Data collected with the test for 2 clinical groups, patients with cerebral vascular accident and traumatic brain injury, are presented and the effects on test performance of age, sex, and educational level are discussed. A newly developed computerized version of this test is demonstrated and its comparability to the paper-and-pencil version outlined.

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**K.A. STRAITS-TRÖSTER, A.I. TRÖSTER, J.A. FIELDS, K. LYONS, & W.C. KOLLER. Determinants of Quality of Life Following Thalamic Stimulation for Essential Tremor.**

We previously reported that thalamic deep brain stimulation (DBS) for essential tremor (ET) is associated with improvements in tremor and quality of life (QOL). This study characterized the determinants of QOL improvements. We hypothesized that mood, coping and social support resources would be related to psychosocial QOL outcomes, and that change in tremor scores would be related to physical functioning aspects of QOL. ET patients ( $N = 40$ ;  $M$  age = 72 years) were evaluated 1 month before and 3 months after implantation (38 left, 2 right). Measures included: Sickness Impact Profile (SIP); adapted Parkinson's Disease Questionnaire (PDQ); Coping Response Inventory (CRI); Life Stress and Social Resources Inventory (LISRES); BAI and BDI. SIP Physical, Psychosocial and Total QOL scores at baseline and followup ( $r = .50-.75$ ,  $p < .05$ ). Coping strategy used to deal with stress of surgery was not related to QOL outcome in this sample. Improved SIP Total and Physical scores were related to improved PDQ Mobility and ADLs ( $r = .35-.72$ ,  $p < .05$ ). Improved mobility and friendship resources were related to improved Psychosocial functioning ( $r = .39$ ,  $p < .05$ ). Improvement in tremor score was not related to improved SIP Physical functioning, probably reflecting the modest role tremor alone plays in total physical functioning. Improvement in tremor scores was related to reduced depression ( $r = -.49$ ,  $p < .01$ ). Change in perceived stigma (PDQ) was associated with improvement in perceived cognition, emotional well-being, social support, and lower depression scores. It appears that improvement in tremor following DBS is associated with improvement in mood, which may reflect improved life satisfaction across multiple domains, regardless of personal style of coping. Correspondence: *Kristy A. Straits-Tröster, Kansas City Veterans Affairs Medical Center, 4801 E. Linwood Boulevard (116-B), Kansas City, MO 64128, USA.*

**J.L. ARESVIK, K. SUNDET, A.-K. SCHANKE, M.F. GJERULDSSEN, & H. BERGERSEN. The Influence of Financial Compensation on the Validity of Neuropsychological Test Profiles.**

Testing for symptom validity is recommended as a prerequisite in neuropsychological assessment whenever financial compensation is considered.

High incidence of malingering of memory impairment is reported in groups of MHI patients seeking litigation. We report data on 15 consecutively diagnosed patients with toxic encephalopathy (TE) pursuing personal injury claims, compared with data on 2 groups of individuals not seeking financial compensation: 18 brain injured patients (BI) engaged in rehabilitation, and 13 clinical controls (CC) presenting no evidence of CNS dysfunction. The patients rated themselves on symptom checklists (EMQ, GHQ), and were assessed with standard neuropsychological tests including CVLT and ROCF, and specific symptom validity measures (VSVT, TOMM). The TE group scored as impaired as the BI group on memory tests, reported significantly higher levels of subjective complaints than the other two groups on symptom checklists, and presented higher evidence of invalid test protocols as defined by their TOMM performance: 5/15 TE participants (33%) compared to 1/18 BI patients (6%) and 0/15 CC patients (0%) scored below the recommended cut-off score for valid responding. Only modest convergence was found between scores on the TOMM, the VSVT, and other suggested indicators of invalid test performance. It is concluded that the risk of obtaining invalid test profiles should be routinely assessed in patients with suspected toxic encephalopathy seeking financial compensation. However, claiming evidence of malingering should be warned against unless a systematic pattern of invalid test profile is found. Correspondence: *K. Sundet, Department of Psychosomatic and Behavioral Medicine, The National Hospital, 0027 Oslo, Norway.*

**D. BARTRÉS-FAZ, C. JUNQUÉ, C. BOUCARD, C. SUMMERFIELD, A. LÓPEZ-ALOMAR, N. VALVENY, P. MORAL, & I.C. CLEMENTE. Relation of ACE Gene Polymorphism to Prefrontal Dysfunction in AAMI Subjects.**

Angiotensin converting enzyme (ACE) is a key enzyme in the renin–angiotensin system. ACE gene (17q23) presents an insertion (I)–deletion (D) polymorphism. The presence of the D allele has been associated with higher ACE serum levels, lower life expectancy, cerebrovascular disease and cognitive impairment in the elderly. Recently it has been shown that subjects with age-associated memory impairment (AAMI) exhibit neuropsychological deficits in tests of frontal lobe function in addition to their declarative memory problems. Our objective was to investigate if the D allele was associated with higher cognitive impairment in a sample of 75 AAMI participants. We compared 65 carriers of the D allele (D/D and D/I genotypes) and 10 homozygous for the I allele on neuropsychological tests of memory and frontal lobe functions. There was no statistical differences in age, mood state, years of education, and in short and long term scores of any of the following declarative memory tests: Rey Auditory Verbal Learning Test, Visual Reproduction from Wechsler Memory Scale–Revised (WMS–R), Visual Paired Associates (WMS–R) and Logical Memory (WMS–R). Tower of Hanoi was used to assess executive function. We found significant differences in the time needed for solving the test and in the number of movements. I/I participants solved the test faster ( $t = 2.79$ ;  $p < .01$ ) and with fewer unnecessary movements ( $t = 5.15$ ;  $p < .0001$ ) when compared to D carriers. Our results suggest that ACE polymorphism can contribute to frontal lobe impairment seen in AAMI patients but not to their declarative memory deficit.

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**K. LAWSON & N.A. DEFILIPPIS. Applicability of Sternberg's Methodology to Executive Assessment**

Sternberg's triarchic theory of intelligence has generated a great deal of interest as a potential alternative approach towards ability assessment. Of particular interest to neuropsychology is the description of creative and problem-solving abilities, which in many ways seem to describe the psychometrically elusive concept of "executive functioning." This study attempted to evaluate the Triarchic Abilities Test, developed by Sternberg, as a possible tool in assessing executive functioning. A review of the voluminous existing literature on the theory revealed minimal empirical data and severe deficiencies in the test itself, which precluded the use of all but

the creative functioning subtest. These problems included a lack of scoring methods; test content that clearly did not assess professed abilities, and nonconformance with basic psychometric requirements. Since no norms were available, the creative test was given to 46 normal adults in an attempt to obtain information on demographic relationships of the test. Results indicated a significant correlation with age ( $p < .01$ ) with the younger group performing better. No correlation with age was found but a trend indicated better performance with lower levels of education. These were unexpected findings, which did not lend construct validity to the test. These findings and the above mentioned psychometric limitations of the test raise serious questions concerning the replicability of validity data on the test presented by its author. Suggestions for further test and theory development are given.

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**C.A. SMITH, C.L. GROTE, M.L. MATTINGLY, E.K. KOOKER, D.C. BERGEN, A.M. KANNER, & M.C. SMITH. Executive Dysfunction in Temporal Lobe Epilepsy.**

Temporal lobe epilepsy (TLE) has been argued to influence performance on the Wisconsin Card Sorting Test (WCST). Specifically, "frontal-like" performance has been found to vary according to dominant or nondominant temporal epileptiform foci. While there is general agreement that TLE affects extratemporal functioning, the relationship between lateralized TLE and frontal systems dysfunction remains equivocal as contradictory results have been reported. We explored the relationship between TLE and frontal lobe dysfunction in a sample of patients with either temporal or frontal lobe pathology. Fifty-three epilepsy patients were administered the WCST as part of a presurgical neuropsychological evaluation. Forty-six percent of the participants with frontal foci demonstrated frontal dysfunction ( $>20$  perseverative responses), while 36% with temporal foci demonstrated frontal dysfunction. We did not find an association between frontal-like dysfunction and lateralized temporal lobe pathology as there were no significant group differences (left temporal, right temporal, and frontal) on the number of categories completed, the number of perseverative responses made, or the number of perseverative errors incurred. While 14 of the 38 participants with temporal lobe epilepsy demonstrated impaired frontal systems, the specific origin of temporal epileptiform activity did not differentiate performance. This supports more recent research that did not find a relationship between lateralized temporal lobe epileptiform activity and frontal dysfunction. Theoretically, this would suggest that, while frontal systems are negatively affected by temporal dysfunction, it is likely that this is due to the global disruption of neural integrity, rather than the direct influence of epileptiform activity on temporal/frontal neural pathways.

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**M. JELICIC, M.M.A. DERIX, C. HENQUET, & J. JOLLES. Test-Retest Stability of the Behavioral Assessment of the Dysexecutive Syndrome (BADS) in Psychiatric Patients.**

The Behavioral Assessment of the Dysexecutive Syndrome (BADS) is a relatively new test designed to assess executive functions. The BADS consists of 6 tests and is considered to be "ecologically valid." We studied the test-retest stability of the BADS in a group of 20 adult psychiatric patients with different etiologies (e.g., personality disorders, schizophrenia, affective disorders). Patients were administered the BADS twice—with an interval of 3 weeks. The test-retest correlations were low for 2 tests, moderate for 1 test, and high for the remaining 3 tests and the overall BADS score. Compared with the initial test session, patients performed significantly better on 2 tests (those with low test-retest correlations) and the overall BADS on the repeat administration of the BADS. Our results suggest that, in clinical practice, the BADS should not be administered on 2 occasions a few weeks apart.

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**T. KONDEL. Prospective Memory in Schizophrenia: Impairment of Frontal Executive Systems?**

Many recent studies have documented a memory deficit in schizophrenic patients; however, all of these studies have examined retrospective memory, that is, memory for past events. By contrast, no study has examined the prospective memory abilities of schizophrenics, namely, the ability to remember to remember. Goshcke and Kuhl report that normals are faster to recognize words from simple scripts when they are told that they may have to later perform the described action (prospective script)—termed the *intention superiority effect* (ISE). They suggest that this may be mediated by the frontal lobes. Given the well-documented frontal lobe dysfunction of schizophrenics, a paradigm was used to investigate the ISE in schizophrenics with and without executive dysfunction. In the current study, 20 schizophrenic patients (RDC criteria), who have WAIS IQs within the normal range, were twice tested in the Goshcke and Kuhl paradigm with a 2-week interval between sessions. Analysis of patient RTs revealed that only those schizophrenics with normal executive function (on verbal fluency and cognitive estimates) showed a trend towards ISE; however, all patients showed an ISE to semantically related distractor words. It is concluded that schizophrenics with executive dysfunction have an impaired ability to form specific intentions; however, like schizophrenics with intact executive function, they retain the ability to form more generalized intentions.

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**N. BARRANTES-VIDAL, M. JODAR, B. CAPARRÓS, & J.E. OBIOLS. Differential Performance of Adolescents With High and Low Schizotypy Scores on the Wisconsin Card Sorting Test.**

*Introduction:* Deficits in executive functions have been consistently found in schizophrenic patients, whereas mixed results have been found in schizotypal individuals. Findings in normals who are deviant in schizotypy scales suggest a mild deficit, but they are also contradictory. These findings have been associated with the prefrontal abnormalities found in schizophrenia spectrum disorders. *Methods:* A sample of 126 normal adolescents coming from a larger ongoing longitudinal project was analyzed ( $M$  age = 17.6;  $SD = 0.77$ ). Participants had been recruited from the school population. The Wisconsin Card Sorting Test was used to assess a set of executive functions and the Oxford-Liverpool Inventory of Feelings and Experiences gave us a score for each schizotypal dimension: Unusual Experiences, Cognitive Disorganisation, Introverted Anhedonia, Impulsive Nonconformity. *Results:* Mean comparisons above and below the median split of each dimension were carried out. They showed (1) a trend for individuals with high cognitive disorganization to get less correct answers and categories, more perseverative answers, and a lower CLR, (2) a surprising trend towards significance for probands with high positive schizotypy to have less nonperseverative errors, perseverative errors, and trials to complete 1st category, (3) no differences in the remaining dimensions. *Conclusions:* Against our expectations, negative schizotypal participants did not present a worse WCST performance. The relationship with cognitive disorganization is confirmed although the magnitude of the difference is small. However, it must be recalled that these participants are not ill and belong to the general population. The most intriguing result is the trend towards superior performance of positive schizotypals.

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**E. STUYVEN & M. GHYSELINCK. Automatic and Voluntary Saccadic Eye Movements: Implications for the Action-Planning Process.**

The action-planning theory of Hommel states that for every voluntary action an action-plan is constructed. This is an integrated representation of stimulus, response, and effective characteristics (i.e., action-codes). Furthermore, according to the binding principle of Prinz, these codes are held together in an action-concept until the to-be-executed action is finished. This implies that codes used in 1 action-plan are less available for plan-

ning another intentional action. Recent evidence has shown this effect by using an ABBA design. Here Task A is planned and prepared for, but not executed until Task B is responded to. When the 2 tasks share relevant features, 1 expects a hampered performance on Task B. We found that the use of saccade tasks are a good means of examining the principles at work in the action-planning and code-binding processes. Saccades can be executed by the caudal superior colliculus (CS) or the frontal eye fields (FEF). The first is supposed to be active during automatic prosaccades, while the latter is implied in intentional saccades. Using different saccade tasks within the ABBA paradigm, we found that for performing intentional saccades, an action-plan is formed. A reflexive like prosaccade, on the other hand, doesn't require the formation of an action-plan. These results prove to be robust over variations of SOA, stimuli, and task order. Furthermore, the SOA manipulation revealed that (1) all action codes are first activated and only binded after approximately 100 ms, and (2) strategic processes can influence action planning.

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**T. NISHIKAWA, J. OKUDA, K. OHNO, J. JAMSHIDI, H. TOKU-NAGA, I. MIZUTA, T. YOSHIMINE, H. TANABE, & M. TAKEDA. Conflict of Intentions in 3 Cases of Callosal Damage.**

Three patients with anterior callosal syndrome exhibited disturbance in performing actions of their own volition. Although this behavioral motor disorder is a minor sign of "diagnostic dyspraxia" originally described by Akelaitis, the patients' symptoms did not necessarily include intermanual conflict but manifested as disturbances of whole bodily actions, including inability or marked delay in initiation of actions, interruption of actions, performance of wrong actions with inability to correct, and repetitive actions. The patients reported that they could not act according to their own wishes because of the occurrence of a contrasting desire for action. We have coined the term "conflict of intentions" for this behavioral disorder. The common lesion of the 3 patients was present in the posterior half of the body of corpus callosum, however, there was no significant involvement of medial cerebral cortexes in all cases. The behavioral disorder manifested about 1 month or more after the onset of callosal damage. The traits of each cerebral hemisphere may become exaggerated during the course of reorganization of its neural systems after partial callosal disconnection and the drifts of both hemispheres to react the environment arise up to the consciousness simultaneously without interhemispheric adjustment in the physiological level. Conflict of intentions may thus be elicited.

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**M. R. NIEUWENSTEIN. Relationship Between Symptom Dimensions and Wisconsin Card Sorting Test Performance: A Meta-Analytic Approach.**

Impaired executive functioning is considered a core neurocognitive deficit in patients with schizophrenia. However, some 50% of patients with schizophrenia perform as well as normal controls on the most widely used test of executive functioning, the Wisconsin Card Sorting Test. Some authors have suggested that the negative, positive, and disorganization dimensions may account for this heterogeneity. Specifically, negative symptoms have been associated with greater levels of impairment than other symptom dimensions. In order to examine the validity of these hypotheses we performed meta-analyses on the published literature on relationships between symptom dimensions and WCST performance. We analyzed correlations with WCST variables number of categories achieved and perseverative errors. The results revealed weak associations between symptoms and WCST performance. Furthermore, no significant differences were found between the neurocognitive correlates of negative symptoms and classic conceptualizations of positive symptomatology. Disorganization symptomatology showed significantly stronger associations with perseverative errors than other types of symptomatology, while the association with number of categories achieved did not differ for the three dimensions of schizophrenia symptomatology. Overall, our findings provide only limited support for

the idea that different clusters of symptoms are related to distinct levels of neurocognitive impairment. Rather, symptomatic expressions and impaired executive functioning seem related to relatively different disease processes, with disorganization symptomatology as a primary interface. Correspondence: *M.R. Nieuwenstein, Moezeldreef 303, 3561 GD Utrecht, The Netherlands.*

**S. DAB & P. FERY. Two Aspects of the Search Memory Processes: 2 Case Studies.**

The understanding of confabulation and memory processes may be increased by comparing confabulating and nonconfabulating brain-damaged patients. In the present study, P.A.D., a confabulating patient was compared to D.E.L., a nonconfabulating patient. In the literature, the difference between these 2 kinds of patients is attributed to an impaired ability to monitor the memory output. According to 1 hypothesis, confabulators have a monitoring impairment whereas amnesics have a search deficiency; according to another hypothesis, confabulators have both a memory search and a memory monitoring impairment whereas the others only exhibit a search deficiency. Our findings challenge both of these hypotheses because the confabulating patient does not have any memory or cognitive monitoring problem. The 2 patients have similar patterns of verbal memory performance: they have impaired free recall, better cued recall, and normal recognition and they use the semantic information during memory retrieval. In addition, both patients performed reasonably well in tasks assumed to be sensibly to frontal lesions. We discuss the case studies in terms of memory process impairment (encoding vs. retrieval) and make alternative hypotheses on the difference between confabulating and nonconfabulating patients. Moreover, it is argued that there are 2 distinct components of search processes.

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**J.N.S. ABREU & W.G. HORTA. Severe Isolated Retrograde Amnesia After Postencephalitic Bilateral Temporal Lobe Damage.**

Isolated retrograde amnesia without or almost no anterograde amnesia is relatively rare. It is well recognized in functional or psychogenic amnesia, but more recently an increasing number of cases with frontal and more anterior temporal lesions have been reported. This disturbance can be observed as a viral encephalitis sequel. Right brain damaged structures are generally associated with episodic memory loss while left brain damage is linked to semantic retrograde amnesia. Searching for anatomic substrates for retrograde amnesia, we describe a 24-year-old man, A.C., who had a herpes encephalitis with no posterior significant anterograde amnesia but with a severe retrograde memory problem, with information loss of all his life prior to illness. Formal neuropsychological assessment and interviews were done. General intelligence, anterograde memory, calculation, attention, planning and performance abilities were preserved. A severe retrograde amnesia was observed with relatively more episodic than semantic memory loss, extending from his childhood through adult life until the illness episode. It included lack of affectivity with relatives, friends and personal life. Besides, he had begun to reveal an ability to draw from copying drawings never observed. Despite the CT Scan and MRI being normal, an EEG revealed focal slow waves (theta) in temporal poles, predominantly on the left side, with no frontal lobe damage evidence. We concluded that bilateral temporal lobe damage only can produce episodic and semantic retrograde amnesia. Whereas semantic memory loss could be due to left temporal pole failure activation, episodic memory impairment could result from bilateral temporal lobe neural lesion.

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**S. CAÑIZARES, T. BOGET, E. ELICES, S. ARROYO, J. RUMIA, & M. SALAMERO. Memory Changes After Anteromedial Temporal Lobectomy: A 1-Year Follow-Up Study.**

*Objective:* To characterize the memory change after anteromedial temporal lobectomy (ATL) in epileptic patients with hippocampal sclerosis 1 year after surgery. *Participants:* The sample was composed of 26 patients who

underwent standard anteromedial temporal lobectomy (ATL; left = 12, right = 14) for the relief of intractable seizures. All of them showed left-hemisphere speech dominance on Wada test and confirmed hippocampal sclerosis on pathological analysis. *Procedure:* The neuropsychological assessment included visual and verbal pairs associated, logical memory and visual reproduction at immediate and delayed recall from the Wechsler Memory Scale Revised (WMS-R). Percent retention scores served as a measure of delayed recall. Patients were tested pre- and 1 year postsurgery. *Statistical analysis:* Multivariate analysis of variance for repeated measures for verbal and visual domains were performed to compare type of task (memory vs. learning), recall condition (immediate vs. delayed), assessment time (pre- vs. postsurgery) and the interactions among them and with side of surgery (left vs. right). *Results:* None of the main effects reached statistical significance. The only statistical significance interaction effect found was side of surgery and assessment time for verbal domain. Right group displayed some pre- to postsurgery gains on verbal memory tasks whereas left group exhibited the reversed pattern or remained at preoperative level. *Conclusions:* Left anteromedial temporal lobectomy (ATL) in patients with hippocampal sclerosis impairs slightly some aspects of verbal memory. At 1-year follow-up, however, the decline is not clinically meaningful.

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#### I. TAUSSIK, M.A.M.P. PARENTE. Mild Cognitive Impairment (MCI) and Prospective Memory (PM).

Prospective memory is the processing that supports the realization of delayed intentions and its associated actions, composed of event-related situations and time-based recollections. Self-initiation constitutes the main activity in order to successfully perform the future intentions and is hypothesized to be most vulnerable to MCI. MCI is diagnosed when marked memory complaints occur without other related cognitive impairments. *Method:* Twenty participants with MCI (Mini-Mental > 27) were compared to 20 control participants without memory complaints, matched by age, sex, and education. The assessment battery was composed of Subjective Memory Questionnaire, Bennett-Levy J. Powell, Mini Mental Examination of Folstein, Depression Scale of Hamilton and a Prospective Memory Test especially designed for this study. This test consists of the reading of a story where the participant has to perform several self-initiated activities according to the proposed instructions. These are divided in different categories: event related actions, and time based actions, as well as repetitive and unique tasks. *Results:* Comparative studies in both populations show a statistically greater difficulty for time-based actions than for event-based actions. This result confirms the existence of a supervisory attentional system (SAS) proposed by Shallice and Burgess and is in accordance to works that show a higher vulnerability of the temporal aspects of PM.

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#### F.F. LEFEVER & S. PEERY. Exploratory Use of ReMeTe Paired With GoodFig, an Analogue of the Recognition Memory Test Pairing of Word and Face Tests, With Spanish-Speaking SAH Patients and Bilingual Normal Volunteers.

A diagnostically useful contrast between verbal and visual memory requires verbal items not easily "imaged" and visual items not easily verbalized; e.g., judging laterality of temporal lobe epilepsy focus with Warrington's Recognition Memory Test (RMT) Word vs. Face. ReMeTe, a Spanish analogue of RMT Word with words more strictly nonimageable than RMT items, was paired with GoodFig, a visual recognition test with items hard to verbalize, correlating with RMT Face, but without culture-bound items (faces of white English men), easier to copy for use in low-budget settings. As with GoodFig and RMT Word, GoodFig and ReMeTe were not correlated for mostly bilingual normal volunteers, nor for Spanish speaking SAH patients. Neither English nor Spanish fluency were correlated with ReMeTe, but combined fluency was, and disparity between

languages (in either direction) was negatively correlated. Years of school did not correlate with GoodFig, but did with ReMeTe. For SAH patients, GoodFig did not with WMS VR (nor did WMS with Rey-Osterrieth) but did with Rey-Osterrieth Intermediate. ReMeTe did not correlate with SVLT (Spanish analogue of CVLT) but combined GoodFig and ReMeTe did, supporting the view that visual memory may contribute to CVLT success, making it unsuitable as a pure verbal memory test.

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#### R.P.C. KESSELS, A. POSTMA, L. J. KAPPELLE, & E.H.F. DE HAAN. Selective Impairments in Object-Location Memory After Ischemic Stroke.

There is evidence that spatial memory, more specifically memory for object locations, can be subdivided into 3 separate processes: (1) encoding of precise metric positions, (2) binding object identities to (relative) positions, and (3) a mechanism that integrates these 2 processes. Previous research has demonstrated selective effects on these 3 processes at a functional level. Moreover, there is evidence that these object-location memory processes as well as other specialized aspects of spatial memory may be supported by different brain structures. To further support the aforementioned distinction, it was the purpose of the current study to find evidence for selective deficits in either of the 3 spatial-memory processes in stroke patients, while other processes are intact. A group of 24 ischemic stroke patients was tested with a paradigm that selectively assesses these 3 processes. The patients studied computer displays containing pictures of everyday objects on different locations, that had to be relocated subsequently (both immediately and after a 3-min delay). Moreover, object-identity memory and visuospatial construction was assessed. Finally, the Corsi Block-Tapping Task and Oxford Stylus Maze Test were used as standard spatial memory tests. The results showed that of these 24 patients, 8 patients had selective impairments in object-location memory processes. This is in line with previous findings demonstrating selective effects of experimental manipulations, and supports the notion that there may be 3 separate cognitive processes within memory for object locations that can be selectively affected by brain dysfunction. The clinical relevance of these findings will be discussed.

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#### A. ESTÉVEZ-GONZÁLEZ, J. KULISEVSKY, A. BOLTES, L. RAMI, N. FUENTES, & C. GARCÍA-SÁNCHEZ. MMSE and Memory Performance in Subjects with Subjective Memory Complaints.

The relationship between subjective memory complaints, objective memory performance and Mini-Mental State Examination (MMSE) is not well established. Thirty-five nondemented participants (age range 60–85 years) with subjective memory complaints, but without familiar antecedents of dementia, depression or neurologic illness were assessed with a comprehensive memory battery and other cognitive functions (attention, language, executive, etc.). Memory performance was analyzed in 2 groups. Group 1: (10M:15F) with MMSE score of 27–30 ( $M = 28.6 \pm 1.0$ ). Group 2: (4M:6F) with MMSE score of 22–26 ( $M = 24.9 \pm 1.2$ ). There were no significant differences between groups on age, years of education ( $M = 7.5 \pm 3.1$ ) and Geriatric Depression Scale. Group 2 performed significantly lower on tasks of working memory ( $p < .001$ , a paradigm adapted from Smith et al.;  $p < .05$ , Sternberg's paradigm), retrospective and prospective memories ( $p < .05$ ; paradigms adapted from Huppert & Beardsall), semantic memory ( $p < .001$ ; paradigms adapted from Shimamura & Squire;  $p < .01$ , Information-WAIS), autobiographical memory ( $p < .001$ , adapted from Kopelman) and nondeclarative memory ( $p < .001$  Priming-Picture Fragment Completion;  $p < .001$ , Porteus' mazes). In this study MMSE score lower than 27 can confirm objective memory impairment in subjects nondemented with memory complaints. In addition, our results also suggest that the recommended cut-off score of more than 23–24 (MMSE) is not enough to include literate participants as controls in studies of dementia. A long-term follow-up study of these participants with memory complaints

is presently conducted to study possible differential cognitive decline according to MMSE score.

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**S. PALSSON, H. PALMASON, TH. J. JONSDOTTIR, J. SNAEDAL, & TH. JONSSON. Memory Impairment in Siblings of Alzheimer's Disease Patients.**

Previous studies have shown that 1st-degree relatives of Alzheimer's disease (AD) patients have an increased risk of developing dementia and, that subtle cognitive impairment can be detected through neuropsychological tests before overt clinical signs appear. The purpose of this study was to examine if there is subtle cognitive impairment in siblings of AD patients (*sibs*) in Icelandic pedigrees selected for genetic research. The participants were 67 *sibs* with family history of dementia and 30 normal controls (NC) without known 1st-degree demented relatives. Age range in both groups was 55 to 79 years. Cognitive abilities were assessed by neuropsychological tests of orientation, verbal and nonverbal memory, abstract reasoning, language, concentration and mental speed, and visuoperceptual and constructional abilities. Health information was obtained from participants by a questionnaire. Participants with known central or peripheral nervous system disorders were excluded from the study. The results showed that *sibs* scored significantly lower than the NC group on immediate and delayed recall of Logical Memory and hard pairs in Associate Learning of the Wechsler Memory Scale. They also scored significantly lower on delayed recall of the Rey–Osterrieth Complex Figure Test. The *sibs* show no significant impairment on other neuropsychological measures. These findings indicate that undiagnosed AD siblings tend to have greater verbal and nonverbal memory problems than those without 1st-degree AD relatives. The memory impairment among the *Sibs* could indicate an early phase of AD. Correspondence: *Smari Palsson, Thjonustumidstod rannsóknaverkefna, Noatun 17, Reykjavik, 105 Iceland.*

**P. BRUGGER, K.I. TAYLOR, A.U. MONSCH, & D.P. SALMON. Semantic and Phonemic Sequence Effects in Patients With Dementia of the Alzheimer Type and Huntington's Disease: A Double Dissociation.**

Dementia of the Alzheimer type (DAT) patients generally perform worse on category than letter fluency tasks, whereas Huntington's disease (HD) patients either perform these tasks equally poorly or exhibit overproportional impairments in letter fluency. We developed a random lexical generation test, the "Hat–Cat–Dog" Test (HCDDT), to further investigate patterns of semantic *versus* phonemic deficits in DAT and HD patients. Seventy-two native English speakers were administered the HCDDT and Dementia Rating Scale (DRS): 20 elderly normal controls demographically matched to 20 DAT patients and 16 middle-aged normal controls demographically matched to 16 HD patients. Both patient groups attained comparable scores on the DRS. Participants were shown a die with 2 hat, cat and dog pictures and were then instructed to close their eyes and guess which item appeared on the die's top face following each of the 60 rolls by the experimenter. All groups named "hat," "cat," and "dog" equally frequently. Three pairings of consecutive responses were of interest: semantic ("cat–dog"/"dog–cat"), phonemic ("hat–cat"/"cat–hat"), and neutral ("hat–dog"/"dog–hat"). Since healthy individuals avoid repeating meaningfully associated response alternatives (i.e., "repetition avoidance"), the increased frequency of semantic or phonemic pairings would reflect selective deficits in encoding semantic or phonemic information, respectively. DAT patients produced more semantic and HD patients more phonemic pairings compared to their respective control groups. These results indicate selective deficits in the appreciation of semantic information in DAT and phonemic information in HD patients.

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**M. GUERREIRO, C. GARCIA, & A. CASTRO-CALDAS. Progressive Aphasia: Is It a Predictor of Dementia?**

We studied 18 cases with the clinical diagnosis of probable primary progressive aphasia (PPA). Based on neuropsychological and behavioral as-

essment, on activities on daily living only 15 cases fit diagnoses of PPA. In the group with neuropsychological diagnosis of PPA, we found that the age of onset was lower than 65 years, the evolution time was about 3.0 years, and half of the cases had nonfluent speech. The first symptoms were anomia and communication difficulties due to articulatory disorders. Comprehension of simple verbal commands was usually intact. Patients with PPA also had impairments on reading, writing, praxis, and constructive abilities. We compared cases with the diagnosis of PPA with 36 cases of Alzheimer's disease in order to characterize demographic and neuropsychological differences between the 2 groups. We are currently studying the long term evaluated of PPA cases to identify predictors of evolution to dementia. The neuropsychological assessment is essential to the diagnosis of PPA and that syndrome has a heterogeneous presentation. This heterogeneity relates to the controversy over PPA as a separate clinical entity from Alzheimer's or Pick's diseases.

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**P. HARRIS, M. FELDMAN, M. DRAKE, F. TARAGANO, & R. ALLEGRI. Memory Complaints in the Diagnosis of Dementia.**

*Background:* Reduced ability to remember facts and events of everyday life is a common complaint in the elderly and is the first sign of Alzheimer's disease (AD). *Objective:* The aim of the present research was to study the interrelationship between severity of memory complaints (MC), family reports, and performance in memory tests. *Material and methods:* One hundred and seventy-three patients (41 age-associated memory impairment (AAMI), 32 Alzheimer's disease, 29 vascular dementia, 14 frontotemporal dementia and 57 other diagnosis) and 30 normal controls were studied using the Subjective Memory Questionnaire (modified version), an objective memory battery (a modified version of Signoret's Memory Battery) and the Hamilton depression scale. *Results and conclusions:* AAMI participants reported more severe MC. No relationship was found between severity of MC and age, sex, or educational level. Patient's MC did not correlate with objective memory battery. A strong correlation was found with Hamilton depression score. Caregiver memory reports correlated with objective memory preferences. Depressive features in AAMI and anosognosia in dementia patients would explain these results. These data suggest that family report is the best predictor of memory performance.

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**M. MATARÓ, M.A. POCA, J. SAHUQUILLO, & C. JUNQUÉ. Effects of Shunt Surgery on Cognition and Quality of Life in Normal Pressure Hydrocephalus Patients.**

Normal pressure hydrocephalus (NPH) is a common dementing illness that can be partially reversed with treatment. Previous literature has not been very optimistic about the results of the surgical treatment due to its high morbidity associated and the lack of significant cognitive improvement. We present the results of 45 patients with NPH who underwent shunting. There were 28 male and 17 female patients with a mean age of 67.98. In 25 patients the hydrocephalus was idiopathic, whereas in the rest it was of secondary type. All patients had ventricular dilatation and at least 1 of the following symptoms: gait dysfunction, sphincter incontinence, and/or cognitive deterioration, unexplained by other neurological disease. In all patients intracranial pressure was continuously monitored with an epidural sensor. All patients received a neuropsychological assessment presurgery and 6 months later. Before treatment, only 8 patients were independent for daily life activities, 21 required some help and 16 were totally dependent. Six months after shunting, 19 patients were able to cope with daily life activities, 18 were partially dependent and the remaining 8 patients remained dependent. *T* test for paired samples showed significant improvement in the Wechsler Memory Scale and in Daily Live Activity scales, as well as in gait and sphincter functioning. There were no surgical complications in 87% of the patients. One patient suffered a subdural haematoma and 3 patients suffered from technical complications without any clinical morbidity. Our results show that neuropsychological deterioration can be

partially reversed and the quality of life greatly improved by shunt treatment with little clinical morbidity associated.

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**N. MOTOMURA, Y. TOMOTA, H. AKAGI, & T. SEO. Direct Priming in Demented Patients.**

Direct priming refers to phenomenon that the processing of a target stimulus is facilitated when the identical stimulus has been previously presented. A word-stem completion task is often used in direct priming task, in which participants are required to fill missing letters to make a word. In patients with dementia, besides explicit memory being profoundly impaired, language, reasoning, and other cognitive functions are impaired. In Japan there are few studies that investigated direct priming in dementia. Therefore, we studied direct priming in patients with dementia from the standpoint of familiarity of words. We developed a new direct priming task, which is constructed from 3-syllable Japanese Kana letters and contains high familiarity words according to Chihara. We administered this task to 10 normal controls (C group), 29 patients with Alzheimer's disease (DAT group), and 31 patients with vascular dementia (VD group) in 30 min after the presentation of the primer words. Each group was matched for age, sex, and educational level. Every group demonstrated the priming effects and the priming effect of low familiarity words was larger than that of high familiarity words in the C group. The priming effect of high familiarity task demonstrated no statistical differences among the control, mild, and moderate dementia groups. However, the severely demented group showed a smaller priming effect. The priming effect in the low familiarity task revealed significant deficits in moderate and severe dementia. These results suggest that word familiarity influences the direct priming effect and that the semantic disturbance in dementia may relate to direct priming. Correspondence: *Naoyasu Motomura, Department of Health Science, Osaka Kyoiku University, 4-6981, Asahigaoka, Kashiwara, Osaka 582-5852, Japan.*

**G.E. SMITH, B. BOEVE, J. McCORMICK, & T. RUMMANS. Dementia Rating Scale Cut-Offs in Nonagenarians.**

We examined the performance of Dementia Rating Scale (DRS) cut scores for dementia in persons over age 90. We attempted comprehensive neurologic evaluations, neuropsychological testing, and functional assessments on all residents of Rochester, Minnesota that are 90–100 years of age. Diagnoses of *normal* (NL), *mild cognitive impairment* (MCI), or *dementia* (Dem) or other were assigned. Only the Short Test of Mental Status (STMS) was used by the neurologist to assist with clinical diagnosis. Out of 292 possible participants, 97 individuals were deceased before our scheduled appointment, 20 had suffered at least 1 cerebral infarct or were unclassifiable, and 58 individuals refused or were unable to participate. Of the remaining 125 individuals, 54 were diagnosed as NL, 14 met criteria for MCI, and 57 met criteria for Dem. The average age was 93.4 (2.4), and the average education is 13.5 (3.54) with no significant differences between groups ( $p > .05$ ). Nursing home or assisted living residence was present for 26% of NL, 29% of MCI, and 77% of the Dem samples. The mean scores on measures for NL, MCI, and Dem groups are as follows, respectively: MMSE: 28, 26, 18; DRS: 133, 122, 100. The standard DRS cut score of <124 correctly classified 31/31 of dementia patients, and 36/43 (84%) of controls. But adjusting the cut-off to <118, 94% of dementia patients and 100% of normals were correctly classified. These data suggest DRS cut-offs continue to have good utility in nonagenarians. Slight adjustments for age add nominal improvements in classification.

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**E.C.C.M. KORTEN, M.M.A. DERIX, F.R.I. VERHEY, & J. JOLLES. Cortical and Subcortical Dementia: Valid Concepts?**

In the 1970s the concept of subcortical *versus* cortical dementia was introduced. From the 1980s until about 5 years ago many publications were devoted to this subject. In recent years the concept of subcortical *versus* cortical dementia seems to have gained a firm foothold in clinical re-

search, and there has been ample discussion about the validity of the concepts. We wanted to examine the clinical use of the distinction, especially whether a consensus exists between Dutch and international dementia experts. We also examined the validity of the 2 concepts in a population of 200 dementia patients. Dementia experts were presented with a list of cognitive functions, mainly based on items of Part B and C of the CAMDEX-R. For each function the experts—relying on clinical experience—had to decide whether it is impaired or unimpaired in each syndrome. For cortical dementia 100% census was reached with regard to impairment of active memory recall, learning, ideational and ideomotor praxis, and complex visuoperception. A consensus >90% was reached for impairment of retrieval of recent information, expressive language, and complex visuoperception. For subcortical dementia consensus was restricted to slowing of visual reaction time, and impaired active memory recall in combination with intact recognition. According to the experts the majority of cognitive functions in mild subcortical dementia is intact. Preliminary results of the population study show that a clearcut distinction is not possible. The results of both, related studies seem to warrant a thorough discussion about the validity of the distinction between cortical and subcortical dementia. Correspondence: *Edith Korten, Department of Neuropsychology, University of Maastricht & Psychomedical Centre Vijverdal, P.O. Box 88, Maastricht, 6200 AB, The Netherlands.*

**Y. NAKAGAWA, A. YAMADOR, M. FUJIMORI, H. KAZUI, M. IKEDA, T. NISHIKAWA, M. TAKEDA, E. MORI, & H. TANABE. Can Semantic Dementia Be Regarded as a Result of Selective Loss of Semantic Memory? Two Questions on the Theoretical Consensus.**

Semantic dementia has been theoretically attributed to a selective deficit of semantic memory with preservation of episodic memory. We experienced a patient with semantic dementia, whose symptoms gave rise to 2 questions on the theoretical definition of “semantic” dementia. The first question is concerned with whether semantic memory totally deteriorates on patients with semantic dementia. Even after the present patient had lost word representations, she was able to sustain some kind of descriptive information that primarily associates with them; she recognized each word with using preserved knowledge of their relationships. Thus, not only “what” system but also “where” system could be involved in retention of descriptive information, so that semantic dementia could be regarded as a deficit of a part of semantic memory. The second question is concerned with the possibility of primal degradation of episodic details of a perceived stimulus, with preservation of temporospatial outline. Further investigation confirmed that 5 patients with semantic dementia, whose symptoms were restricted to words, could not retain details of visual meaningless materials as episodic memory, which may be minimally influenced by deterioration of semantic information. This result indicates that patients with semantic dementia do not totally preserve episodic memory. These 2 findings suggest that symptom of semantic dementia could be explained by an impairment on “what” information with sparing of “where” information, crossing over the theoretical distinction between semantic and episodic memory.

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**C. MOHR, C. RÖHRENBACH, & M. REGARD. Affective Quality of Odor Fluency.**

Odors are verbally difficult to describe and olfaction is more closely linked to emotional memory than are, for example, vision and audition. To assess and compare the quantitative and qualitative aspects of verbal associations from 2 sensory domains, we developed two (1-min) category fluency tasks, 1 consisting of the generation of olfactory associations and the other of auditory associations. Forty participants rated their responses on the fluency tasks as well as an independent group of 40 participants as either pleasant or unpleasant. Moreover, all 80 healthy right-handed participants rated their subjective emotional state on a visual analogue scale. The mean number of words generated did not differ between the 2 tasks. However, pleasant associations were significantly more frequent in the olfactory



(67.5%) than in the auditory fluency task (57.4%). Although the subjective emotional state of the participants performing the fluency tasks tended to be less happy than that of the independent raters, the former rated the generated words as slightly more pleasant. The finding of more pleasant associations in both tasks confirms previous reports and the pronounced effect in the olfactory task suggests that odors may be less cognitively coded than other sensory modalities, namely, audition. Although the majority of odors are perceived as aversive, those retrieved from memory have pleasant meaning.

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### Symposium 2/9:00–10:45 a.m.

#### THE WRITING ON THE WALL: TECHNOLOGY AND REHABILITATION

**Organizer and Chair: Barbara A. Wilson**

**B. WILSON. The Writing on the Wall: Technology and Rehabilitation.** The growth in technology has benefited rehabilitation in a number of ways and this benefit is likely to increase in the future. Cognitive rehabilitation has moved on from computers as exercise machines through to computers as communication aids, interactive task guidance systems and cognitive prostheses. The 4 papers in this symposium describe the value of technology in different areas and consider how the field may develop over the next decade. The 1st paper is concerned with the extent to which attention to motor control may be affected by the attentional demands of other (cognitive) demands. The authors describe a portable gait analysis system that can simultaneously deal with cognitive stimuli. The 2nd paper is a report of a randomized control trial with 200 people aged between 8 and 83 years, to determine the efficacy of an electronic memory aid. The 3rd paper is concerned with more sophisticated systems to help memory impaired people; it compares 2 different types of electronic organizer for cognitively impaired people. The final paper is concerned with wider ranging aspects of technology and how this can enhance quality of life in elderly people with cognitive and sensory impairment. The discussion considers the future of technology in the 21st century.

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**J. COCKBURN, P. HAGGARD, J. COCK, & C. FORDHAM. Low-Cost Gait Analysis in a Clinical Setting.**

Although the main aim of neurological rehabilitation is to facilitate recovery of the individual's ability to perform functional everyday activities, traditional separation of therapeutic roles has hindered the realization that processes of motor and cognitive recovery cannot be addressed in isolation. Recent research, however, has highlighted the extent to which attention to motor control may be affected by attentional demands of other ongoing activities. Such studies have raised important questions for evaluation of functional recovery of gait control: Does a measure of a motor parameter alone, such as 10-m walking time, give adequate information about a patient's readiness to return home? A major constraint on development of clinical assessments of cognitive–motor interaction has been the difficulty of devising reliable and affordable measures of gait analysis for use in a clinical setting. However, a low-cost, portable system has recently been developed that enables accurate on-line measurement of a number of gait parameters. Small force-sensing resistors, taped to ball and heel of each foot, record on- and off-pressure for each stride, which is transferred to a data acquisition card in a laptop computer. Simultaneously with gait trace recording, a cognitive stimulus can be presented and the verbal response recorded via the same computer. Thus precise relationships between stride onset and duration, stimulus presentation and response initiation can be computed, allowing for accurate quantification of dual-task effects within the normal therapy setting.

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**H. EMSLIE, B. WILSON, K. QUIRK, & J. EVANS. Evaluating the Value of NeuroPage® for People With Brain Injury.**

We report an evaluation of NeuroPage®, a paging device designed to improve independence in people with memory problems and executive deficits. After a successful pilot study, we conducted a randomized control trial with 200 people aged between 8 and 83 years of age. All had 1 or more of the following: memory, planning, attention, or organization problems. Most had sustained a traumatic brain injury or a stroke although a few had developmental learning difficulties and a few had a progressive condition such as dementia. The crossover design ensured some people received a pager following a 2-week baseline while others were required to wait for a 7-week period after the baseline before receiving a pager. Everyone was assessed at three time periods, baseline, 7 weeks later, and at 14 weeks after baseline. More than 3/4 of those who completed the 16-week trial were significantly more successful in carrying out everyday activities (such as self-care, self-medication, and keeping appointments) when they were using the pager in comparison with the baseline period. For the majority of these, significant improvement was maintained when monitored 7 weeks after returning the pager. We consider the relationship between successful use of the pager and other variables such as age, number of years postinsult, and neuropsychological test results.

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**N. ROGERS, P. WRIGHT, C. HALL, B. WILSON, J. EVANS, & H. EMSLIE. The Development of a Simplified Pocket Computer Memory Aid for Use by People With Nonprogressive Memory Impairment.**

We report on a study that investigates how electronic memory aids can help people with nonprogressive memory impairments restore some of their independence. Wilson et al. have demonstrated how the use of NeuroPage®, a portable paging system, was effective in reducing everyday memory problems for people with memory impairments. Our study aims to establish whether people with nonprogressive memory impairments can use pocket computers as memory aids. An electronic memory aid was developed that consisted of a diary and notebook, which enabled links to be made between diary entries and pages in the notebook. The memory aid was specifically designed to limit the demands made on memory by providing cues on the interface that reduced the learning required. The memory aid was implemented on 2 machines differing in how text was entered. The success of the memory aid was evaluated both with respect to people's ability and their willingness to use it over a 2-month period. Results are presented for 10 people, aged between 21–53 years. After 2 training sessions all the participants were able to use the diary ( $p < 0.01$ ) on both machines. The frequency of use of the diary suggested a bimodal distribution with a marked divide between high and low users. The relationship between frequency of use, neuropsychological profile, attitude and lifestyle are discussed and related to differences between the pocket computers.

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**P. GREGOR & A. NEWELL. Information Technology for Rehabilitation and as Cognitive Prostheses.**

Well-designed communication and information technology systems have great and unrealized potential to enhance the quality of life and independence of elderly people and those with cognitive and sensory dysfunction by allowing them to retain a high level of independence and control over their lives; providing appropriate levels of monitoring and supervision of "at-risk" people, without violating privacy; keeping people intellectually and physically active; and providing communications methods to reduce social isolation. Examples include: Computers are patient, consistent, and tireless, and do not become emotionally involved in a shared task and multimedia and multimodal systems can provide a very rich interaction. These systems thus have great potential in addressing the problems of memory loss and the more severe problems presented by dementia such as confusion, disorientation, profound personality changes. Communication systems using synthetic speech, predictive programs which can facilitate writing, and a range of non linguistic methods of communication, can be

used by those with speech and language dysfunction caused due to hearing loss, speech dysfunction, dementia or strokes. It is essential, however, that research work in this field should be multidisciplinary and also involve the potential users of the technology at all stages of development as partners in the research. The potential of this technology and an appropriate methodology for work in this area will be illustrated by research within the Department of Applied Computing at the University of Dundee, Scotland. Correspondence: *Peter Gregor, University of Dundee, Department of Applied Computing, Dundee DD1 4HN, UK.*

### Paper Session 11/9:00–10:45 a.m.

#### GENDER AND LATERALITY

##### T. ALLISON & E. ZAIDEL. Lateralized Lexical Decision With Smoking-Related Words: Differences Between Smokers and Nonsmokers.

We studied effects of cigarette smoking on hemispheric function using lateralized lexical decision. Stimuli were 24 smoking-related and 24 unrelated words from Jarvik et al., with 48 matched nonwords. On each trial, 1 underlined stimulus was the target; a distractor appeared simultaneously in the opposite visual field (VF). This paradigm yields independent decision in each VF (hemisphere). Four groups were tested: *never-smokers* ( $N = 7$ ), *ex-smokers* ( $N = 13$ ), *smokers abstaining for 16 hr* ( $N = 11$ ), or *smoking before testing* ( $N = 15$ ). Reaction times were analyzed by ANOVA, with group (never-smoker, ex-smoker, abstaining, and smoking) between-subjects, target and distractor (smoking-related, unrelated, nonword), and VF of target (left, right) within-subjects. We found an interaction between  $VF \times Target$  ( $p < .05$ ); this right VF advantage (RVFA) for words indicates degree of hemispheric specialization. There was a main effect of target ( $p < .01$ ), indicating fastest response to smoking-related words and slowest to nonwords; contrary to prior studies, this was not affected by abstinence. Indeed, we found no differences between the two groups of smokers, nor between ex- and never-smokers. Upon collapsing across groups, nonsmokers, but not smokers, showed an RVFA ( $VF \times Target \times Group$ ,  $p < .01$ ). Our results show that reduced hemispheric asymmetry in smokers is not due to (1) differences in callosal transmission, as there were no significant interactions between distractor, target, and group ("lexicality priming"); (2) acute effects of nicotine, as reduced asymmetry persisted after 16 hr of abstinence; or (3) genetic effects, as longer-term quitting normalized performance.

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##### S.H. OFTE & K. HUGDAHL. Right–Left Discrimination: Sex and Handedness Differences.

To experimentally study right–left discrimination, a paper-and-pen test has been developed in our laboratory, consisting of line drawings of a human figure with 1, both, or no arms crossing the sagittal axis. The test has 3 sections: the line drawings viewed from the back, the front, or randomly alternating between the back and front drawings. The task is to indicate the right or left hand of the figure according to an instruction (R or L) underneath each of the figures. In the present study we examined differences between the sexes and effects of handedness. The basic design was  $2$  (gender)  $\times 2$  (handedness)  $\times 3$  (figure orientation: back view, front view, and alternating view)  $\times 3$  (arm position: no, 1, and both arms crossing). There were 72 participants, 36 right-handers (18 male, 18 female), 36 left-handers (18 male, 18 female). There was a significant main effect of gender [ $F(1,67) = 6.25, p < .01$ ]; men performing better than women. However, the men performed better than women only in the left-handed group ( $p < .035$ ). There was also a significant main effect of figure orientation [ $F(2,134) = 32.70, p < .001$ ], and of arm position [ $F(2,134) = 18.03, p < .001$ ]. Further analysis showed that both arms crossing the sagittal axis in the Alternating views condition was the most difficult condition ( $p < .001$ ).

The findings are discussed in relation to theories of handedness and lateralization.

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##### J. YONKERS & A. HERLITZ. Androgens and Visuospatial Tasks in Men.

Differing levels of androgens in young men have previously been linked to visuospatial task performance. The aim of our study was to examine how, in men, androgens and visuospatial ability change throughout the age span and how relationships between age and hormone level can impact performance on visuospatial tasks. Four hundred and forty-two healthy men between the ages of 35 and 85 were tested on the WAIS–R block design task, fluency tasks, and on a number of episodic, semantic and procedural memory tasks. Blood was drawn for analysis of total testosterone, free testosterone, and DHEA. As expected, the overall cognitive performance, together with hormone levels, decreased as a result of increasing age. In addition, results showed that men with relatively high levels of free testosterone performed at a lower level than men with relatively low levels of free testosterone on the block design task across the age span. Preliminary further analysis indicated that levels of DHEA and free testosterone were related to performance on some other cognitive tasks in older, but not in younger men. The results suggest that visuospatial ability may rely on free testosterone levels, but that the mechanism of androgen impact on cognition may differ throughout the age span.

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##### V. JAGAROO, J. LIEDERMAN, & M. ROGERS. The Right Parietal Factor and Sex Differences in Spatial Rotation: A Neurocognitive Study Implicating the Spatiotopic Module.

This study sought to elucidate neurocognitive mechanisms underlying well documented sex differences in mental rotation tasks and general visuospatial function. The investigation involved 27 adults, 14 male and 13 female, each with a single focal lesion localized to one of 4 cortical areas: the left or right posterior parietal cortex (PPC) or left or right prefrontal cortex (PFC). Selection of these 4 loci was based on neuroanatomic and neurophysiologic profiles defining regions within these cortical areas as major centers of allocentric ("mental") spatial encoding. Participants performed 6 allocentric tests that included the 3-D shape rotation test (SRT) and 2 other rotational tests. Nonparametric analyses assessed the difference between men and women on these tests. In the right hemisphere and parietal groups, men scored significantly higher than women on all 3 rotational tests. In the left hemisphere and frontal groups, no significant differences emerged between men and women. Tests without a strong rotational component did not yield significant differences between the males and females in any of the subgroups. A right parietal factor was identified from the results. Central to the study was a theoretical framework outlining (1) the coordinate structure of the SRT; (2) the activation of the PPC during mental rotation; and (3) the role of the PPC in the spatiotopic conversion of retinal coordinates to a 3-D imaginal system. In the context of this theoretical model, the critical mechanism underlying sex differences in mental rotation, appears to be the spatiotopic module of the right PPC.

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##### E. VENTER & J.J. SPANGENBERG. Premenstrual Syndrome and Cognitive Functions.

The inclusion in the DSM–IV of premenstrual dysphoric disorder (PMDD) (late luteal dysphoric disorder in the DSM III–R) is still not without controversy. PMDD may mimic symptoms of various other anxiety and depressive disorders, which have been the main focus of research in this area. This study examines the relationship between premenstrual syndrome (PMS) and cognitive functioning and aims to determine which functions are compromised by PMS. Thirty-eight women between 20 and 40 years old who suffered from PMS according to self-report were neuropsychologically

tested premenstrually and postmenstrually. The researcher devised a checklist for premenstrual dysphoric disorder on the basis of DSM-IV criteria. Associations were sought between PMS symptoms, age, and cognitive functions (measured by the Rey and Taylor Complex Figure Tests, the Stroop Colour and Word Test, the Wechsler Digit Repetition subtest, the Auditory Verbal Learning Test, the Porteus Maze and the Benton Visual Retention Test). Statistical analysis consisted of the following: matched-sample *t* tests, repeated measures analysis of variance, the Scheffé test for *post-hoc* probabilities and comparisons, the  $2 \times 2$  repeated measures ANOVA, means, and standard deviations. The results were also qualitatively assessed. It was found that the menstrual cycle played a role in the cognitive functioning of the women in this sample. The older group (30–40) performed worse premenstrually than did the younger (20–29) group. The group as a whole performed significantly more poorly premenstrually than postmenstrually with regard to most of the cognitive functions examined. These functions included concentration, memory, visual–perceptual functions, and planning. Correspondence: *Erica Venter, P.O. Box 12035, Die Boord, Stellenbosch, 7613, Republic of South Africa.*

**J. ANDRIKOPOULOS. Gender Differences in Neuropsychological Functioning in Alzheimer's Disease.**

Recent research has suggested that there are sex differences in cognitive performance in patients with Alzheimer's disease. Some studies have indicated that women tend to perform worse on measures of semantic memory, verbal fluency, and aspects of orientation. Disproportionately worse naming in women has been a particularly robust finding. The present study examined cognitive differences in 250 consecutive patients with a diagnosis of Alzheimer's disease using a comprehensive range of neuropsychological tests. There were 77 men and 173 women. All patients had

appropriate laboratory studies and imaging study of the brain. There was no significant difference between women and men in education, age, or duration of illness. There was no statistically significant sex differences on measures of intelligence (WAIS-R Performance, Verbal and Full IQ), orientation (Benton Temporal Orientation Test), memory (WMS-R Logical memory I and II, and Visual Reproduction I and II), language (Visual Naming, Controlled Oral Word, and Token Test from the Multilingual Aphasia Examination), visuocognitive functions (Judgment of Line Orientation and Facial Recognition Test), and attention (WMS-R Attention–Concentration Index). The discrepant findings between the present and previous studies may be accounted for by the manner in which groups are matched for severity of dementia, the higher educational level of men, the use of non-standardized tests, the utilization of screening measures (MMSE) that do not adequately sample a particular cognitive domain, and small sample size. With the adequate application of these methodological considerations in future studies, fewer sex differences are likely to be found.

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**State of the Art Lecture 3/11:15 a.m.–12:15 p.m.**

**NEUROPSYCHOLOGICAL THERAPY  
IN MULTIPLE INJURED PATIENTS AND  
ITS EFFECTS ON QUALITY OF LIFE**

**Edmond Neugrbauer**