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# Final Program

## The 2013 International Neuropsychological Society

### Mid-Year Meeting

July 10-13, 2013  
Amsterdam, The Netherlands

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#### WEDNESDAY, JULY 10, 2013

- 9:00–11:00 AM**                      **CE Workshop 1: Neuropsychological Rehabilitation of Social Cognition Impairments Resulting in Behavioural Changes**  
**Presenter: Jacoba M. Spikman**  
*Ballroom*
1. SPIKMAN, J                      Neuropsychological rehabilitation of social cognition impairments resulting in behavioural changes
- 9:00–11:00 AM**                      **CE Workshop 3: Cognitive Assessment at the Stroke Unit: from Bedside Testing to Full Neuropsychological Assessment**  
**Presenter: Martine van Zandvoort**  
*Orange Room 5-6*
1. VAN ZANDVOORT, M              Cognitive assessment at the stroke unit: from bedside testing to full neuropsychological assessment
- 11:00–11:30 AM**                      **Wednesday Morning Coffee Break**  
*Diamond*
- 11:30 AM–1:30 PM**                      **CE Workshop 2: Attentional Disorders and Their Rehabilitation**  
**Presenter: Ian Robertson**  
*Ballroom*
1. ROBERTSON, I                      Attentional Disorders and Their Rehabilitation
- 11:30 AM–1:30 PM**                      **CE Workshop 4: Frontotemporal Dementia: Classification, Assessment, Diagnosis and Management**  
**Presenter: Julie Snowden**  
*Orange Room 5-6*
1. SNOWDEN, J                      Frontotemporal dementia: classification, assessment, diagnosis and management
- 12:45–2:00 PM**                      **Student Workshop: Assessing Reliable Change in the 21st Century: Enhancing Evidence-Based Practice**  
**Presenter: Gordon Chelune**  
*Orange Room 1-2*
1. CHELUNE, G                      Assessing Reliable Change in the 21st Century: Enhancing Evidence-Based Practice
- 2:00–3:30 PM**                      **Invited Symposium: Complex Neuropsychological Rehabilitation: Beyond Common Cognition and Acquired Brain Injury**  
**Chair: Jacoba M. Spikman**  
**Discussant: Caroline Van Heugten**  
*Ballroom*
1. SPIKMAN, JM                      Complex neuropsychological rehabilitation: beyond common cognition and acquired brain injury  
2. SPIKMAN, J                      Impact and Treatment of Deficits in Emotion Recognition after Traumatic Brain Injury  
3. FASOTTI, L                      Fatigue after Stroke, an Untreatable Problem ?  
4. EVANS, J                      Impulsivity in a Virtual World: An Investigation of Decision Making after Brain Injury  
5. GEHRING, K                      Cognitive Deficits in and Interventions for Patients with Primary Brain Tumours
- 2:00–3:30 PM**                      **Invited Symposium: Neuropsychological Phenotyping Bridges Clinical and Basic Research**  
**Chair: Jos Egger**  
**Discussants: Ellen Wingbermühle, Tjitske Kleefstra**  
*Orange Room 5-6*
1. EGGER, J                      Neuropsychological phenotyping bridges clinical and basic research

2. FEENSTRA, I From karyotype to targeted microarray
3. EGGER, J In 17q21.31 microdeletion syndrome, hypersocial behaviour may be part of the neuropsychological phenotype
4. VAN RIJN, S Theory of mind and underlying cognitive mechanisms in children with an extra X chromosome
5. VERMEULEN, K Kleefstra Syndrome, an example of a single gene defect (EHMT1) with important neurocognitive consequences
6. WINGBERMÜHLE, E Cognitive functioning in adults with Noonan syndrome

**2:00–3:30 PM****Paper Session 1: Aging**  
*Orange Room 1-2*

1. CASTRO, SV Ouch! Age-related Changes in the Recognition of Emotional Vocalizations
2. VAN DINTEREN, R P300 Development Across the Lifespan: A Cross-Sectional Study in 6-87 Year Olds
3. COLLETTE, F The Role of Memory Traces Quality in Directed Forgetting: A Comparison of Young and Elderly Participants using the Item Procedure
4. OOSTERMAN, J Neuroanatomical and Neuropsychological Predictors of Impaired Instrumental Activities of Daily Living
5. DASELAAR, S Less wiring, more firing: Low-performing older adults compensate for impaired white matter with increased neural activity

**3:30–4:00 PM****Wednesday Afternoon Coffee Break**  
*Diamond***3:30–5:00 PM****Poster Session 1: ADHD / Autism / Learning Disability / Genetics / Forensic / Cancer / Psychopathology / TBI (Child)**  
*Nassau/Staten***ADHD/Attentional Functions**

1. BORRANI, J ADHD Symptoms and Components of Attention in Juvenile Delinquents
2. CASEY, JE Development of Graphomotor Fluency in Adults with and without ADHD: A Kinematic Analysis
3. CASEY, JE Empirical differences in the quality of handwriting between children with and without ADHD
4. HOKKANEN, L Cognitive Courses after Perinatal Emergencies: A 30 Year Follow-up
5. O SHEA, D Raven's Advanced Progressive Matrices: An Index For Predicting Inattentive Blindness In Older Adults?
6. VALDEZ, P Effects of Simultaneous Performance of Two Tasks on the Indices of Sustained Attention
7. VIERIKKO, E Self-perceptions of Children with Attention Problems
8. ZABEL, TA Sensitivity and Specificity of the BASC-2 Scales for Screening Youth at Risk for ADHD
9. ZABEL, TA Online Screening of Academic Difficulties Using Parent Report: Clinical Utility of the Colorado Learning Difficulties Questionnaire

10. HIEMSTRA-BEERNINK, A Training Working Memory in Children with Attention-Deficit/Hyperactivity Disorder: A Pilot Study
11. VOLLEBREGT, M Neurocognitive and Behavioral Outcome Measures after EEG-Neurofeedback in Children with ADHD: A Double-Blind Randomized Placebo-Controlled Trial
12. ROORDING, S Working Memory Training in Children with Neuropsychiatric Disorders with or without Borderline Intellectual Disabilities

**Learning Disabilities/Academic Skills**

13. FLETCHER, JM Validity and Reliability of a Hybrid Classification of Learning Disabilities: The Importance of Instructional Response
14. LOUGHAN, AR Foundational neuropsychological correlates in the development of mathematics
15. MATUTE, E Literacy effect on language task performance
16. MECCA, TP Cognitive Profile of Adults with Developmental Dyslexia on WAIS-III
17. PEREIRA, N Cognitive Training Effects In Children With Reading Difficulties
18. SCHEPER, A Auditory and neurocognitive factors relating to language learning in Dutch SLI
19. VAN DER VLUGT, M Alexia without agraphia in an eight-year-old girl
20. FREIRE, T Long Latency Auditory Evoked Potentials (LLAEP) in the Study of Reading and Writing Disorders – A Systematic Review

**Genetics/Genetic Disorders**

21. GONÇALVES, TD Related Aspects to the Candidate Susceptibility Genes for Developmental Dyslexia: A Systematic Review
22. EGGER, J Impaired executive function, weak motor skills, and a rare form of epilepsy in an intellectually disabled girl with a 8q12.3q13.2 microdeletion
23. HERBEN-DEKKER, M Emotion Recognition and Decision Making in Huntington's Disease
24. LIN, D Metabolic Profiling Studies in Children with Angelman Syndrome

**Autism Spectrum Disorders**

25. BARENDSE, E The Utility of Standardized Measures of Executive Functioning in High Functioning Adolescents with an Autism Spectrum Disorder (ASD)
26. DE VRIES, M Inhibitory Control & Working Memory in Children with Autism: An Individual Difference Approach
27. GEURTS, H Is there an inhibitory control deficit in people with autism?
28. KOOLEN, S Can Monitoring in Language Comprehension in Autism Spectrum Disorder be Modulated? Evidence From P600 to Semantic Implausibilities
29. LEVER, AG Working Memory in Adults and Elderly with Autism Spectrum Disorders
30. MOUGA, S Adaptive Functioning of Children with Autism Spectrum Disorders (ASD): a Study with the Vineland Adaptive Behavior Scale (VABS) at Different Intellectual Levels versus Non Autism Population

**TBI (Child)**

31. CASE, RJ Mild Traumatic Brain Injury at School: Teacher Perspectives and Educating Educators
32. SILBERG, T Verbal Memory Abilities among Children with Severe TBI: the Differential Effect of Age on the Rey AVLT

33. SILBERG, T Parents and teachers reporting on behavioral, emotional and cognitive difficulties among children with severe TBI: the proxy challenge
34. STARKEY, NJ Executive Function, Social Competence and Quality of Life in Children One Year After Mild Traumatic Brain Injury
35. STUDER, M Subtle attentional problems and elevated postconcussive symptoms in children after mild traumatic brain injury
- Emotional Processes**
36. KOK, TB Social cognition and executive functioning in newly diagnosed pediatric brain tumor patients
- Cancer**
37. MEISSNER, A Predictors of Subjective Cognitive Complaints in Brain Tumor Patients after Brain Surgery
38. MENNING, S Pretreatment fMRI During Planning and Memory in Breast Cancer Patients
39. STOUTEN-KEMPERMAN, MM Late Effects of Cancer Treatment on Cognitive Function and White Matter in Breast Cancer Survivors
- Forensic Neuropsychology**
40. HERKOV, MJ Intellectual and Achievement Differences in Delinquent and Sexual Offending Adolescents
41. WILLIAMS, H Parenting, head injury and aggression: Predictive pathways of offending in male young offenders
- Psychopathology/Neuropsychiatry (Other)**
42. FRAMPTON, I Testing the Insula Hypothesis Of Anorexia Nervosa: FMRI Studies
43. AI, H A longitudinal fMRI study to the neural changes related to recovery from major depressive disorder
44. HENDRIKS, A The Relation Between Social Experience and Perspective Taking: Assessing Deictic Relational Responding Skills in Social Anxiety Using Relational Frame Theory
45. IBARRETXE-BILBAO, N Altered White Matter Connectivity Relates to Semantic Fluency in Bipolar Disorder Relatives
46. JONES, H An Investigation of Pervasive, Social and Interpersonal Difficulties in Childhood: Clinical, Cognitive and Behavioural Features
47. MATALLANA, DL Bipolar Affective Disorder And Behavioural Frontotemporal Dementia: Where Is The Link?
48. SCHOUWS, S Is there a faster decline in cognitive performance in elderly with bipolar disorder? A 5 year follow-up study
49. SERRA-BLASCO, M Cognitive Function in Treatment-Resistant Depression Treated with Deep Brain Stimulation of Cg25
50. STAVITSKY, K Poor Sleep Quality is Related to PTSD, Cognitive Difficulties, and Quality of Life in OEF/OIF Veterans with Blast Exposure
51. VAN OOSTROM, I The Relationship Between Memory Functioning and Hippocampal Volume as a Function of Electroconvulsive Therapy for Treatment Resistant Patients with Depression
52. ZHANG, WL Brain Activation During Self-Reflection in Bipolar Disorder
- Hemispheric Asymmetry/Laterality/Callosal Studies**
53. ABBOTT, J The Perception of Positive and Negative Facial Expressions in Unilateral Brain-damaged Patients: An Updated Meta-Analysis
54. NUCHE BRICAIRE, AJ Education Level Effects on Language Organization in the Healthy Elderly
55. YEATES, GN **TBI (Adult)**  
Characterising Mentalising Impairments following Acquired Brain Injury and their Clinical Significance

**4:00–5:30 PM**

**Symposium 1: Parkinson's Disease: Evidence for Early Stage Cognitive, Executive, and Social Changes**

**Chair: Paul J. Eslinger**

**Ballroom**

1. ESLINGER, PJ Parkinson's Disease: Evidence for Early Stage Cognitive, Executive, and Social Changes
2. DUFF CANNING, SJ Characterization and Diagnosis of Cognitive Dysfunction in Parkinson's Disease
3. KOERTS, J Awareness of and Compensation for Executive Dysfunctions in Patients with Parkinson's Disease
4. KALBE, E Theory of Mind and Moral Decision-Making: Evidence for Dysfunctions in Patients with Parkinson's Disease

**4:00–5:30 PM**

**Symposium 2: Social Decision-making during Adolescence**

**Chair: Lydia Krabbendam**

**Orange Room 5-6**

1. KRABBENDAM, L Social Decision-making during Adolescence
2. BURNETT HEYES, S Cooperative Investment in Adolescent Social Networks
3. LEE, N Risk-taking Behaviour in Social Situations Predicts Trust during Adolescence
4. GÜROGLU, B Neural correlates of Fairness Related Decision-making
5. DERKS, J Adolescent Trust and Trustworthiness: The Role of Gender and Social Value Orientation

**4:00–5:30 PM**

**Symposium 3: Prospective Memory Development across the Lifespan: Exploring Underlying Mechanisms**

**Co-Chairs: Mareike Altgassen, Esther van den Berg**

**Discussant: Judi A. Ellis**

**Orange Room 1-2**

1. ALTGASSEN, M Prospective Memory Development across the Lifespan: Exploring Underlying Mechanisms
2. RENDELL, PG Prospective Memory during a Virtual Week in Children with Autism
3. WILLIAMS, D Time-Based and Event-Based Prospective Memory in Autism Spectrum Disorder: Strengths, Weaknesses, and Compensatory Strategies
4. SCHNITZSPAHN, KM Mood Effects on Prospective Memory Performance in Young and Older Adults: The Mediating Role of Monitoring Behaviour
5. KANT, N Functional Correlates of Prospective Memory in Stroke
6. HERING, A Exploring the Underlying Neural Mechanisms for the Development of Prospective Memory across the Lifespan
7. ELLIS, JA Underlying Mechanisms of Prospective Memory Development across the Lifespan - An Integrative Discussion

5:30–6:30 PM

**Invited Address: Cognitive Neuropsychiatry of Hallucinations****Presenter: André Aleman****Ballroom**

1. ALEMAN, A

Cognitive Neuropsychiatry of hallucinations

6:30–8:30 PM

**Welcome Reception****Diamond****THURSDAY, JULY 11, 2013**

8:45–9:45 AM

**Invited Address: Cognitive Reserve****Presenter: Ian Robertson****Ballroom**

1. ROBERTSON, I

Cognitive Reserve

10:00–11:30 AM

**Symposium 4: Retraining of Cognitive Functions after Acquired Brain Injury: Old Wine in New Bottles?****Chair: Caroline Van Heugten****Ballroom**

1. VAN HEUGTEN, C

Retraining of cognitive functions after acquired brain injury: old wine in new bottles?

2. VAN HEUGTEN, C

Cognitive Retraining for Patients with Brain Injury

3. MURRE, J

Online Brain Training and Testing of Older Adults and Patients with Cognitive Impairments

4. RAZ, A

Brain Training

5. STURM, W

Evidence-based Attention Retraining

10:00–11:30 AM

**Paper Session 2: Memory****Orange Room 5-6**

1. POREH, AM

Bridging the gap between modern neuroscience and the clinical assessment of memory

2. CONSTANTINIDOU, F

Factors Implicated in Age-related Decline of Verbal Learning Among Healthy Adults and Patients with Mild Cognitive Impairment: Education and Primary Memory Capacity

3. VERFAELLIE, M

Medial Temporal Lobe Contributions to Short-Term Memory for Faces

4. IRISH, M

The neural substrates of recent and remote autobiographical memory - insights from frontotemporal dementia

10:00–11:30 AM

**Invited Symposium: Neurocognitive Disorders in HIV-1 Infected Patients: The Role of Neuroimaging Factors, Ageing, and Psychosocial Variables****Chair: Roy Kessels****Discussant: Ben Schmand****Orange Room 1-2**

1. KESSELS, RP

Neurocognitive Disorders in HIV-1 Infected Patients: The Role of Neuroimaging Factors, Ageing, and Psychosocial Variables

2. HEATON, RK

Overview of HIV Associated Neurocognitive Disorders (HAND): Findings from the Six-Site CNS HIV Anti-Retroviral Effects Research (CHARTER)

3. SU, T

Neuropsychological and Neuroimaging Status of Middle-aged HIV-infected Males with Suppressed Infection on Combination Antiretroviral Therapy (cART) Compared to a Representative Control Group

4. KOPELMAN, MD

A Longitudinal Study of the Effects of Ageing and HIV-1 Infection on Cognitive Performance

5. JANSSEN, M

Cognitive Performance and the MoCa in Relation to Global Brain Atrophy in HIV-1-Infected Adults on cART

11:30 AM–12:00 PM

**Thursday Morning Coffee Break****Diamond**

11:30 AM–1:00 PM

**Poster Session 2: Aging/Dementia/HIV****Nassau/Staten****Aging**

1. ALLEN, JB

Quality vs. Quantity of Education as a Predictor of Premorbid Intellectual Ability

2. GARCIA, F

Analysis of the Components of Attention in Elderly People

3. HATTA, T

Cognitive and Cerebro-cerebellar Functions in Middle and Later-middle Aged People: Evidence From the Yakumo Study

4. IWAHARA, A

Carotid Intimal Medial Thickness and Cognition in Middle Aged and Older Adults Without Clinical Vascular Disease: Evidence from Minabe Study in Japan

5. KNIGHT, RG

Prediction of Dementia and Decline in Memory: A 10-year Follow-up

6. LEE, BH

Resting state functional connectivity in normal cognitive aging

7. CHEANG, K

A Case Series of Depressed Elderly (&gt;64 years) presenting in a General Hospital in Singapore

8. MANARD, M

Does Fluid Intelligence and Executive Functioning Protect from Age-related Decline in Cognitive Control?

9. MCCADE, D

Visual Processing and Emotion Recognition in Mild Cognitive Impairment: An Eye-Tracking Study

10. MIHALJCIC, T Investigating the Impact of Reduced Awareness of Functional Impairment on Rehabilitation Engagement in the Older Hospitalised Population
11. PALMIERO, M How dimensions of creativity change across years: implications for dementia
12. PIMONTEL, MA The External Validity of MRI-defined Vascular Depression
13. TIERNEY, MC Factors Influencing the Accuracy of Primary Care Physicians' Recognition of Cognitive Impairment in Their Older Patients
14. VERMEIJ, A Cerebral and Vascular Factors May Predict Memory Performance in Healthy and Pathological Aging
15. ZAMARIAN, L Effects of Age and Prior Arithmetic Competence on Arithmetic Skill Acquisition
- Dementia (Alzheimers)**
16. AL SALMAN, A Characteristics of the Normative Data for the Arabic Version of the Addenbrookes Cognitive Examination
17. ALEGRET, M A four-year follow-up of patients with Mild Cognitive Impairment searching for the neuropsychological, APOE  $\epsilon 4$  genotyping and functional neuroimaging predictors of conversion to Alzheimer's Disease dementia
18. BOYCHEVA, E Relationship Between Low Education and Dementia in the NEDICES Cohort: a Preliminary Analysis of the Cognitive Reserve Hypothesis
19. COUTINHO, G Is it possible to identify MCI and AD individuals using a 30-minute neuropsychological battery?
20. CUCIUREANU, DI Vascular mild cognitive impairment related to lacunar stroke
21. DE WERD, M Implementation of a Manual for Errorless Learning in Dementia Care
22. FOSTER, J The Long-Term Impact of Closed Head Injury on Neurocognitive Functioning: Findings from the AIBL Study of Aging, Mild Cognitive Impairment and Dementia
23. GUZMAN-VELEZ, E Feeling Without Memory in Alzheimer's Disease
24. MARKOVA, H Left-Right Discrimination and Mental Rotation Impairment Contribute To Spatial Navigation Impairment in Dementia, but Not in Mild Cognitive Impairment
25. MONTANES, P Neuropsychological Profiles of Fronto Temporal Dementia and Alzheimer Disease
26. PASSAFIUME, D Concepts Associations in Semantic Network: Verbal and Visuo-perceptual Differences in Normal and Pathological Aging
27. RADFORD, K High Rate of Dementia in the Urban Aboriginal Population of Australia
28. SHAKED, D Metamemory in Alzheimer's Disease and its Relationship to Indices of Executive Function
29. SPAAN, P Differentiating Between Early Alzheimer's Disease And Normal Aging At Very Old Age Using A Verbal Description Variant Of The Boston Naming Test
30. WEINBORN, M Performance on the Wechsler Test of Adult Reading amongst individuals with dementia and declining cognition: a longitudinal study
31. MOON, S Gene Interaction and Structural Brain Change in Early-onset Alzheimer's Disease
32. EL HAJ, M Directed forgetting of source memory in Alzheimer's Disease
- Dementia (Subcortical, Specific Disorders, MCI, etc.)**
33. EL HAJ, M Destination recall in Huntington's Disease
34. BEZDICEK, O Alterations in Working Memory in Parkinson's Disease Mild Cognitive Impairment
35. CAMMISULI, DM Neuropsychological Profile of Patients Suffering From Mild Cognitive Impairment-Parkinson's Disease (MCI-PD)
36. CHANG, YL Evaluation of the Utility of the Mandarin Phrase Fluency Test in Identifying Individuals at Risk for Alzheimer's Disease
37. DECARLO, C Genetic Influences and Vascular Health Moderate MCI Status and Stability: Evidence from the VLS
38. FUJITA, T Differences in behavioral disorders in patients with Alzheimer's disease and Mild cognitive impairment determined using the at-the-desk instrumental activities of daily living (IADL) test
39. HENDRY, K Informant Single Screening Questions for Delirium and Dementia in Acute Care
40. IBARRETXE-BILBAO, N Cognitive reserve mediates the relation between processing speed and memory in Parkinson's Disease
41. LUCCHELLI, F Short Term Memory in Degenerative Aphasia due to Alzheimer's Disease: beyond verbal impairment?
42. MERCK, C Is semantic dementia a syndrome of semantic knowledge disequilibrium rather than of a distressing loss of concepts? Evidence from a semantic priming paradigm
43. MIDORIKAWA, A Hyperesthesia and dementia
44. MIOTTO, EC Right DLPFC activation differentiates MCIs from controls in the use of verbal learning strategies
45. MONTORO, N INECO Frontal Screening (IFS): A Test Sensitive to Executive Alterations In Mild Cognitive Multidomain Impairment
46. NIKOLAI, T Figural and spatial components of nonverbal memory in Rey-Osterrieth Complex Figure are associated with hippocampal atrophy in non-demented elderly
47. OLIVEIRA, RM Disexecutive Mild Cognitive Impairment Predominance in Elderly Assisted at a Geriatric Clinic in a Public Hospital in Rio de Janeiro
48. RODRÍGUEZ, M What is common and what is different in everyday functioning between Dementia and Mild Cognitive Impairment
49. RUSINA, R FTLD-TDP and Progressive Supranuclear Palsy in Comorbidity: Study of a Rare Case
50. SITEK, EJ Changes in Creative Output in an Artist Painter with Frontotemporal Dementia with MAPT P301L Mutation
51. STOKHOLM, J Neuropsychological Changes in Nine Asymptomatic FTD-3 CHMP2B Mutation Carriers over an Eight-year Period
52. LEE, M The Mediation Effects of Self-absorption on the Relationship between Depression and Memory Complaints in Older Adults
53. ZANDI, T Identifying vascular dementia risk factors
- HIV/AIDS/Infectious Disease**
54. AU, A Dimensions of Impulsivity and Their Relationships to Memory Functioning in Persons Living with HIV in Hong Kong
55. CATTIE, J Poorer Theory of Mind and Risky Decision-Making in HIV
56. CLARK, US Effects of Early-Life Stress on Amygdala Function in HIV Positive Patients: A Pilot Study

12:00–1:00 PM

**Invited Address: Frontotemporal Dementias: Behaviour, Cognition, Phenotypes and Genotypes**  
**Presenter: Julie Snowden**  
**Ballroom**

1. SNOWDEN, J

Frontotemporal Dementias: Behaviour, Cognition, Phenotypes and Genotypes

**12:00–1:30 PM****Symposium 5: Mechanisms of Dysregulation of Thought and Emotion Within the Broad Autism Spectrum****Chair: Sophie van Rijn****Discussant: Hanna Swaab****Orange Room 5-6**

1. VAN EYLEN, L Mechanisms of Dysregulation of Thought and Emotion Within the Broad Autism Spectrum
2. VAN RIJN, S Social Attention, Arousal and Empathy in Men With XXY: Evidence From Eyetracking and Skin Conductance
3. BARNEVELD, P Deficits in Executive Functioning in Adolescents With Autism Spectrum Disorder: Markers of Vulnerability to Develop Schizotypal Symptomatology?
4. VAN EYLEN, L Neurocognitive Profiling of Children With Neurofibromatosis Type 1 With and Without Co-occurring Autism Spectrum Disorder
5. BIERMAN, M The Role of Language and Executive Functions in Dysregulation of Thought in Children and Adolescents With an Extra X Chromosome

**12:00–1:30 PM****Symposium 6: Validation of the NIH Toolbox in Individuals with Neurological Impairments and Disabilities.****Chair: David S. Tulsky****Discussant: Erin Bigler****Orange Room 1-2**

1. TULSKY, DS Validation of the NIH Toolbox in Individuals with neurological impairments and disabilities
2. GERSHON, R Development and Norming of the NIH Toolbox for Neurological and Behavioral Functioning
3. MCCLINTOCK, SM The Feasibility of the NIH Toolbox Cognitive Battery in Patients with Parkinson's Disease
4. TULSKY, DS Validation of the NIH Toolbox for Neurological and Behavioral Functioning in Individuals with Traumatic Injury
5. HEINEMANN, AW Relationships between the NIH Toolbox and Participation in Persons Living with Stroke, Traumatic Brain Injury and Spinal Cord Injury in the Community

**2:00–4:00 PM****Paper Session 3: Dementia****Ballroom**

1. SCHMAND, B Responsiveness of Magnetic Resonance Imaging and Neuropsychological Assessment in Memory Clinic Patients
2. SAVAGE, S Word Retraining in Semantic Dementia: Can Trained Words Generalise to Other Contexts?
3. SCHMAND, B MRI and Cerebrospinal Fluid Biomarkers Do Not Improve Accuracy of Diagnosis of Alzheimer Disease Following a Brief Memory Test
4. BROEDERS, M The Evolution Of Mild Cognitive Impairment In Parkinson Disease
5. M. J. VONK, J Semantic Decline in Alzheimer's Disease: The Effects of Semantic Sub-categories, Word Class, and Abstractness
6. UYSAL-BOZKIR, ÖZGÜL The Cross-cultural Dementia Screening (CCD): A New Dementia Screening Battery for Non-Western Migrant Elders
7. EL HAJ, M Prospective and retrospective time perception in Alzheimer's disease

**2:00–4:00 PM****Paper Session 4: Traumatic Brain Injury****Orange Room 5-6**

1. HILES, A Investigating the Neurocognitive and Neuroimaging Correlates of Multiple Mild Traumatic Brain Injuries in Professional Athletes: a Magnetic Resonance Imaging Study
2. MCDONALD, S Does traumatic brain injury selectively impair the production of emotional expressions?
3. HART, T Trajectory of Acute Recovery in Traumatic Brain Injury: Relationship to Patient Characteristics, Injury Severity, and Inpatient Rehabilitation
4. DENBOER, J Utilizing Serial Neuropsychological Assessment to Evaluate Recovery from Traumatic Brain Injury: Acute to 2 Years Post-Injury
5. TUCK, DE Prognostic Evidence for Serum S100B as a Biomarker for Neuropsychological Outcomes after TBI
6. BAR, O "Pure PTA": Differentiating disorientation from amnesia during the sub-acute phase of recovery from pediatric TBI
7. SCHÖNBERGER, M Fatigue as a cause, not a consequence of depression and daytime sleepiness: A cross-lagged analysis

**2:00–4:00 PM****Paper Session 5: Miscellaneous****Orange Room 1-2**

1. BAKER, S Mild traumatic brain injuries associated with and diffusion tensor imaging findings in rugby players
2. OLAITHE, M Cognitive Dysfunction in Obstructive Sleep Apnoea; Mechanisms of Harm
3. HUIJTS, M The Total Burden Of Brain MRI Markers Of Small Vessel Disease Is Associated With Cognitive Function In Patients With Cerebral Small Vessel Disease
4. NYGAARD, E Cognitive Abilities of Children Prenatally Exposed to Opiates and Polysubstances: A Longitudinal Study
5. MCILROY, A Atypical Bilateral Frontal Lobe Activation During a Language fMRI Task in Young People with Agenesis of the Corpus Callosum (ACC)
6. BRAGA, LW Does Literacy Improve Brain Function?
7. BROOMFIELD, N Post Stroke Anxiety is prevalent at the population level, especially amongst socially deprived and younger age community stroke survivors

**3:15–4:45 PM****Poster Session 3: Assessment / Intervention / Multiple Sclerosis  
Nassau/Staten****Assessment/Psychometrics/Methods (Child)**

1. AHONNISKA-ASSA, J Short Neuropsychological Assessment Protocol for Children with Cerebral Palsy (CP)
2. CANCELLIERE, A Boston Naming Test Norms for Ages 14 and 15: A plateau in developmental growth?
3. CHAPIESKI, L Validity of Subjective Reports of Everyday Memory in a Pediatric Population
4. COENEN, MA Development of Facial Emotion Recognition in Childhood: Age-related Differences in a Shortened Version of the Facial Expression of Emotions - Stimuli and Tests
5. EVANKOVICH, KD Contributions of Attention and Mood to Everyday Memory in Children
6. HOLCOMB, M Increased Intrasubtest Scatter on WISC-IV Verbal Subtests in Language Disorder and ADHD Clinical Groups
7. OKAMURA, Y Comparison of the Behavior Rating Inventory of Executive Function in English and Japanese
8. THOMAS, S Paediatric Cerebellar Mutism Syndrome: Challenges to Cognitive Assessment
9. THOMAS, SA Parental Perceptions of a Support and Information Group for Parents of Children with Hydrocephalus
10. VAN ITERSSEN, L Rates of Reliable Cognitive Change (RC) after a change of WISC test version in children with refractory epilepsy: adjustment for Flynn effects

**Assessment/Psychometrics/Methods (Adult)**

11. AMBROZIAK, AR Narrative Medicine: Implications for Neuropsychological Assessment
12. ARCARA, G Normative Data for the Italian Version of the Montreal Cognitive Assessment (MoCA): the Impact of Sociocultural Variables on Cut-offs
13. BERTHOLD, M When Asking Does Matter: A Comparison of Subjective and Objective Measures in the Cognitive Basic Assessment (COGBAT) Test Battery in Healthy Subjects and Patients with Schizophrenia
14. BIECHOWSKA, DH Semantic verbal fluency of animals: a normative and predictive study in a Polish population
15. BIELIAUSKAS, L Normative Addenbrooke's Cognitive Examination (ACE-R) performance among older inpatient veterans
16. BIELIAUSKAS, L Modification of the ACE-R for use among American Veterans
17. BOUMAN, Z Validation of the WMS-IV Brief Cognitive Status Exam (BCSE) in Elderly with MCI and Dementia: Comparison with the MMSE
18. BRUIJNEN, CJ Screening of Cognitive Disorders in Substance Abuse Patients Using the Montreal Cognitive Assessment - Dutch Version (MoCA-D)
19. DANDACHI-FITZGERALD, B Incredible Symptom Reports of Patients Referred for Neuropsychological Assessment in a General Hospital
20. DAVISON, J Supplementing the RBANS with the MoCA for detecting dementia
21. ENNOK, M New Scoring Method and Preliminary Estonian Normative Data for the Coetsier Story Recall Test
22. ENNOK, M Examining the Errors on the Stroop Test
23. HUA, M The Clinical Utility of the Family Pictures Subtest on Content- and Context-Related Memory Assessment
24. JAVURKOVA, A Can we Identify Malingered Neuropsychological Deficits in Temporal Lobe Epilepsy Patients?
25. LAFOSSE, C The Development of a Virtual Interactive Task-Dependent Assessment Combining Physical Responses With Sensory and Cognitive Tasks Demands
26. LANTING, SC Reliability and Validity of the Ruff Neurobehavioral Inventory Cognitive Scale in Older Adults
27. POREH, AM The Rey Auditory Verbal Learning Test Forced Choice Task for the Screening of Malingering
28. URBANOVÁ, M Free and Cued Selective Reminding Test in Differential Diagnosis of Alzheimer's Disease and Frontotemporal Lobar Degeneration
29. YOKOGAWA, M Advantage of Time-Reduced Psychomotor Vigilance Task
30. TRIVIÑO, M Neuropsychological Profile of Confabulators. Towards a sensitive assessment

**Cognitive Intervention/Rehabilitation**

31. TRIVIÑO, M Effectiveness of a Treatment for Confabulations after Brain Injury
  32. ABEN, L Patient Satisfaction after Memory Self-efficacy Training for Stroke Patients
  33. AKAMATSU, T Effect of health tourism on motor and non-motor functions of people with Parkinson's disease in Kyoto
  34. ANDERSON-HANLEY, C Exercising for Cognitive Health: Virtual versus Outdoor Cycling
  35. CHROMEK, P The Efficiency of Self-Generated Cues in Face-Name Recall in Relapsing-Remitting Multiple Sclerosis
  36. ESLINGER, PJ Cognitive and Mood Effects of Therapeutic Optical Radiation in Long-term Care Residents
  37. FIELDS, JA A Multicomponent Intervention for Mild Cognitive Impairment Improves Mood and Cognition in Patients and Caregivers
  38. HASHIMOTO, K Relationship between verbal IQ (VIQ) scores in hearing-impaired children and reading tests
  39. HOLLEMAN, M Effects of a Comprehensive Neuropsychological Rehabilitation Programme (Intensive NeuroRehabilitation, INR): Results of a Waiting-List Controlled Study
  40. KAFADAR, H IQ UP Cognitive Training Program's Effect On The Cognitive Improve
  41. KIMURA, D Covariance structure analysis to determine the factor influencing cognitive functions in elderly people
  42. KINSELLA, G Are Neuropsychological Measures Informative in Measuring Outcome of Memory Strategy Training in Older People?
  43. KOLK, A Attention rehabilitation in children with neurological disorders using FORAMENRehab software – efficacy of two different rehabilitation designs
  44. LOETSCHER, T Systematic Review Of Cognitive Interventions For Attention Deficits Following Stroke
  45. OJEDA, N Baseline predictors of functional outcome improvement after a cognitive remediation program
  46. PITTERI, M On The Need for Repeated Assessments in Neglect Rehabilitation: A Preliminary Investigation
  47. RIVERO, TS Dissociation between attention and motor control in a video game a training: Prototype data
  48. SHIBASAKI, M The Effectiveness of Cognitive Rehabilitation of Response Inhibition Deficits in a Patient with Chronic Prefrontal Lesions: A NIRS Study
  49. WESTERHOF - EVERS, HJ Emotion perception in traumatic brain injury: an exploratory eye tracking study
- Multiple Sclerosis/ALS/Demyelinating Disorders**
50. BLANKESPOOR, RJ Subjective and Objective Cognitive Functioning in Multiple Sclerosis Following Mindfulness-Based Cognitive Therapy
  51. CHEN, K Cognitive And Behavioural Deficits in Motor Neuron Disease Are Not Associated With Site of Disease Onset or Disease Progression
  52. VAN DER HIELE, K How Accurate are Self-Reports of Executive Functioning in Patients with Multiple Sclerosis?

53. VAN DER HIELE, K

Psychosocial Stress in Patients with Multiple Sclerosis

54. VOS, SH

Personality Traits in Multiple Sclerosis Relate to Subjective Cognitive Functioning

55. KLAAS, P

**Epilepsy/Seizures**

Response Latencies to Median Nerve Stimulation in Patients with Intractable Epilepsy

**4:15–4:45 PM****Thursday Afternoon Coffee Break***Diamond***4:45–5:45 PM****Birch Lecture: On Educational Neuropsychology and the Bridge between Research and the Educational Domain****Presenter: Jelle Jolles***Ballroom*

1. JOLLES, J

On Educational Neuropsychology and the Bridge between Research and the Educational Domain

**6:15–9:15 PM****Boat Tour and Conference Dinner***Foyer***FRIDAY, JULY 12, 2013****8:45–9:45 AM****Invited Address: Rostral Prefrontal Cortex: the Seat of Metacognition****Presenter: Paul W. Burgess***Ballroom*

1. BURGESS, PW

Rostral prefrontal cortex: the seat of metacognition

**10:00–11:30 AM****FESN Invited Symposium: Neuropsychological Rehabilitation: From Bench to Bedside****Chair: Guy Vingerhoets***Ballroom*

1. VINGERHOETS, G

Neuropsychological Rehabilitation: From Bench to Bedside

2. VANHAUDENHUYSE, A

How Neuroimaging Techniques Can Help to Diagnose Disorders of Consciousness?

3. DIJKERMAN, HC

Direct Current Stimulation in Rehabilitation of Hemispatial Neglect

4. VALLAT-AZOUVI, C

Rehabilitation of Working Memory in Patients With Brain Injury: Issues of Generalization and Specificity

5. VAN HEUGTEN, C

Impaired Awareness Following Brain Injury

**10:00–11:30 AM****Symposium 7: The Non-Unitariness of Anosognosia in Dementia****Chair: Robin G. Morris***Orange Room 5-6*

1. ROSEN, H

Anosognosia in Frontotemporal Dementia vs. Alzheimer's disease: A Window onto the Mechanisms of Self-Appraisal

2. MOGRABI, D

Short- and Long-term Implicit Adaptation in AD Despite Performance Anosognosia

3. MORRIS, R

Anosognosia Correlates of Emotional Reactivity in People with Alzheimer's Disease to Viewing Emotional Film Material Including that Depicting Alzheimer's Disease

4. BASTIN, C

Dorsomedial Prefrontal Metabolism and Unawareness of Current Characteristics of Personality Traits in Alzheimer's Disease

5. GENON, S

Specific Impairment of Metacognitive Judgements for Episodic Memories in Alzheimer's Disease: the Role of the Hippocampus

6. MORRIS, R

The Non-Unitariness of Anosognosia in Dementia

**10:00–11:30 AM****Symposium 8: Advances in Paediatric Social Neuroscience: the Foundations for Assessment and Intervention?****Chair: Anna-Lynne R. Adlam****Discussant: Vicki Anderson***Orange Room 1-2*

1. ADLAM, AR

Advances in paediatric social neuroscience: the foundations for assessment and intervention?

2. WILLIAMS, HW

Neuroscience and Violence: What We Can Do To Lessen Hurt and Harm and Promote Social Inclusion

3. GUROGLU, B

Reward Processing in Adolescence: A Role for Social Context

4. ADAMS, S

Facing up to Faces: Modifying Face Emotion Perception to Improve Emotional Processing

**11:30 AM–12:00 PM****Friday Morning Coffee Break***Diamond*



**11:30 AM–1:00 PM****Poster Session 4: Behav Neurology / CNS/ Language / Executive Function / Electrophysiology / Drugs Nassau/Staten**

- Behavioral Neurology**  
 Fronto-striatal correlates of neuropsychiatric dysfunction in frontotemporal dementia (FTD) and Alzheimer's disease (AD)
1. HORNBERGER, M  
 2. PITTERI, M  
 The Brainstem and Cognitive (Dys)functions: From Neural Disconnection to Behavioural Disregulation
- Cognitive Neuroscience**  
 Psychopathic Traits And The Use Of Social And Non-social Information During Associative Learning: A Computational Approach
3. BRAZIL, I  
 4. GALVEZ, A  
 Aging and Executive Control Effects on the Flexible Shifting of Stimulus-Response Mappings in a Novel Bi-field Visuomotor Task with Increasing Cognitive Demands
5. LOUGHAN, AR  
 The importance of neuroeducation: Perspectives from special educators
6. MESKAL, I  
 Cognitive deficits in patients with trigeminal neuralgia
7. PINA RODRIGUES, A  
 Attentional Cueing Processing is Eccentricity Dependent in Developmental Dyslexia
8. RASMUS, A  
 Verbal fluency in metabolic syndr
9. SERVAAS, MN  
 Neuroticism and the Processing of Negative Emotions: Evidence from a Quantitative Meta-analysis of Neuroimaging Studies
10. SILVESTRE, A  
 Neuropsychology in Down Syndrome – What Happens One Year Later?
11. THISAYAKORM, K  
 Atropine Induced Amnesia in Aged Rats Possibly Due to the Accumulation of A $\beta$  Production: A Rat Model of Cognitive Impairment Measuring by Operant Behavior
12. UENO, A  
 Neural correlates of facial recognition with and without cosmetics: an fMRI study
13. VILLACAMPA, J  
 Unspecific Restart and Mixing Costs: Combined Effects of Aging and Executive Control on Maintenance Task-Set Inhibition as Indexed by Task-Switch
14. VINGERHOETS, G  
 Task Difficulty Modulates Left Inferior Frontal Cortex During Matching of Hand Posture to Object Use
- Language and Speech Functions/Aphasia**  
 A Standard Neurolinguistic Approach to Awake Brain Surgery
15. DE WITTE, E  
 16. LUCCHELLI, F  
 Unusual Speech Abnormalities in Behavioural Variant Fronto-Temporal Degeneration: a Single Case Study
17. SZYMASZEK, A  
 Temporal Information Processing Underlies Auditory Speech Comprehension: Clinical Evidence From Aphasic Patients
18. VAN DER MEULEN, I  
 Melodic Intonation Therapy (MIT) in subacute aphasia
- Executive Functions/Frontal Lobes**  
 Changes in Prevision from Preadolescence to Adolescence
19. ARROYO, LR  
 20. BERTENS, D  
 Diagnostic Utility of a New Scoring Method of a Modified Six Elements Test Measuring Executive Function
21. BIECHOWSKA, DH  
 Executive functioning in type 2 diabetes
22. EMMANOUEL, A  
 The Effects of Lesion Location on Daily Dysexecutive Symptoms of Brain Injured Patients using the DEX Questionnaire. The Associations of the DEX with the BADS and two other Open – Ended Real-Life Executive Measures, the EDT and the TQT
23. FUNES, MJ  
 Errors in Everyday Life actions after frontal lobe damage: Which kind of distracters are more harmful?
24. GARCIA-BARRERA, MA  
 25. GARCIA-BARRERA, MA  
 The Elusive Outcomes of Executive Control after Concussive Events: A Meta-Review and Empirical Study
- Performance Patterns on Card Selection during the Iowa Gambling Task: Preliminary Evidence of High Sensitivity to Losses after mTBI
26. HINDMAN, E  
 Executive Functioning in Young People from Disadvantaged Backgrounds
27. HOOD, A  
 The effects of variability in blood phenylalanine levels on IQ and executive abilities in children with PKU
28. KOERTS, J  
 The Influence of Cognitive Reserve on Impairments in Executive Functioning in Parkinson's Disease
29. LORAINS, F  
 Problem Gamblers' Decision Making Under Risk and Ambiguity
30. MUELLER, U  
 Self-Control in 4-Year-Olds: Executive Function, Parenting, and Temperament
31. NAJAS GARCIA, A  
 Executive Functions in Preschoolers with ODD, ADHD and comorbid ODD-ADHD: Evidence from the preschool version of Behavior Rating Inventory of Executive Function (BRIEF-P)
32. OKRUSZEK, L  
 Executive Dysfunction in Patients with Frontal Lobe Lesions and in Patients with Schizophrenia: Can We Tell the Difference with Commonly Used Neuropsychological Tests?
33. RIOS-LAGO, M  
 Neuropsychological consequences of psychosurgery in Obsessive-Compulsive Disorder: dissociations in cognitive flexibility
34. ROTH, RM  
 Two vs Three Factor Model Scores on the BRIEF in Children and Adults with ADHD
35. ROTH, RM  
 Self-Reported Executive Function in Adolescents and Perceived Risk-Taking in Others
36. ROTH, RM  
 Parenting Style in Childhood and Executive Functions in the Everyday Life in Young Adults
37. SOLER, A  
 Attention and working memory in fibromyalgia and chronic pain
38. THOMPSON, LI  
 Emotional Distress and Affective Decision-Making Processes Involved in Sex Under the Influence of Alcohol Among Emerging Adults
39. UEHARA, E  
 Preliminary evidence of the reliability and validity of a Brazilian executive function computer task for children: The Circus Magic Cards Game
40. VARGENS, FL  
 Children and Adolescents Performance Profile on Executive Function Assessed by NEPSY II
41. VLAGSMA, T  
 The Goal Setting Approach Within Treatment For Dysexecutive Functioning: Do Parkinson's Disease Patients Set Different Goals Than Patients With ABI?
42. YEH, Z  
 Investigation of theory of mind and empathy performance in patients with frontal lobe damage
- Electrophysiology/EEG/ERP**  
 Exploring Mirror Systems and Social Cognitive Deficits in Bipolar Disorder and Schizophrenia
43. ANDREWS, SC  
 44. BERNARDINO, I  
 Neural Correlates of Visual Integration in Williams Syndrome: an EEG Study
45. BOUCHER, O  
 Emotion Processing in the Human Insula: an Intracranial ERP Study
46. ERLBECK, H  
 Effects of Attention and Passiveness on Event-Related Potentials
47. FRAGA GONZALEZ, G  
 Differences in visual processing of printed words in dyslectic children
48. LEBEDEVA, I  
 Auditory Oddball N100, Single-voxel 1H-MRS and DTI of the Corpus Callosum Genu in Young Male Patients with Schizophrenia
49. UNDERHILL, J  
 Does Vermal TMS Decrease the Negative Symptoms of Schizophrenia? A Case Study

50. ALHASSOON, OM  
Neuropsychological Characteristics of Anxious and Depressed Alcohol-Dependent Patients
51. MUNRO, CA  
Childhood Lead Exposure and High School Graduation Rates in Men and Women
52. RUIS, C  
Navigation and Memory Problems after Sporadic Ecstasy Use
53. SMITHIES, V  
Overnight Memory Consolidation in Ecstasy-Polydrug Users: Findings From an Online Visual Memory Task

#### **ADHD/Attentional Functions**

54. BRAMHAM, J  
The impact of depression on cognitive functioning in adults with ADHD

**12:00–1:00 PM**

#### **Invited Address: Functional Heterogeneity for Memory of the Medial Temporal Lobes and their Connections**

**Presenter: Andrew Mayes**

**Ballroom**

1. MAYES, A  
Functional Heterogeneity for Memory of the Medial Temporal Lobes and their Connections

**12:00–1:30 PM**

#### **Paper Session 6: Oncology**

**Orange Room 5-6**

1. BOELE, FW  
Associations Between Cognitive Functioning and Health-Related Quality of Life in Glioma Patients
2. VAN ZANDVOORT, M  
Intraoperative Monitoring of Executive Functioning in Brain Tumors Patients
3. SCHUTTEMA, I  
Neurocognitive Deficiencies in Adult Survivors of Childhood Leukemia, 25 Years after Treatment
4. PATEL, SK  
Pro-inflammatory Cytokines and Comorbidity Predict Neurobehavioral Functioning in Women with Cancer
5. FAULKNER, J  
A New Test Battery for Assessing Language in Brain Tumour Patients

**12:00–1:00 PM**

#### **SLC Discussion Panel: Neuropsychology Research Training in North America**

**Orange Room 1-2**

**2:00–3:30 PM**

#### **NIP Invited Symposium: Quality of Neuropsychological Tests: New Developments and Techniques**

**Chair: Rudolf Ponds**

**Ballroom**

1. PONDS, R  
Quality of neuropsychological tests: new developments and techniques
2. HURKS, P  
The utility of review systems for evaluating quality of psychological tests
3. SCHMAND, B  
Advanced Neuropsychological Diagnostics Infrastructure (ANDI)
4. HENDRIKS, M  
Developments in the application of computer-based neuropsychological assessment
5. SCHRETLEN, D  
The International Neuropsychological Normative Database Initiative

**2:00–3:30 PM**

#### **Symposium 9: Social Cognition in Neurodegenerative and Psychiatric Conditions**

**Chair: Olivier Piguet**

**Orange Room 5-6**

1. SNOWDEN, JS  
Drawing Inferences in Frontotemporal Dementia and Huntington's Disease
2. TORRALVA, T  
Comparative Neuropsychology of Behavioural-Variant Frontotemporal Dementia and Bipolar Disorder
3. IRISH, M  
Elucidating the Neural Correlates of Theory of Mind Deficits in Neurodegenerative Disorders
4. PIGUET, O  
Loss of Empathy and its Effect on Carers of Patients with Frontotemporal Dementia and Alzheimer's disease
5. PIGUET, O  
Social Cognition in Neurodegenerative and Psychiatric Conditions

**2:00–3:30 PM**

#### **Invited Symposium: The Neuropsychology of Parietal Lobe Function**

**Chair: Chris Dijkerman**

**Orange Room 1-2**

1. DIJKERMAN, C  
The neuropsychology of parietal lobe function
2. VINGERHOETS, G  
Contributions of the posterior parietal cortex to motor cognition
3. HUSAIN, M  
Attention, working memory and pharmacological modulation of the neglect syndrome
4. O'CONNOR, A  
Frontoparietal contributions to establishing and evaluating expectations that aid memory decision-making
5. FARNÈ, A  
Multisensory Perception for Action

**3:30–4:00 PM**

#### **Friday Afternoon Coffee Break**

**Diamond**

**3:30–5:00 PM**

#### **Poster Session 5: Imaging / Stroke / Memory / Visuospatial**

**Nassau/Staten**

##### **Imaging (Functional)**

1. ITO, A  
Gender differences in the patterns of vmPFC activity associated with preference judgments for faces
2. KAWASAKI, I  
Neural Correlates of Pleasant and Unpleasant Emotions Induced by Social Reputation from The Same and Opposite Genders
3. LIEMBURG, E  
Decreased fronto-parietal activation related to apathy in patients with schizophrenia

4. MIOTTO, EC Neural Correlates of Episodic Verbal Memory in OCD Children after Semantic Strategy Training
5. MURAKAMI, Y Effects of Cosmetics Use and Gaze Direction on Facial Attractiveness: An fMRI Study
6. ORON, A The Neuroanatomical Basis of Phonological Awareness - an fMRI Study
7. SALAS, R A Striatal Reward Learning Signal is Associated to Habenulo/striatal Resting State Functional Connectivity in Tobacco Smokers
8. VAN DER VELDE, J A meta-analysis on alexithymia related brain activity during emotion processing
9. VINGERHOETS, G Neural underpinnings of impaired predictive motor timing in children with Developmental Coordination Disorder
10. ALHASSOON, OM **Imaging (Structural)**  
Relationship between Hepatic Function, Corpus Callosum Microstructural Integrity and Neuropsychological Performance in Recently Detoxified Alcoholics
11. BANKS, SJ Verbal and Nonverbal Memory and Hippocampal Volumes in a Memory Clinic Patient Population
12. IBARRETXE-BILBAO, N Altered White Matter Connectivity Relates to Executive Function Deficits in Schizophrenia
13. KATARZYNA, J The usefulness transcranial sonography in diagnosis of psychiatric symptoms in Huntington disease patients
14. LAZARUS, T Occipital lobe hemangioma and Neuro-cognitive findings in recalcitrant substance abuse: A Case Study
15. MATSUI, M Normal developmental changes of the corpus callosum from infancy to early adulthood
16. THIEL, FA Gray matter atrophy and cognitive deficits in patients after Herpes Simplex Encephalitis
17. TRIVIÑO, M Mapping Temporal Preparation
18. ANZAKI, F **Memory Functions**  
Brain Regions Relevant to Letter Span and Digit Span using Functional Near-Infrared Spectroscopy
19. BOWMAN, C Development of Prospective Memory (PM) Across Adolescence: the Effect of PM Target Numbers and the Role of Executive Functions
20. CALUN-NADULSKA, P The effect of cognitive distractors on real idiothetic memory in humans
21. FRISCH, S Cognitive Deficits in Transient Global Ischemia (TGI) – Memory and Beyond
22. GEURTS, S Long term forgetting and memory complaints
23. GOFER- LEVI, M The Differential Effect of Age and Non- Verbal Intelligence on Different Skill Learning Types among Children with Spastic Cerebral Palsy
24. GOMEZ SEGOVIA, C Incomplete inversion of the hippocampus: study of 3 clinical cases in pediatric patients not associated with epilepsy
25. JÓDAR, M Verbal memory performance in Fibromyalgia patients: self-report and objective measures
26. GONÇALVES, C Memory Functioning: a Comparison Between Alzheimer's Dementia and Subcortical Vascular Disease
27. HENDRIKS, M Visual Novelty Processing in Patients with Unilateral Temporal Lobe Resection
28. KOZLOVSKIY, SA Neuropsychological Visuo-Spatial Working Memory Tests Performance and Anatomical Characteristics of Hippocampi, Caudate Nuclei and Cingulate Cortex Regions
29. KULIKOVA, I Using guided affective imagery in psychotherapy of patients with amnesic syndrome as a result of traumatic brain injury
30. RAMÍREZ, C Effects of 24-h Sleep Deprivation on the Components of Working Memory
31. REUHKALA, M Verbal Recall in Adult Attention Deficit Hyperactivity Disorder and Dyslexia – the Role of Repetition
32. SAITO, S The left prefrontal cortex might relate to not memory recollection but recognition
33. SURIYA PRAKASH, M Neural Correlates of Memory Load During Encoding in Visuo-Spatial Working Memory Task
34. VALLET, CT All Errors Are not the Same: Different Memory Profiles between Aging, Alzheimer's Disease and Semantic Dementia from a New Memory Test
35. VAN DEN BERG, E Meta-analysis of Prospective Memory in Parkinson's Disease
36. VAN GELDORP, B Relational and Conjunctive Working Memory Binding across Age
37. WITKOWSKA, MA Functioning Of Prospective Memory And Mnemonics Used By Pulmonary Patients
38. ARANGO LASPRILLA, JC **Stroke/Aneurysm**  
Neuropsychological Findings and Recovery in a Group of Spanish Speaking Individuals Six Months Post Stroke
39. BOERBOOM, W Differences in cognitive and emotional outcomes between patients with perimesencephalic and aneurysmal subarachnoid hemorrhage
40. BUUNK, AM Nonaneurysmal Subarachnoid Hemorrhage compared to Aneurysmal Subarachnoid Hemorrhage: Long-term Cognitive, Emotional and Behavioral Consequences Related to Vocational Outcome
41. CALDERON CHAGUALA, JA Longitudinal Changes in Quality of Life in Individuals with Stroke from Ibagué, Colombia
42. CARTER, SL Down the Rabbit Hole: Neuropsychological Findings in a Case of Alice-in-Wonderland Syndrome
43. GERRITSEN, M How Minor Is Minor Stroke With Respect To Cognitive Functioning?
44. HUENGES WAJER, I Participation after Aneurysmal Subarachnoid Hemorrhage
45. MICHIELS, KM Measuring Quality of Life before and after a Multidisciplinary Rehabilitation Program in Stroke Patients by means of the Stroke-specific Quality of Life Scale
46. MORENO, L Cognitive Outcome After Surgical Repair Of Unruptured Aneurysm
47. SCHAAPSMEERDERS, P Episodic Memory Profile in First-Ever Ischemic Stroke in Young Adults: Separating Vascular from Ageing-Related Memory Components
48. STOLWYK, RJ Characterising Neurobehavioural Change Following Stroke: Preliminary Findings
49. TIMOIANU, R Faith as a possible preventive coping mechanism in post-stroke depression
50. TIMOIANU, R Self-esteem in post-stroke depression
51. TIMOIANU, R Meaning in life in post-stroke depression
52. TIMOIANU, R **Visuospatial Functions/Neglect/Agnosia**  
Line bisection performances in professional musicians
53. BROUWER, WH On-Road Driving In Homonymous Hemianopia After Stroke: The Importance Of Attention And Perceptual Speed
54. DE HAAN, GA The Effect of Compensatory Scanning Training on Mobility in Hemianopia Patients
55. ERSHOV, BB Executive dysfunction and visual memory impairments in major depressive disorder
56. HISCOCK, M Categorical and Coordinate Spatial Judgments Differ According to Visual Quadrant and Subjects' Handedness
57. HUITEMA, R Effect of Prism Adaptation as a Treatment for Unilateral Spatial Neglect on Lane Tracking Performance
58. LUCCHELLI, F Visuo-Spatial Impairment and Apraxia in Posterior Cortical Atrophy: a Possible Relationship

4:00–5:00 PM

**INS Presidential Address: It's Not Only the Injury that Matters, but the Kind of Head  
Ballroom**

1. PONSFORD, J

It's not only the injury that matters, but the kind of head

5:15–6:00 PM

**INS Business Meeting  
Ballroom****SATURDAY, JULY 13, 2013**

8:45–9:45 AM

**Invited Address: Divided Attention and Working Memory after Severe Traumatic Brain Injury:  
From Assessment to Rehabilitation  
Presenter: Philippe Azouvi  
Ballroom**

1. AZOUVI, P

Divided attention and working memory after severe traumatic brain injury : from assessment to rehabilitation

8:45–10:15 AM

**Symposium 10: Neurocognitive Development in Adolescence: Normal and Subnormal  
Chair: Mariette Huizinga  
Discussant: Peter Isquith  
Orange Room 5-6**

1. VAN DUIJVENVOORDE, A

Neural Correlates of Expected Risks and Returns in Children's, Adolescents', and Adults' Risky Choice

2. DE ZEEUW, P

Neuropsychological Heterogeneity in ADHD: Implications for Theory and Practice

3. DEKKER, S

Dominant Goal Orientations Predict Differences in Academic Achievement During Adolescence Through Metacognitive Self-Regulation

4. HUIZINGA, M

The Struggle Between Socio-Emotional Impulses and Cognitive Control Among Adolescents: The Relationship with School Performance

5. HUIZINGA, M

Neurocognitive Development in Adolescence: Normal and Subnormal

8:45–10:15 AM

**Symposium 11: Neuropsychology of Navigation  
Chair: Ineke van der Ham  
Orange Room 1-2**

1. VAN DER HAM, I

Neuropsychology of navigation

2. VAN DER HAM, I

Navigation impairment in mild stroke patients

3. WEGMAN, J

Gray and White Matter Correlates of Navigational Ability in Humans

4. WIENER, JM

Maladaptive bias for extrahippocampal navigation strategies in aging humans

5. HERINGA, SM

Spatial Navigation in Patients with Mild Cognitive Impairment or Early Alzheimer Disease

6. VAN EKERT, J

The Development of a Neural Wayfinding Mechanism

9:45–11:15 AM

**Poster Session 6: Epilepsy / Medical / Schizophrenia / TBI (Adult)  
Nassau/Staten****Epilepsy/Seizures**

1. GALLAGHER, A

Are there modality-specific memory impairments following hippocampal asymmetry in children with temporal lobe epilepsy?

2. HIROMITSU, K

Religious experiences and out-of-body experiences during awake surgery

3. KRAMSKA, L

Memory performance two years after stereotactic radiofrequency amygdalohippampectomy

4. LECHOWICZ, M

Recollection of Past and Construction of Future Events in Patients with Unilateral Medial Temporal Lobe Epilepsy

5. LEVAV, M

Neuropsychological Short Assessment Battery for Children Presenting with Epileptic Disorders (SNACE)

6. RANTANEN, K

Academic Competence of School-Aged Children with Early-Onset Epilepsy

7. VIÑAS DÍEZ, V

A Preliminary Study: Cognitive Impairment In Frontal Lobe Epilepsy

**Medical/Neurological Disorders/Other (Adult)**

8. BONILLA, X

Neurosyphilis - A Case Study of the Nexus of Severe and Persisting Mental Illness, Addiction, Homelessness, and Ignorance

9. BRUMMELMAN, P

Cognitive Functioning in Patients with Secondary Adrenal Insufficiency

10. BUCKS, RS

Impact of Sleep Disordered Breathing on Self-reported Memory Function: It's More Than Just Being Old and Sad

11. DIJKSTRA, H

Attention in Parkinson's disease: traditional versus ecologically valid and subjective measures

12. GEURTSSEN, CJ

Is mild cognitive impairment in Parkinson's disease predictive for further cognitive decline after deep brain stimulation?

13. JONES, DJ

Evidence from a Latent Learning Task for Temporal Lobe Impairment in End Stage Renal Disease

14. COSTA, A

Reliability of Intra-individual Cognitive Fluctuations in Haemodialysis Patients

15. VAESSEN, T

Cognitive Complaints In Obstructive Sleep Apnea Syndrome

16. VAN DER LINDEN, SD

Cognitive Deficits in Meningioma Patients in Preoperative and Postoperative Stage

**Medical/Neurological Disorders/Other (Child)**

17. EBBINK, J

Cognitive Outcome Of Patients With Classic Infantile Pompe Disease Receiving Enzyme Therapy

18. HOCHMAN COHEN, H

The Effect of Cerebellar Mutism on Neuropsychological Functions Among Children With Posterior Fossa Tumors

19. MARYNIAK, A

Huge Arachnoid Cyst Discovered Accidentally. Exemplary Student with "Underdeveloped Brain"

20. BENNETT, E

Paediatric brain tumour parent/carer support and information group: An evaluation

21. TALBOT, E Encephalitis-Related Sleep Difficulties in the Developing Brain  
 22. TALBOT, E Dancing Eye Syndrome (Myoclonus Opsoclonus Syndrome) in Children: A Case Study
- Psychopathology/Neuropsychiatry (Schizophrenia)**  
 23. ANDRÉS, E Neuropsychological profile of first-episode schizophrenia patients  
 24. BAIS, L Efficacy and Durability of Left and Bilateral repetitive Transcranial Magnetic Stimulation (rTMS) for Auditory Verbal Hallucinations in Schizophrenia  
 25. BARDER, HE Ten year neurocognitive trajectories in first-episode psychosis  
 26. CHAN, H Profiling Neurocognition and Social Cognition in Frontotemporal Dementia (FTD) and Chronic Schizophrenia  
 27. DEL PINO SÁEZ, R Clinical Symptoms Moderate the Association Between Nicotine Dependence and Cognition  
 28. FERNANDEZ-GONZALO, S Preliminary Efficacy Findings of a New Social and Non-Social Cognitive Rehabilitation Computerized Program for Schizophrenia/Schizoaffective Disorders in Early Stages  
 29. IBARRETXE-BILBAO, N Altered White Matter Connectivity Relates to Processing Speed Deficits in Schizophrenia  
 30. KIM, M Deficits of decision making in patients with schizophrenia  
 31. KLAASEN, NG Brain Activation in Unaffected Relatives of Patients with Schizophrenia During Emotional Perception  
 32. KOS, C Cognitive Performance in Schizophrenia Patients Before and After rTMS Treatment over the Prefrontal Cortex  
 33. OPMEER, E Neural correlates of self-reflection in individuals with an ultra-high risk for psychosis  
 34. TSOTSI, S The role of attention in emotion perception in schizophrenia: training attention to facial features  
 35. TSOTSI, S A differential deficit in executive function in 1st psychotic episode patients: a six months and 1 year follow-up  
 36. TURON, M Improving Jumping To Conclusions Bias After Social and Non-Social Cognitive Computer-based Intervention in First-episode Schizophrenia and Schizoaffective Patients  
 37. VERWEIJ, K The association between intelligence scores and family history of psychiatric disorder in schizophrenia patients, their siblings and healthy controls  
 38. VISSERS, CT Attention in Schizophrenia and Autism Spectrum Disorders: Evidence from P300
- TBI (Adult)**  
 39. BARKER-COLLO, SL Prevalence and Predictors of Posttraumatic Stress Disorder in Adults 1 Year Following Traumatic Brain Injury: A Population Based Study  
 40. BEECKMANS, K Evaluation of Impaired Self-awareness of Memory Deficits after Traumatic Brain Injury by means of the Predicted Performance Method  
 41. YANG, C 'Good-old-days' Bias: A Prospective Follow-Up Study to Examine the Pre-Injury Super-Normal Status in Patients with Mild Traumatic Brain Injury  
 42. FEDIO, AA Quality of Life following Traumatic Brain Injury: The Importance of Family and Friends  
 43. LANTING, SC Examination of Recruitment Bias in a Prospective Study on Outcome from Mild Traumatic Brain Injury in a Level 1 Trauma Center  
 44. MARQUEZ DE LA PLATA, C Compromised Structural and Functional Connectivity Among Professional Boxers  
 45. MASSEY, JS The Effect of Acute Stress Disorder on Information Processing Under Conditions of Increasing Cognitive Load in Individuals with Mild Traumatic Brain Injury  
 46. MATHIAS, JL Traumatic Brain Injury Research: How Comparable are Community and Orthopaedic-injury Control Groups?  
 47. MBAKILE-MAHLANZA, L The Experience of Traumatic Brain Injury in Botswana  
 48. MEARES, S The Impact of the Abbreviated Westmead Post-Traumatic Amnesia Scale on Length of Stay in an Emergency Department  
 49. DE PEREIRA, AA Executive functions after TBI in Brazilian patients  
 50. PHILLIPS, A Keeping the mind on the game, and the brain in mind: Concussion care in elite rugby  
 51. RASMUS, A The changes of cognitive functions in patient after head injury followed by coma during 10 year observation period  
 52. RICHARDSON, CJ A Cross-Sectional Analysis of Self-Awareness Deficits after Traumatic Brain Injury from 3 months to 20 years Post-Injury: The Importance of Injury Severity and Emotional Distress in Self and Close-Others  
 53. RUSHBY, J Impaired Emotional Prosody Processing in Severe Traumatic Brain Injury: An Event-Related Potentials Study  
 54. STARKEY, NJ Executive Functions in Adults One, Six and Twelve Months after Mild Traumatic Brain Injury

10:00–10:30 AM

**Saturday Coffee Break***Diamond*

10:30 AM–12:00 PM

**Invited Symposium: Cognition and Cancer****Chair: Sanne B. Schagen***Ballroom*

1. WEFEL, JS Cognition and Cancer  
 2. SCHAGEN, SB Neurocognitive Deficits in Patients with Non-CNS Tumors  
 3. DIETRICH, J Chemotherapy associated CNS damage  
 4. WEFEL, JS Neurocognitive Function in Patients with Brain Tumor  
 5. KLEIN, M Resective surgery for infiltrative brain tumors: plasticity of function

10:30 AM–12:00 PM

**Symposium 12: "Getting a Life" – Return to Previous Activities Following Traumatic Brain Injury****Chair: Catherine Willmott***Orange Room 5-6*

1. WILLMOTT, C "Getting a Life" – Return to Previous Activities Following Traumatic Brain Injury  
 2. MCDONALD, S Social Cognition in Adolescents with Traumatic Brain Injuries  
 3. WILLMOTT, C Frequency and Quality of Return to Study Following Traumatic Brain Injury  
 4. TATE, R Preparing Adolescents for Life After School: A Randomized Controlled Trial into the Effectiveness of a Coaching-based and Motivational Interviewing Intervention

10:30 AM–12:00 PM

**Symposium 13: Regulatory Mechanisms and their Neural Substrates in Aggression and Antisocial Behavior**

**Chair: Stephan Huijbregts**

**Discussant: Hanna Swaab**

*Orange Room 1-2*

1. SWAAB, H
2. SWAAB, H
3. VAN ZONNEVELD, L
4. HUIJBREGTS, S
5. POPMA, A

Regulatory Mechanisms and their Neural Substrates in Aggression and Antisocial Behavior  
Aggressive Behavior in Preschoolers: Inhibitory Control Deficits Moderate the Influence of Negative Emotionality  
Eye-tracking and the Role of Social Attention Regulation in Aggressive Children  
Executive Functioning and Reward Sensitivity in Proactive and Reactive Aggression  
Neural Correlates of Deficient Fear Conditioning and Reward/Punishment Anticipation in Delinquent Male Adolescents

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# Abstracts Presented

## The 2013 International Neuropsychological Society

### Mid-Year Meeting

July 10-13, 2013  
Amsterdam, The Netherlands

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#### WEDNESDAY MORNING, JULY 10, 2013

##### **CE Workshop 1: Neuropsychological Rehabilitation of Social Cognition Impairments Resulting in Behavioural Changes**

**Presenter: Jacoba M. Spikman**

**9:00–11:00 a.m.**

##### **J. SPIKMAN. Neuropsychological rehabilitation of social cognition impairments resulting in behavioural changes.**

Social cognition is psychological construct that comprises the capacities of individuals to understand the behavior of others and to react adequately in social situations. Brain injury, in particular when prefrontal areas or circuits are affected, can result in behavioral changes. These changes involve inadequate and inappropriate social-emotional behavior and are known to have adverse consequences for daily life functioning of patients. There is accumulating evidence that deficits in social cognition are an underlying mechanism of these behavioral changes. This workshop addresses the use of a framework for social cognition in clinical neuropsychological practice, and evaluates methods for assessment and treatment of social cognition deficits.

A new neuropsychological rehabilitation treatment for social cognition problems will be presented and illustrated with patient case histories. By the end of the workshop participants will:

- understand impairments in (aspects of) social cognition and how these relate to behavioral changes and prefrontal lesions
- know some methods (and their limitations) to assess impairments in social cognition
- know some methods (and their limitations) to treat impairments in social cognition
- understand how a new treatment protocol for social cognition impairments after TBI, T-ScEmo, can be administered to individual patients

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##### **CE Workshop 3: Cognitive Assessment at the Stroke Unit: from Bedside Testing to Full Neuropsychological Assessment**

**Presenter: Martine van Zandvoort**

**9:00–11:00 a.m.**

##### **M. VAN ZANDVOORT. Cognitive assessment at the stroke unit: from bedside testing to full neuropsychological assessment.**

The debilitating consequences of cognitive impairments after a stroke with respect to cognitive outcome, participation and quality of life make up a large proportion of the workload of clinical neuropsychologist, especially for those working in hospital settings and rehabilitation centres. The importance of cognitive assessment in the early days post stroke and its prognostic validity has been widely acknowledged. Classical neuropsychological syndromes as well as unique, rare syndromes can be found on careful neuropsychological assessment in the early days post-stroke.

To date, cognitive screening tests are of growing importance and often used in the early days post stroke. Especially since in clinical practice the medical condition of the patient not always permits to perform a complete neuropsychological assessment. In addition, time constraints, and budgetary and logistical considerations often play a role in clinical practice as well as in research settings. Moreover, a full neuropsychological assessment may not be necessary for each patient. Therefore, a brief cognitive evaluation forms a useful first step in the neuropsychological diagnostic process as well as with respect to research in which often large number of individuals need to be seen for neuropsychological examination.

Despite the frequent use of cognitive screening instruments, they share several important drawbacks. One important drawback is the ceiling effect and their lack of specificity over good sensitivity. The second drawback is that most of the cognitive screening instruments available today, despite their generic use, have been developed for the detection of dementia, particularly Alzheimer's disease. Well documented instruments like the MoCa, MMSE and the RBANS will be discussed as well as more recently developed instruments like the SINS. In addition the influence of fatigue, motivation and mood disturbances will be taken into account.

This workshop will provide with:

- an overview of the common and uncommon neuropsychological syndromes in the early days post stroke
- handhelds for neuropsychological assessment in the early days post stroke
- a comparison of the available cognitive screeners and their validity and reliability in the early days post stroke

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##### **CE Workshop 2: Attentional Disorders and Their Rehabilitation**

**Presenter: Ian Robertson**

**11:30 a.m.–1:30 p.m.**

##### **I. ROBERTSON. Attentional Disorders and Their Rehabilitation.**

By the end of this two hour workshop, participants will be able to: a) identify different subtypes of supramodal attention which are relevant to neuropsychological assessment; b) learn a range of methods for assessing these; c) describe some of the manifestations in everyday life and clinical problems of deficits in attention; d) learn about potential rehabilitation methods for some of these types of attention deficit.

a) Identify different subtypes of supramodal attention

This will cover selective, sustained, switching, and divided attention, their brain correlates and some relevant electrophysiological signatures and genetic correlates.

b) Learn a range of methods for assessing these

Some common measures of attention used clinically will be reviewed, with a particular focus on these tests which map onto underlying neurocognitive processes. These will include the Test of Everyday Attention (for adults and for children). In addition, EEG, ERP and pupillometry measures of attention will be reviewed.

c) Describe some of the manifestations in everyday life  
The impact of the different subtypes of attention on such processes as memory, forgetfulness, accident-proneness, boredom and emotional function will be described. A particular focus will be on problems of awareness and their measurement.

d) Learn about potential rehabilitation methods  
Some methods of improving attention, including sustained and selective attention, will be outlined and the relevant data presented on two groups in particular – adult ADHD and traumatic brain injury.

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**CE Workshop 4:  
Frontotemporal Dementia: Classification, Assessment,  
Diagnosis and Management**

**Presenter: Julie Snowden**

**11:30 a.m.–1:30 p.m.**

**J. SNOWDEN. Frontotemporal dementia: classification, assessment, diagnosis and management.**

Cerebral Function Unit, Greater Manchester Neuroscience Centre, Salford Royal Foundation Trust and  
Institute of Brain, Behaviour and Mental Health, University of Manchester, UK

Frontotemporal dementia is the second most common form of dementia affecting younger people. It occurs worldwide and has profound impact on families. Recognition is complicated because the clinical presentation is variable and it may be mimicked by other psychiatric and neurological disorders. To add to the potential confusion, nomenclature has changed over recent years, so that the label 'frontotemporal dementia' is now used to embrace a wider variety of clinical syndromes than in the past. The course addresses the classification of frontotemporal dementia. It examines behavioural and cognitive characteristics of three canonical clinical variants that fall within its rubric: behavioural, semantic and aphasic, and examines the clinical and neuropsychological characteristics that help to differentiate these from other disorders such as Alzheimer's disease, vascular dementia and affective disorders. The nature of patients' behavioural and/or cognitive disorder can have direct implications for management. The course concludes with a consideration of management issues and tailored-management strategies in frontotemporal dementia.

At the end of the course participants should be able to

- i) understand the current classification of frontotemporal dementia,
- ii) recognise its distinct behavioural and cognitive characteristics,
- iii) know how to differentiate it from other neurological and psychiatric disorders and
- iv) appreciate the importance of understanding individual patients' disorder for optimal person-centred management.

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**WEDNESDAY AFTERNOON, JULY 10, 2013**

**Student Workshop:  
Assessing Reliable Change in the 21st Century:  
Enhancing Evidence-Based Practice**

**Presenter: Gordon Chelune**

**12:45–2:00 p.m.**

**G. CHELUNE. Assessing Reliable Change in the 21st Century: Enhancing Evidence-Based Practice.**

Assessment of cognitive change is at the crux of neuropsychological assessments. Be it from a presumed premorbid level or an observed baseline, the evidence-based practitioner of the 21st century needs to be able to identify when a reliable and clinically meaningful change in a patient's cognitive ability has occurred. Serial assessments have become a standard of practice to evaluate both disease progression and recovery as well as the efficacy and side effects of medical procedures such as medications, surgical interventions, medical management, and rehabilitation. This session will discuss the fundamental factors that affect retest scores, with special attention given to such issues as differential practice effects, measurement error, regression to the mean, and individual differences in baseline ability. Simple versus Predicted methods of calculating Reliable Change will be reviewed, and participants will be provided a simple and readily available tool for creating regression equations based on basic summary data typically found in test manuals and research reports to evaluate the significance of individual change scores.

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**Invited Symposium:  
Complex Neuropsychological Rehabilitation: Beyond  
Common Cognition and Acquired Brain Injury**

**Chair: Jacoba M. Spikman**

**Discussant: Caroline Van Heugten**

**2:00–3:30 p.m.**

**J.M. SPIKMAN, L. FASOTTI, J. EVANS, J. SPIKMAN, L. FASOTTI, K. GEHRING & C. HEUGTEN, VAN. Complex neuropsychological rehabilitation: beyond common cognition and acquired brain injury.**

**Symposium Description:** Neuropsychological rehabilitation is increasingly recognized as useful therapy for the neuropsychological consequences of brain injury, with accumulating evidence for its effectiveness. To date, as extensively reviewed by Cicerone and colleagues (2000, 2005, 2011), there are many successful treatment protocols available for impairments in the major cognitive domains (attention, memory, executive function) and for patients with the most common forms of acquired brain injury (TBI, Stroke). Recently, the focus of research is shifting towards more complex or less common problems, for instance behavioural problems like impulsivity, social cognition deficits and fatigability, and towards less obvious patient groups, for instance patients with malignant brain tumours.

In the present symposium we will present new developments regarding the field of complex neuropsychological rehabilitation and the challenges that come with them. The symposium will include four presentations of researchers from the Netherlands and the UK. Prof. dr. Caroline van Heugten, one of the leading researchers in this field, will act as discussant.

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**M. WESTERHOF-EVERS, A. VISSER-KEIZER & J. SPIKMAN. Impact and Treatment of Deficits in Emotion Recognition after Traumatic Brain Injury.**

**Objective:** Impairments in social behavior are frequently found in patients with moderate to severe brain injury. It is hypothesized that deficits in social cognition underly these behavioral changes. A crucial element of social cognition is the ability to recognize facial emotional expressions. In a range of studies, deficits in this ability were found in TBI patients. In previous studies we found that emotion recognition deficits are related to injury severity and unrelated to other, non-social cognitive deficits. We found that deficits in emotion recognition are indicators of behavioral problems, as rated by significant others, and of impaired self-awareness. Moreover, deficits in emotion recognition are negative predictors of success of cognitive rehabilitation for executive dysfunction. For these reasons, impairments in emotion recognition can be considered an important target for treatment. However, until now there are few evidence based treatment protocols available.

**Participants and Methods:** We developed a training for Emotion Recognition, as part of a treatment protocol for social cognition deficits (T-SeeMo). It is expected that this treatment will have effect on emotion recognition in daily life situations. In an RCT this treatment is compared to a control treatment aimed at improving attention (CogniPlus), to investigate its effectivity.

**Results:** We now have preliminary results for a group of 21 TBI patients on both a static measure of emotion recognition (the FEEST) and a dynamic, ecologically valid measure of emotion recognition (the TASIT-EET). Contrary to the expectation, the patients who received the emotion recognition training improved significantly more on the FEEST than the controls, but no improvement was found on the TASIT-EET.

**Conclusions:** The results indicate that emotion recognition can be trained effectively in TBI patients. However, additional measures are needed to establish whether daily life social functioning has been improved.

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**L. FASOTTI. Fatigue after Stroke, an Untreatable Problem ?**

**Objective:** Post-stroke fatigue (PSF) is a frequently signaled and persisting complaint after stroke, experienced by approximately 50% of stroke survivors. PSF has been found to negatively influence quality of life, rehabilitation outcome, functional independency, and even suicide rates and mortality.

Despite these high prevalence rates and the dire consequences of PSF on stroke patients, no fatigue-relieving evidence-based treatments have been developed until now. Therefore, we designed a new treatment combining cognitive therapy (CO) with graded activity training (GRAT), called COGRAT, to alleviate fatigue and fatigue-related symptoms in stroke patients.

**Participants and Methods:** The effects of COGRAT were investigated in a randomized, controlled, assessor-blind clinical trial conducted in 8 rehabilitation centers. After a qualification period, eighty-three stroke patients (>4 months after stroke) were randomly assigned to a CO or COGRAT treatment. Primary outcomes (Checklist Individual Strength-subscale Fatigue (CIS-f); self-observation list-fatigue (SOL-f)) and secondary outcomes (Hospital Anxiety and Depression Scale, Stroke-Adapted Sickness Impact Profile, SOL-pain, SOL-sleep-D, 6-minute walk test) were collected at baseline (before and after the qualification period) and after treatment (immediately and 6-month follow-up).

**Results:** The qualification period showed stable fatigue levels. Both treatments showed significant beneficial effects on fatigue and other outcome measures (except pain and anxiety) with intention-to-treat analyses. Gains for the COGRAT group exceeded those in the CO group on number of individuals showing clinical improvement on the CIS-f and on physical endurance.

**Conclusions:** We conclude that a cognitive therapy program can alleviate persistent fatigue after stroke. However, the best results are obtained when cognitive therapy is augmented with graded activity training.

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**J. NELLANEY, R. MORRIS & J. EVANS. Impulsivity in a Virtual World: An Investigation of Decision Making after Brain Injury.**

**Objective:** Impulsivity is commonly reported to be problem after brain injury. Despite the potential for serious consequences of impaired decision making, there has been relatively little development of assessment tools or rehabilitation interventions specifically addressing impulsivity in this population. In this study we undertook a preliminary investigation of a non-immersive virtual reality task (The Secret Agent Task) designed to measure decision making after brain injury and compared performance on this task with a questionnaire measure designed to measure various aspects of impulsivity.

**Participants and Methods:** 30 people with brain injury participated (mean age 42.0 years), with most being in the severe injury range. The Secret Agent (SA) Task uses a game like format in which participants must carry out a mission as a secret agent, requiring various types of decision. Two measures of impulsivity were derived from the SA Task. Performance was compared with ratings on the UPPS (Urgency, Lack of Premeditation, Lack of Perseverance, Sensation Seeking) Impulsivity Scales. Ratings were self-rated and in addition data was available from a sub-sample of 14 relatives.

**Results:** The SA task was able to be understood and completed by all participants. For one of the SA task measures of impulsivity there was a significant correlation ( $\rho = 0.416$ ,  $p=0.022$ ) with the Urgency subscale of the UPPS, an unexpected negative correlation ( $\rho=-0.390$ ,  $p=0.033$ ) with the Lack of Premeditation scale and non-significant correlations with the other UPPS scales. For the other measure of impulsivity derived from the SA task there were no significant correlations with the UPPS scales. Carer ratings did not significantly correlate with SA performance.

**Conclusions:** The SA task is an engaging task and there is preliminary evidence of a relationship with a measure of Urgency (the tendency to engage in impulsive behaviours under conditions of negative affect). The challenge of examining impulsivity with this client group will be discussed.

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**K. GEHRING. Cognitive Deficits in and Interventions for Patients with Primary Brain Tumours.**

**Objective:** Many patients with primary brain tumours suffer from cognitive deficits including impairments in attention, executive function and memory. Studies have shown that the tumour, tumour-related neurological complications such as epilepsy, the various treatments, and psychological factors can cause cognitive deficits. Although in most cases the cognitive deficits are merely mild or moderate, they can substantially impact on the lives of these patients, who are on average 40 years of age at diagnosis.

Treatment of the cognitive deficits in patients with brain cancer may be complicated by the progressive nature of the disease, the concurrent tumour treatments, and the relatively poor understanding of the potential mechanisms that underlie the cognitive deficits. However, these patients, in particular those with slowly growing tumours, can be good candidates for interventions for the cognitive impairment.

In this presentation, I will discuss the results of our own randomized controlled trial in which we evaluated a multifaceted cognitive rehabilitation program in 140 patients with primary brain tumours. We observed statistically significant effects for measures of subjective cognitive functioning immediately after the intervention. At the 6-month follow-up, the intervention group performed significantly better than the control group on neuropsychological tests of attention and verbal memory, and reported less mental fatigue. We are currently developing a web-based version of the cognitive rehabilitation program.

Finally, I will describe the progress of our pilot randomized controlled trial on the feasibility and efficacy of a physical exercise program for improving cognitive function in 60 patients with primary brain tumours. Correspondence: *Karin Gehring, School of Social and Behavioral Sciences, Tilburg University, Tilburg 5000 LE, Netherlands. E-mail: k.gehring@tilburguniversity.edu*

**Invited Symposium:  
Neuropsychological Phenotyping Bridges Clinical and  
Basic Research**

**Chair: Jos Egger**

**Discussants: Ellen Wingbermühle, Tjitske Kleefstra**

**2:00–3:30 p.m.**

**J. EGGER, E. WINGBERMÜHLE, T. KLEEFSTRA, T. KLEEFSTRA, J. EGGER, S. VAN RIJN, K. VERMEULEN & E. WINGBERMÜHLE. Neuropsychological phenotyping bridges clinical and basic research.**

**Symposium Description:** Genetic disorders can initially manifest with a specific pattern of psychological dysfunctions and/or behavioural disorders. This holds for genetic disorders resulting from large chromosomal abnormalities but also for the many novel microdeletion syndromes that have been described recently. A well-known example of the first category is Klinefelter or XXY syndrome, while 17q21.31 microdeletion syndrome (17qMDS) and Kleefstra syndrome (KS) are examples of the last. KS was originally described as the 9q subtelomeric deletion syndrome associated with marked mental retardation, specific dysmorphisms, particular sleep disturbances, and progressive deterioration and apathy, suggestive for a 'neurodegenerative phenotype'. Haploinsufficiency of the EHMT1 gene has proven to be the causative factor. 17qMDS, thought to be caused by MAPT haploinsufficiency, comprises moderate mental retardation, dysmorphisms and various congenital anomalies. Hypersociability has been suggested to be part of its behavioural phenotype.

There is great variability in the degree to which genetic disorders are investigated on behavioural and neurocognitive variables. For instance, Noonan syndrome (NS), a relatively common autosomal dominant congenital disorder often caused by a mutation of genes in the Ras/MAP kinase pathway (e.g., PTPN11, KRAS, and SOS1), has been described from a neuropsychological perspective only very recently.

In this symposium, an overview will be given of modern genetic analysis techniques followed by recent findings on neuropsychological and psychopathological phenotypes of 17qMDS, XXY, NS, and KS. It is concluded that in all of the above syndromes, neuropsychological examination was able to demonstrate specific patterns of neurocognitive development and social interaction. Findings will be discussed as to their potential to further clarify the genotype-phenotype relation and to establish individualized behavioural and clinical management programs. Correspondence: *Jos Egger, PhD, Donders Institute for Brain, Cognition and Behaviour; Behavioural Science Institute, Radboud University Nijmegen, P.O. Box 9104, Nijmegen 6500 HE, Netherlands. E-mail: j.egger@psych.ru.nl*

**I. FEENSTRA, B. VAN BON, D. KOOLEN, R. PFUNDT, T. KLEEFSTRA & N. DE LEEUW. From karyotype to targeted microarray.**

**Objective:** Routine microscopic karyotyping is an important part of the diagnostic work-up in patients with multiple congenital anomalies and/or intellectual disability, allowing for the detection of microscopically visible chromosome aberrations. Smaller but clinically relevant deletions and duplications, however, remain unnoticed. Therefore high-resolution genome-wide technologies such as genomics microarrays are needed to improve the genotype-phenotype relationship.

**Participants and Methods:** The implementation of microarray technologies as a routine diagnostic setting to detect causative copy number variations (CNV) in MCA and/or ID patients.

**Results:** Patients with a chromosome aberration usually do not only display developmental delay, but can have behavioural disorders as well, like for instance in the well-known microdeletion syndrome Velo-Cardio-Facial syndrome (22q11.2 deletion). New microdeletion and -duplication syndromes are frequently discovered with the implementation of new techniques and sometimes psychiatric problems are part of the phenotype too (e.g., 15q13.3 and 16p11.2 deletion syndrome). A complicating factor in determining the phenotype, however, is that these CNVs are detected as a de novo finding in children with autism spectrum disorder or schizophrenia, yet also in normal parents without a psychiatric disorder.

**Conclusions:** Improvement in molecular genetic techniques has provided promising results, in that the chance to find a causative etiology has greatly increased. Collaborative and careful genotype-phenotype studies in these rare chromosome aberrations are needed to come to good quality definition of the phenotypic spectrum, including psychiatric and neuropsychological disorders.

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**J. EGGER, E. WINGBERMÜHLE, M. DIJKMAN & W. VERHOEVEN. In 17q21.31 microdeletion syndrome, hypersocial behaviour may be part of the neuropsychological phenotype.**

**Objective:** The 17q21.31 microdeletion encompasses among others the microtubule associated protein tau (MAPT) gene that is highly expressed in the brain and is involved in several neurodegenerative disorders such as fronto-temporal dementias and progressive supranuclear palsy. It can be postulated that in 17q21.31 microdeletion syndrome (17qMDS), normal brain development is disturbed as a result of MAPT haploinsufficiency, which in turn may compromise neurocognitive functioning. It is hypothesized that hypersocial behaviour, which has been observed in these patients, results from impaired response inhibition subsequent to prefrontal lobe dysfunction.

**Participants and Methods:** The present study aims to investigate neurocognitive functioning, including measurement of personal space (PS) and sensitivity for fairness (DG), in three patients with a genetically proven 17qMDS and in three intellectually disabled, physically healthy control subjects.

**Results:** All subjects, patients and controls, were moderately intellectually disabled with a congruent cognitive profile, except for a relatively strong memory for social-contextual information in the patients. As to social cognition, in both patients and controls, mentalizing abilities were confined to simple perspective taking whereas basic facial emotion perception was undisturbed. In the control subjects, however, marked difficulties in the recognition and expression of experienced emotions (cf., alexithymia) were present. As reflected in the PS distance measures, patients generally tended to tolerate close proximity towards the investigator. However, they showed less generosity or fairness on the DG.

**Conclusions:** Despite the methodological limitations characteristic for research in people with intellectual disabilities, with a neuropsychological assessment strategy, in three patients with 17q21.31 microdeletion syndrome, preliminary evidence for hypersocial behavior with a high level of frustration tolerance was found that may be implicated in its behavioral phenotype.

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**S. VAN RIJN & H. SWAAB. Theory of mind and underlying cognitive mechanisms in children with an extra X chromosome.**

**Objective:** Because of the risk for development of autistic symptoms, it has been suggested that studying individuals with an extra X chromosome may help in the search for cognitive, neural and genetic mechanisms underlying autism symptoms. This study focused on theory of mind skills, and underlying cognitive mechanisms, in children with an extra X chromosome as compared to children with autism spectrum disorder (ASD).

**Participants and Methods:** In total, 60 children (35 boys and 25 girls) with an extra X chromosome, 60 boys and girls with ASD and 110 non-clinical controls participated in the study. We used the Social Cognitive Skills Test (SCVT) to assess theory of mind skills. We also assessed language skills, executive functioning, face processing skills and intellectual functioning.

**Results:** Theory of mind scores were lower in the group with an extra X chromosome as compared to controls, and scores could not be differentiated from those in children with ASD. In the extra X group, 57 % of the children scored within the atypical range. Performance was similar in boys and girls with an extra X. Regression analysis showed that different cognitive functions predicted theory of mind performance in the extra X and ASD groups. Working memory and face processing were significant predictors in the extra X group, whereas inhibition, processing speed and language were significant predictors in the ASD group.

**Conclusions:** Our findings suggest that impaired theory of mind might help explain increased vulnerability for autism symptoms in children with an extra X. Executive dysfunctioning and deficient face processing seem to play a crucial role in theory of mind impairments in this population. This knowledge may help in diagnosis and treatment of children with an extra X, tailored to the specific profile of cognitive dysfunctioning. This study illustrates the importance of a neuropsychological approach in defining specific targets for treatment aimed at improving social functioning in different children with autism symptoms.

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**K. VERMEULEN, T. KLEEFSTRA, J. BUITELAAR, H. VAN BOKHOVEN & J. EGGER. Kleefstra Syndrome, an example of a single gene defect (EHMT1) with important neurocognitive consequences.**

**Objective:** Emerging evidence shows that different cognitive disorders, such as Intellectual disability, autism, and schizophrenia, share underlying molecular and pathological mechanisms. However, knowledge about how these molecular pathways affect cognition is highly fragmentary. EHMT1 is a regulatory gene, which is involved in histone modulation and is presumed to play an important role in the etiology of cognitive dysfunctioning. Animal studies with EHMT mutant species showed deviations in attention and social behavior. Adult patients with an EHMT1 mutations showed behavioural disturbances with a sudden decline in functioning (e.g., apathy and sleep problems). The current study examined development, temperament and behaviour in children with an EHMT1 gene defect and aims at the identification of cross-species cognitive endophenotypes through integration of these data.

**Participants and Methods:** Five children with a genetically proven EHMT1 mutation underwent child psychiatric examination, a structured assessment battery, and observation at home, to evaluate (mal)adaptive functioning and describe the behavioral phenotype in childhood.

**Results:** All children had severe developmental delay with deficits in social interaction skills. They all met the criteria for an autism spectrum disorder. Sleep problems as well as anxiety and mood disorders were highly prevalent. Temperament was characterized by low scores on attentional focusing and inhibition, whereas high scores were found on reaction to low intensity stimuli.

**Conclusions:** The behavioral phenotype of Kleefstra Syndrome is characterized by developmental delay and autistic-like features in childhood. Anxiety, mood disorders and sleep problems frequently occur. Further research on attentional and social cognitive deficits may elucidate neurocognitive endophenotypes associated with the specific EHMT1 gene defect and could provide insight into shared pathological mechanisms of cognitive dysfunctioning.

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**E. WINGBERMÜHLE, R. ROELOFS, I. VAN DER BURGT, W. VERHOEVEN, R. KESSELS & J. EGGER. Cognitive functioning in adults with Noonan syndrome.**

**Objective:** Noonan syndrome (NS) is a common genetic disorder characterized by short stature, facial dysmorphism, congenital heart defects and a slightly lowered mean IQ. Genetic research has revealed mutations in nine genes in the RAS-MAPK pathway. Although research on cognitive functioning in NS is scarce, previous studies indicate generalised deficits in children with NS. In this study, functioning within all major cognitive domains was evaluated in a large group of adults with NS, and compared with a control group.

**Participants and Methods:** A group of 42 adult patients with NS (16-61y), as well as 42 healthy controls matched for age, sex and education level underwent extensive neuropsychological assessment, including the multiple tested domains intelligence, speed of information processing, memory, executive functioning, and visuoconstruction. Domain scores were compared by GLM multivariate analyses of variance and post-hoc independent t-tests were performed for between-group comparisons within significant domains.

**Results:** Patients with NS showed a significantly worse performance in the domain speed of information processing ( $p < 0.05$ ,  $\eta^2 = 0.059$ ), while their performance on delayed recall was better than that of the control group ( $p < 0.05$ ,  $\eta^2 = 0.055$ ). No between-group differences were found on any of the other cognitive domains.

**Conclusions:** While diffuse cognitive problems seem to be present in children with NS, cognitive functioning of adults with this syndrome is characterized by mental slowness, but no other cognitive impairments, taken education level into account. Despite this relatively intact profile, patients frequently report cognitive complaints, indicating that individual neurocognitive and psychological assessment is important in clinical management of NS. Longitudinal research is needed to study cognitive development in NS.

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**Paper Session 1:  
Aging**

**2:00–3:30 p.m.**

**S.V. CASTRO, C. LIMA, T. ALVES & S.K. SCOTT. Ouch! Age-related Changes in the Recognition of Emotional Vocalizations.**

**Objective:** To examine how age shapes emotion recognition in nonverbal vocalizations, namely positive and negative ones. Age-related effects have been described for emotion recognition in faces, namely for negative emotions, but evidence for such effects in voice is scarce.

**Participants and Methods:** Forty-three younger adults ( $M = 22$  years) and 43 older ones ( $M = 61.4$  years) provided multiple emotion ratings on vocalizations expressing four positive and four negative emotions: achievement/triumph, amusement, pleasure and relief; anger, disgust, fear and sadness. These stimuli were taken from a previously validated and published database. Control measures included hearing acuity, general cognitive status, cognitive control, verbal intelligence, working memory, current affect, emotion regulation, and personality.

**Results:** Older adults were less sensitive than younger ones to positive and negative emotions (lower ratings on the intended emotion scales and lower categorization accuracy). They also differed in the pattern of ratings on the non-intended emotion scales. The impact of age on emotion recognition was not mediated by differences in general cognitive abilities, emotion regulation, current affect, and personality traits. Low-level acoustic features of vocalizations predicted with similar strength subjective ratings in younger and older participants, but the emotion-specific pattern of predictors differed across groups.

**Conclusions:** This study revealed age-related decrements in the recognition of nonverbal emotion vocalizations; these effects were not modulated by valence, nor explained by domain-general cognitive abilities or differences in affect and personality related variables. This suggests that age shapes emotion processing in nonverbal vocalizations, such as laughter or sighs, in a primary, non trivial manner.

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**R. VAN DINTEREN, M. ARNS, M.L. JONGSMA & R.P. KESSELS. P300 Development Across the Lifespan: A Cross-Sectional Study in 6-87 Year Olds.**

**Objective:** The event-related potential P3 (or P300) component is a large positive waveform that can be extracted from the ongoing electroencephalogram in a target detection task. It reaches a maximum at approximately 300 milliseconds after target presentation and has been associated with cognitive processes, e.g. working memory and attention. Development of the P3 across the lifespan was investigated.

**Participants and Methods:** This study analyzed and reviewed the development of the P3 across the lifespan employing 1) a cross-sectional study including 1,572 participants from ages 6-87 years and 2) a meta-analysis including 3,168 participants from 88 articles published between 1986 and 2012.

In the cross-sectional study, an auditory oddball paradigm was used to elicit the P3. Curve fitting software was used to obtain a model of P3 development across the lifespan.

**Results:** Logarithmic Gaussian (LG) models for P3 latency (P3lat) and amplitude (P3amp) explained the age-related variance significantly better than a normal Gaussian model. LG models for gender differed significantly between male and female participants. Gender effects revealed that males had lower P3amps and slower P3lats, albeit with very small effect sizes. This was confirmed by a 1-way ANOVA on the total group. No significant effects of education on P3lat or P3amp were obtained.

The LG model was prospectively replicated in a meta-analysis incorporating selected literature. The P3lat and P3amp age-related LG models of both the cross-sectional study and meta-analysis revealed similar trajectories, although statistically they differed significantly. The P3 is known to be susceptible to differences in recording methods and paradigm parameters. The role of paradigm parameters will be further investigated using the data from the meta-analysis.

**Conclusions:** Age effects on P3lat and P3amp followed a LG model indicating a rapidly increasing efficiency in information processing at a young age and a slow decrease in efficiency in information processing with aging in adults.

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**F. COLLETTE, J. GRANDJEAN, C. LORENT & C. BASTIN. The Role of Memory Traces Quality in Directed Forgetting: A Comparison of Young and Elderly Participants using the Item Procedure.**

**Objective:** The presence of a reduced directed-forgetting (DF) effect in normal aging has been frequently observed with the item method. These results were interpreted as reflecting age-related difficulties in inhibiting the processing of irrelevant information. The present study aimed at investigating the influence of memory traces quality on the magnitude of the DF effects in normal aging. We predicted that increasing the quality of memory traces (by increasing presentation times at encoding) would be associated with a deterioration of the directed forgetting performance of elderly participants (i.e., attenuated DF effects) due to the increased difficulty of inhibiting highly activated memory traces.

**Participants and Methods:** A classical item-method DF paradigm was administered to 48 young and 48 elderly participants under short and long encoding conditions. Memory performance for information to memorize (to-be-remembered items) and to suppress (to-be-forgotten items) was assessed with recall and recognition procedures.

**Results:** The results indicated that, when memory traces are equated between groups in the long encoding condition, DF effects observed with the recall and recognition procedures are of similar amplitude in both groups (all  $p > 0.05$ ).

**Conclusions:** We found that the older participants were as able as the younger ones to efficiently suppress the processing of to-be-forgotten items when the quality of the memory traces for to-be-remembered information is equated between groups. This suggests that the decreased DF effect previously observed in older adults might not actually depend on their inhibitory abilities.

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**J. OOSTERMAN, J. CLAASSEN & E. OVERDORP. Neuroanatomical and Neuropsychological Predictors of Impaired Instrumental Activities of Daily Living.**

**Objective:** Impaired instrumental activities of daily living (IADL) is one of the core characteristics of dementia and has been associated with neuropsychological deficits and structural brain abnormalities. However, little is known about their unique contributions to impaired IADL. In this retrospective study, we examined the independent contributions of white matter hyperintensities (WMH), medial temporal lobe atrophy (MTA), global atrophy (GA), executive function (EF), episodic memory, general cognition and working memory.

**Participants and Methods:** We used data of 365 older adults visiting the memory clinic of Zutphen hospital (Zutphen, NL). The Lawton and Brody IADL scale and an extensive neuropsychological battery were administered. Visual rating scales were used to determine the severity of WMH, MTA and GA. Spearman correlations and multiple logistic regression analyses with stepwise selection were employed to determine the unique contributions of these variables to IADL.

**Results:** All neuroimaging and neuropsychological scores were significantly related to IADL. Subsequent analyses revealed that WMH, MTA, EF and general cognition independently predicted impaired IADL. Separate analyses were performed for the following subgroups to examine whether the predictors differed as a function of diagnosis: Alzheimer's dementia (AD;  $n=85$ ), mild cognitive impairment ( $n=72$ ), vascular dementia ( $n=25$ ) and psychiatric disorder ( $n=27$ ). Results showed that the correlates of impaired IADL differed between the groups: e.g., IADL was associated with several neuropsychological domain scores but not with neuroimaging variables in the psychiatric patients, whereas general cognition, WMH and MTA were the main correlates in AD.

**Conclusions:** This study reveals that multiple factors independently predict impaired IADL. Hence, judgments about a patient's ability to carry out IADLs might be hazardous if based solely on test performance. Our results support the use of neuroimaging as an additional investigation of functional decline in older people.

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**S. DASELAAR. Less wiring, more firing: Low-performing older adults compensate for impaired white matter with increased neural activity.**

**Objective:** The reliable neuroimaging finding that older adults often show greater activity (overrecruitment) than younger adults is typically attributed to compensation. Yet, the neural mechanisms of overrecruitment in older adults are largely unknown. Rodent electrophysiology studies have shown that as number of afferent fibers within a circuit decreases with age, the fibers that remain show an increase in synaptic field potentials ("less wiring, more firing"). Extrapolating to system-level measures in humans, we proposed and tested the hypothesis that increased activity in older adults compensate for impaired white-matter connectivity.

**Participants and Methods:** Using a neuropsychological test battery in 45 older adults, we measured individual differences in executive functions associated with the prefrontal cortex and memory functions associated with the medial temporal lobes. Using event-related functional magnetic resonance imaging, we compared activity for successful vs. unsuccessful trials during a source memory task. Finally, we measured white-matter integrity using diffusion tensor imaging.

**Results:** The study yielded three main findings. First, low-executive older adults showed enhanced success-related activity in the prefrontal cortex, whereas low-memory older adults showed enhanced success-related activity in the medial temporal lobes. Second, low-executive older adults displayed white matter deficits in the prefrontal cortex, whereas low-memory older adults displayed white matter deficits in the medial temporal lobes. Finally, in both prefrontal and medial temporal lobe regions, white-matter decline and success-related activations occurred in close proximity and were negatively correlated.

**Conclusions:** Our findings support the less-wiring-more-firing hypothesis, which provides a testable account of compensatory overrecruitment in older adults.

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**Poster Session 1:**

**ADHD / Autism / Learning Disability / Genetics / Forensic / Cancer / Psychopathology / TBI (Child)**

**3:30–5:00 p.m.**

**ADHD/Attentional Functions**

**J. BORRANI, M. FRÍAS, A. GARCIA, M. CERVANTES, V. MARTÍNEZ & P. VALDEZ. ADHD Symptoms and Components of Attention in Juvenile Delinquents.**

**Objective:** It has been found that juvenile delinquents have a high prevalence of attention deficit and hyperactivity disorder (ADHD) symptoms. The objective of this study was to analyze ADHD symptoms and possible difficulties on the four components of attention (tonic alertness, phasic alertness, selective attention and sustained attention) in juvenile delinquents.

**Participants and Methods:** Participants were 45 males, 15 juvenile delinquents (JDG), 15 non-delinquent adolescents paired by age (PAG) and 15 non-delinquent adolescents paired by age and education level (PAEG). ADHD symptoms were self-reported using the Conners Questionnaire. The components of attention were analyzed using a Continuous Performance Task.

**Results:** There were no group differences on the predominantly inattentive ADHD scale (JDG  $4.04 \pm 2.13$ , PAG  $2.51 \pm 1.42$ , PAEG  $2.93 \pm 1.88$ ;  $H=4.08$ , NS) but there were differences on the predominantly hyperactive – impulsive ADHD scale (JDG  $4.69 \pm 2.40$ , PAG  $2.54 \pm 1.41$ , PAEG  $2.72 \pm 2.05$ ;  $H=8.58$ ;  $p<0.05$ ). There were differences on all components of attention, tonic alertness (JDG  $79.95 \pm 21.93\%$  of correct responses, PAG  $94.86 \pm 8.16\%$ , PAEG  $87.09 \pm 15.56\%$ ,  $H=12.03$ ,  $p<0.01$ ), phasic alertness (JDG  $60.25 \pm 30.72\%$ , PAG  $81.60 \pm 18.62\%$ , PAEG  $71.36 \pm 24.84\%$ ;  $H=7.03$ ,  $p<0.05$ ), selective attention (JDG  $55.06 \pm 21.85\%$ , PAG  $74.14 \pm 16.45\%$ , PAEG  $61.69 \pm 24.84\%$ ;  $H=7.70$ ,  $p<0.05$ ) and sustained attention (JDG  $26.40 \pm 18.0$  responses in the longest hit run, PAG  $59.07 \pm 25.12$  responses, PAEG  $42.93 \pm 27.17$  responses;  $H=11$ ,  $p<0.01$ ). Post-hoc analysis showed that the JDG reported more ADHD symptoms than non-delinquent adolescents (PAG and PAEG), independently of education level. On the other hand, attention was higher in the group with more years of education (PAG), compared to the groups with less years of education (JDG and PAEG).

**Conclusions:** Juvenile delinquents show higher levels of hyperactive – impulsive ADHD symptoms; whereas a decrease in the components of attention occurs in adolescents with lower levels of education, including juvenile delinquents and non-delinquents.

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#### T.A. DUDA, J.E. CASEY, N. MCNEVIN & V. PETRAUSKAS. Development of Graphomotor Fluency in Adults with and without ADHD: A Kinematic Analysis.

**Objective:** Motor problems, including poor handwriting, are common in Attention-Deficit Hyperactivity Disorder (ADHD) but are not well understood and often go untreated (e.g., Barkley, 2006; Fliers et al., 2009). Kinematic graphomotor fluency differences have been found in children (but not adults) with ADHD “on” versus “off” stimulant medication and when compared to controls (Tucha & Lange, 2001, 2004). Digitizing technology has been used to study kinematic graphomotor fluency development in healthy individuals (Portier & van Galen, 1992) but not in ADHD. This study sought to identify whether a similar pattern of development would occur in adults with ADHD “on” and “off” medication and in comparison to healthy adults.

**Participants and Methods:** Twelve controls randomly selected from a larger study and 11 ADHD participants were recruited. Participants wrote a novel symbol 30 times on a digitizing tablet, with ADHD participants counterbalanced to perform the task on and off medication. Graphomotor fluency was operationalized using Normalized Jerk (NJ), with higher values indicating dysfluency and lower values indicating fluency.

**Results:** A repeated measures One-Way ANOVA was used to compare the average NJ of the first 10 versus the last 10 trials for ADHD participants on and off medication and controls. A statistically significant decrease in NJ ( $\alpha = .02$ ) was observed in controls  $F(1, 11) = 10.39$ ,  $p = .008$ , but not in ADHD participants on,  $F(1, 10) = 2.63$ ,  $p = .136$ , or off medication,  $F(1, 10) = 0.28$ ,  $p = .870$ . Large (.44), medium (.13), and negligible (.00) effect sizes (partial omega-squared) were observed, respectively.

**Conclusions:** Adults with ADHD did not develop graphomotor fluency as quickly as controls. Noting that attention improves with medication, the data suggest a concomitant dysfunction within the motor system.

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#### V.M. PETRAUSKAS, J.J. LONG & J.E. CASEY. Empirical differences in the quality of handwriting between children with and without ADHD.

**Objective:** Clinical observation suggests that children with ADHD have more difficulties with printing and handwriting. Previous re-

search using subjective ratings of handwriting quality have found poor quality performance in children with ADHD (Brossard-Racine et al., 2008). The purpose of this study was to objectively examine the quality of handwriting in children with ADHD as compared to those without. To further understand any differences in handwriting quality, groups were also compared on fine motor control and cognitive factors.

**Participants and Methods:** Children with ADHD ( $n=50$ ) and control children ( $n=50$ ) were compared on measures of handwriting and fine motor control. Handwriting was measured using the overall standard scores of the manuscript and cursive versions of the Test of Handwriting Skills-Revised (THS-R). Fine motor control was measured using the raw scores of the Drawing Lines Through Paths tasks of the Bruininks-Oseretsky Test of Motor Proficiency-2 (BOT-2). Children were also compared on the Block Design, Similarities, Digit Span, and Coding subtests of the WISC-IV. Groups were compared using MANOVA, followed by discriminant function analyses.

**Results:** Groups differed significantly on the manuscript and cursive overall standard scores of the THS-R [ $F(2, 97)=9.10$ ,  $p=0.00$ ] with cursive writing best differentiating between groups. There was no significant difference between groups on the Paths tasks of the BOT-2 [ $F(2, 97)=2.97$ ,  $p=0.056$ ]. There was a significant difference between groups on WISC-IV performance [ $F(4, 95)=13.80$ ,  $p=0.00$ ] with Digit Span and Coding best differentiating between groups.

**Conclusions:** Findings indicate that children with ADHD have poorer quality cursive and manuscript handwriting as compared to control children; furthermore, children with ADHD performed worse on cursive writing as compared to manuscript. The findings suggest that this difference is not related to fine motor control in isolation and may be related to working memory and symbol processing.

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#### L. HOKKANEN, J. LAUNES, M. LAASONEN, M. VIRTÄ, A. TUULIO-HENRIKSSON & K. MICHELSSON. Cognitive Courses after Perinatal Emergencies: A 30 Year Follow-up.

**Objective:** To analyze the factors relating to change in cognitive and ADHD symptoms in a prospective birth cohort followed-up 30 years.

**Participants and Methods:** A cohort of children born 1971-74 with at least one of 8 perinatal risks (i.e. low APGAR or birth weight) were assessed at 5, 9 and 30 years ( $n=845/748/523$ ). By 1983 184 children were diagnosed with minimal brain dysfunction (MBD, now obsolete) i.e. three or more behavioral or cognitive impairments, 667 cohort and 166 control children had fewer or no impairments. At 30, remaining cognitive problems and self-reported ADHD symptoms of childhood and adult age were surveyed: MBD group 97, non-MBD 356, controls 90 responded.

**Results:** The groups differed in WISC FSIQ ( $p<.000$ ) and in a teacher rating for hyperactivity ( $p<.000$ ) at 9 years, the MBD group performing worst ( $p<.000$ ). At 30, in the MBD group cognitive deficits persisted in 46/97 individuals, the other two groups had significantly less problems ( $p<.05$ )

The mean (SD) ADHD symptom scores were: for MBD 11.2 (9.8) in childhood and 6.2 (5.8) as adult, for non-MBD 7.1 (10.0) childhood and 5.7 (6.5) adult; for controls 5.2 (6.8) childhood and 4.8 (4.7) adult. In a mixed ANOVA, there was a significant effect of age ( $p<.000$ ), group ( $p<.001$ ), and age x group interaction ( $p<.000$ ), MBD group improving most. No differences existed between the groups in the adult symptom score at 30 years.

42 subjects scored abnormal both for childhood and adult symptoms (cutpoint control group mean+1.5SD) while 39 improved from abnormal to normal range. The improved and non-improved groups did not differ in Draw-a-person test or Illinois Test of Psycholinguistic Abilities score at 5 years, nor the WISC FSIQ at 9 years ( $t$ -test ns). They had, however, received slightly more special education (58% vs 42%,  $p<.05$ ).

**Conclusions:** Cognitive as well as behavioral symptoms often persist in adults with developmental deficits. The factors contributing to compensation should be explored further. Special education may be beneficial for ADHD symptoms.

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#### **D. O SHEA. Raven's Advanced Progressive Matrices: An Index For Predicting Inattentive Blindness In Older Adults?**

**Objective:** Previous research has shown that aging increases susceptibility to inattentive blindness (Graham & Burke, 2011) as well as individual differences in cognitive ability relating to working memory and executive functions in separate studies. Therefore, the study was conducted in an attempt to bridge a gap that involved investigating 'age-sensitive' cognitive abilities that may predict inattentive blindness in a sample of older adults.

**Participants and Methods:** Thirty six healthy older adults took part in the study. Using the inattentive blindness paradigm developed by Most, Scholl, Clifford, & Simons (2001), I investigated whether rates of inattentive blindness could be predicted by participant's performance on the Raven's Advanced Progressive Matrices, Visual Patterns Test, the Paper Folding Test and a measure of reaction time.

**Results:** A logistic regression analysis showed that a higher score on the Raven's Advanced Progressive Matrices and the Visual Patterns Test individually, increased the likelihood that participant's would NOT exhibit inattentive blindness. Performance on the Raven's was also a slightly better predictor than performance on the Visual Patterns Test. Despite performances on the Paper Folding Test correlating strongly with performances on the Raven's and measure of reaction time, these measures were not significant predictors of inattentive blindness.

**Conclusions:** My results suggest that individual differences in abstract reasoning ability and visuo-spatial ability, play a key role in whether someone notices an unexpected object in this experiment or not. The findings also suggest an association between attention control and abstract reasoning ability and how differences in these functions may influence environmental awareness.

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#### **M. GUERRERO, B. SALDAÑA, E. ALEJO, J. CORTEZ, D. JUÁREZ, A. GARCÍA & P. VALDEZ. Effects of Simultaneous Performance of Two Tasks on the Indices of Sustained Attention.**

**Objective:** Efficiency tends to decrease when two tasks are performed simultaneously. This could be due to a decrease in sustained attention. Sustained attention is the capacity to respond efficiently to the environment during prolonged periods (from minutes to hours). The objective of this study was to determine the effect of the simultaneous performance of two tasks on the indices of sustained attention (general stability, time on task stability and short-term stability).

**Participants and Methods:** Participants were 11 volunteers, 6 males and 5 females, with a mean age of  $18.36 \pm 1.88$  years. The indices of sustained attention were assessed with a Continuous Performance Task (CPT). Participants responded a visual CPT, an auditory CPT and then both tasks simultaneously.

**Results:** Simultaneous performance of both tasks (visual and auditory) showed a decrease on two indices of sustained attention: general stability (standard deviation of correct responses, visual CPT  $1.41 \pm 1.33$ , simultaneous visual CPT  $2.64 \pm 0.73$ ,  $T=7$ ,  $p<0.05$ , auditory CPT  $1.11 \pm 0.98$ , simultaneous auditory CPT  $2.64 \pm 0.74$ ,  $T=3$ ,  $p<0.01$ ) and short-term stability (longest hit run, visual CPT  $63.45 \pm 43.30$ , simultaneous visual CPT  $24.09 \pm 10.23$ ,  $T=5$ ,  $p<0.05$ , auditory CPT  $93.18 \pm 69.40$ , simultaneous auditory CPT  $23.90 \pm 11.87$ ,  $T=0$ ,  $p<0.01$ ; longest error run, visual CPT  $4.81 \pm 2.96$ , simultaneous visual CPT  $8.63 \pm 4.22$ ,  $T=6.5$ ,  $p<0.05$ , auditory CPT  $5 \pm 3.31$ , simultaneous auditory CPT  $8.36 \pm 2.54$ ,  $T=5$ ,  $p<0.05$ ). There were no significant differences on time on task stability.

**Conclusions:** Simultaneous performance of two tasks decreases efficiency of both tasks on two indices of sustained attention: general stability and short-term stability. These results may explain errors when two tasks are performed simultaneously for prolonged periods.

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#### **E. VIERIKKO. Self-perceptions of Children with Attention Problems.**

**Objective:** Children with ADHD are shown to have overly positive perceptions of their own behavior, although they have consistently negative interactions with their parents and peers. This study examined whether self-perception of feelings and behaviors of children with attention problems differs from those of control children. The associations between child's self-perception, parenting practices and experiences of parenthood were also studied.

**Participants and Methods:** Participants were 37 children (26 boys/11 girls) aged 6-12 referred to neuropsychological group intervention for children with attentional and executive function problems at the Psychology Clinic at the University of Tampere, Finland, and 32 age-matched control children. Children completed The Self-Evaluation Scale for Children to assess child's self-perception. Parenting and experiences of parenthood were assessed by a questionnaire developed in cooperation with Niilo Mäki Institute and the Department of Psychology, University of Jyväskylä.

**Results:** Preliminary results show that the children with attention problems had more negative self-perceptions of their behaviors and social skills, and lower interest in school activities compared to control children. Negative self-concept was related to poorer social skills and lack of interest in school activities, and poor social skills to anxiety and disorganized behaviors. Child's negative self-perceptions were associated with increased parenting stress, e.g. mother's exhaustion and fathers' restrictive parenting. In contrast, father's nurturance was related to child's more positive self-concept.

**Conclusions:** Contrary to expectations the children with attention problems had more negative self-perceptions than control children. Further, parenting and parental stress seems to of importance for children's negative perceptions. These results should be taken into account in clinical practice.

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#### **T.A. ZABEL, M. MCCURDY & L.A. JACOBSON. Sensitivity and Specificity of the BASC-2 Scales for Screening Youth at Risk for ADHD.**

**Objective:** Broad-based symptom questionnaires such as the Behavior Assessment System for Children-2 [BASC-2] are a popular method of screening children at risk for multiple pediatric conditions, and have been proposed to be useful for diagnosing core symptoms of ADHD. As online versions of the BASC-2 and other measures are becoming increasingly available for widespread patient screening, we examined the utility of this scale for identifying youth at risk for ADHD.

**Participants and Methods:** De-identified data were obtained from 148 clinically-referred children (64% male) ages 6 to 18 ( $M=10.3$ ;  $SD=3.1$ ). Parent-report measures included a pre-visit online version of the ADHD-IV scale as well as clinic-based completion of two behavioral questionnaires (Conners Parent Rating Scale-3 [CPRS-3] and BASC-2).

**Results:** Using the DSM-IV-TR criteria ( $\geq 6$  of 9 symptoms), pre-visit ratings of inattention and hyperactive/impulsive behavior on the ADHD-IV resulted in more frequent elevated symptom endorsement for inattentive (IA; 43% of children) than hyperactivity/impulsive (H/I; 18%) behaviors. Mean CPRS-3 DSM-IV scores were significantly higher than comparable BASC-2 scores for IA (CPRS-3  $T=72.9$ ; BASC-2  $T=62.6$ ;  $p<0.01$ ) and H/I (CPRS-3  $T=65.9$ ; BASC-2  $T=58.7$ ;  $p<0.01$ ). Using cut-offs of  $T \geq 70$  on both the CPRS-3 and BASC-2 to predict youth meeting DSM-IV-TR parent-rated symptom threshold ( $\geq 6$  symptoms), the CPRS-3 was more sensitive (IA sens=0.87, spec=0.64; H/I sens=0.93, spec=0.73) and the BASC-2 was more specific (IA sens=0.48, spec=0.89; H/I sens=0.67, spec=0.94).

**Conclusions:** The DSM-IV scales of IA and H/I on the CPRS-3 appear more sensitive to threshold level ADHD than corresponding scales of the BASC-2, and are thus preferable for screening and diagnostic purposes. We urge caution concerning the use of the BASC-2 alone for screening a high incidence condition like ADHD, as the low sensitivity / high specificity qualities of the BASC-2 IA and H/I scales could result in significant under-identification of cases.

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**T.A. ZABEL, K. PATRICK, M. MCCURDY, D.L. CHUTE & L.A. JACOBSON. Online Screening of Academic Difficulties Using Parent Report: Clinical Utility of the Colorado Learning Difficulties Questionnaire.**

**Objective:** Lifetime prevalence of learning disability (LD) in children is estimated at 10%, but believed to be under-identified. Brief screening procedures are needed to identify children requiring more comprehensive assessment. We examined the clinical utility of a brief parent report measure (Colorado Learning Difficulties Questionnaire [CLDQ]) for predicting children with performance based learning deficits. We hypothesized that parent report of academic functioning would predict actual academic achievement deficits.

**Participants and Methods:** De-identified data were obtained from 339 clinically-referred children (67% male) ages 3 to 18 ( $M=10.2$ ;  $SD=3.3$ ) with intact overall intelligence ( $M=94.9$ ;  $SD=16.2$ ) seen in an outpatient testing clinic. Assessment included use of a pre-visit online version of the CLDQ (5 reading items, 5 math items) as well as office-based standardized measures (WJ-III or WIAT-III) of math (3 domains) and reading (4 domains).

**Results:** There was a high incidence of impaired scores ( $SS \leq 85$ ) for individuals taking each of the reading (~25%) and math subtests (~33%). Moderate correlations between CLDQ scores and WJ-III/WIAT-III achievement subtest scores were identified for reading ( $r = -.45$  to  $r = -.70$ ,  $p < .01$ ) and math ( $r = -.39$  to  $r = -.46$ ,  $p < .01$ ). Total scores for the CLDQ reading and math scales predicted low achievement, with the area under the ROC curve ranging from 0.77 to 0.87 for reading subtests and from 0.72 to 0.75 for math. Using cutoffs of  $>1SD$  above the CLDQ normative sample means, the strongest within-domain classification accuracy was for reading fluency ( $sens=0.92$ ;  $spec=0.55$ ) and math problem-solving ( $sens=0.88$ ;  $spec=0.45$ ), respectively.

**Conclusions:** This study adds to the validity of the CLDQ reading and math scales and supports the use of parent report for identifying children at risk for LD. Inclusion of the CLDQ in online patient screening surveys and patient dashboards holds potential to identify youth in need of more comprehensive LD assessment.

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**A. HIEMSTRA-BEERNINK & M. VAN DER DONK. Training Working Memory in Children with Attention-Deficit/Hyperactivity Disorder: A Pilot Study.**

**Objective:** Children with AD(H)D often suffer from working memory problems, which can lead to academic failure and malfunctioning in every day life. Studies show that computerized working memory training can improve working memory capacity and also has broader cognitive benefits. The aim of this pilot study was to assess the neuropsychological effects of a computerized working memory training in children with AD(H)D between the age of 7 and 15 years-old. Special interest of this study was to assess the effect of the training on broad cognitive (neuropsychological) functioning such as attention, working memory and organization skills.

**Participants and Methods:** Clinically-referred children with AD(H)D between the age of 7 and 15 years-old ( $N = 26$ ) followed the Cogmed RM working memory training. Neuropsychological assessment took place before and after the training in a child face-to-face meeting. Parents and teachers completed the Behavior Rating Inventory of Executive Functioning (BRIEF) before and after the training.

**Results:** Repeated-measures ANOVA showed that children improved on several working memory tasks after training. There was no convincing evidence for improvement on other neuropsychological tasks such as attention or inhibition.

**Conclusions:** These results will contribute to the discussion of the possible near and far transfer effects of the training. The results of this pilot study will be taken along in a large randomised controlled trial.

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**M. VOLLEBREGT, M. VAN DONGEN-BOOMSMA, D. SLAATS-WILLEMSE & J. BUITELAAR. Neurocognitive and Behavioral Outcome Measures after EEG-Neurofeedback in Children with ADHD; A Double-Blind Randomized Placebo-Controlled Trial.**

**Objective:** In the past decades, EEG-neurofeedback has been suggested to be of potential value for children in the treatment of Attention-Deficit/Hyperactivity Disorder (ADHD). However, despite the finding of medium to large effect sizes, recent reviews are reserved about the efficacy of EEG-neurofeedback in children with ADHD, mainly because of methodological shortcomings of the studies. Although the most recent published studies have more robust methodological designs, only 3 of more than 20 published randomized controlled trials (RCTs) included a placebo-condition. A double-blind, randomized, placebo-controlled study was designed to address the question if EEG-neurofeedback in children with ADHD is an effective alternative treatment option.

**Participants and Methods:** Forty-one children (8-15 years) with a DSM-IV-TR diagnosis of ADHD were randomly allocated to EEG-neurofeedback or placebo-neurofeedback treatment for 30 sessions, twice a week. Children were stratified by age, electrophysiological state of arousal, and medication use. Behavioral effects on the core symptoms of ADHD were measured by the severity of ADHD symptoms on the ADHD DSM-IV rating scale, scored at baseline, during treatment, and at study end. Clinical improvement was measured by the Clinical Global Impression-Improvement (CGI-I).

A neurocognitive test battery addressing attention, (working-)memory, reward- and time-processing, was administered before and after the treatment period. Everyone involved in the study, except the neurofeedback-therapist, was blind for treatment allocation.

**Results:** Repeated-measures analyses of variance with time as within-subjects factor and group as between-subjects factor were performed. EEG-neurofeedback was not superior to placebo-neurofeedback in improving behavioral and neurocognitive parameters in children with ADHD.

**Conclusions:** Neither these findings, nor the existing literature indicate a robust benefits of EEG-neurofeedback in children with ADHD.

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**S. ROORDING, H. KLIP, J. BUITELAAR & D. SLAATS-WILLEMSE. Working Memory Training in Children with Neuropsychiatric Disorders with or without Borderline Intellectual Disabilities.**

**Objective:** Working memory training has been shown to be a successful treatment in children with ADHD. Behavior problems as well as neurocognitive functioning improved after training with Cogmed as shown in studies of Klingberg and others. The focus of our research is to study the effect of Cogmed in children with different neuropsychiatric disorders and comorbid disorders. In an intervention study, differences in training effects between children with ADHD, learning disorders and learning problems are studied. In a randomized controlled trial, the effect of Cogmed is studied in children with neuropsychiatric disorders and borderline intellectual functioning ( $70 < IQ < 85$ ).

**Participants and Methods:** The intervention study included 100 children. The randomized controlled trial is still running and may include 100 children. In both studies, children trained with Cogmed RM, 5 times a week, 5 weeks. Outcome measures in the intervention study are behaviour questionnaires and in the randomized controlled trial both behaviour and neurocognition.

**Results:** In the intervention study repeated-measures ANOVA showed that Cogmed may be effective in children with ADHD, learning disorders and learning problems, although there are differences in efficacy. Pilot results of the randomized controlled trial will be presented at the symposium.

**Conclusions:** Cogmed working memory training may be an effective treatment possibility in specific groups of neuropsychiatric patients. Differences in training effect between groups will be discussed in light of recent literature.

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## Learning Disabilities/Academic Skills

### J.M. FLETCHER, K.K. STUEBING, S. VAUGHN, C.A. DENTON, A.E. BARTH, D.J. FRANCIS, A.C. PAPANICOLAOU & J.J. JURANEK. Validity and Reliability of a Hybrid Classification of Learning Disabilities: The Importance of Instructional Response.

**Objective:** This paper summarizes a series of studies addressing the validity and reliability of a hypothetical classification of learning disabilities based on three attributes: low academic achievement, inadequate instructional response, and exclusion of other disorders that predominantly cause low achievement.

**Participants and Methods:** In four studies, several hundred children and adolescents were screened and received intensive reading interventions in their schools. At the end of the intervention, each participant received multiple assessments of intervention response using norm referenced and criterion referenced reading measures. The participants were defined as adequate and inadequate responders using decoding, fluency, and comprehension benchmarks and compared on assessments of neuropsychological skills using. A subset received functional and structural neuroimaging assessments.

**Results:** In all four samples, validity studies using MANOVA showed that responders demonstrated higher levels of performance on neuropsychological tests, with phonological awareness most sensitive to responder status. Syntactic processing and working memory contributed to group differentiation, but not IQ and motor functions. Differences in neuropsychological profiles paralleled the severity of the reading problems, representing a continuum of severity. Neuroimaging studies also showed differences in the degree of activation of key areas of the known reading network and not compensatory patterns. For reliability, agreement and coverage across single indicators of response were good to fair, but improved with use of multiple indicators.

**Conclusions:** These results provide evidence in support of a hypothetical classification of learning disabilities based on low achievement, but with assessments of instructional response used to indicate that low achievement is unexpected. Children with learning disabilities should be viewed as difficult to teach, not unable to learn.

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### A.R. LOUGHAN, R. PERNA, J. LE, J. HERTZA & M. COHEN. Foundational neuropsychological correlates in the development of mathematics.

**Objective:** Math disorders have been recognized for as long as language disorders, yet have received far less attention in the literature. Mathematics is a complex construct and for proper development, multiple cognitive abilities may be required. Studies suggest that short-term memory, working memory, visuospatial skills, processing speed, and various language skills relate to math development and performance. However, most investigations have focused on children meeting criteria for Math Disability instead of relative weaknesses. The hypotheses explored in this research were that children who performed lower on math achievement than Full Scale IQ (as defined by 10 or 15 standard score discrepancy) would exhibit weaknesses in executive functions, memory, and visuo-perceptual skills.

**Participants and Methods:** Participants included 474 children [Girls=27%, Boys=73%; ages 5-17 years, mean age of 9.5 years; 90% Caucasian] who were referred for neuropsychological evaluations due to academic and/or behavioral problems.

**Results:** ANCOVA results for the 10pt discrepancy group, correcting for IQ ( $p = .015$ ) and gender ( $p = .001$ ), suggests that children who have a relative weakness in mathematics also appear to have weaknesses in attention ( $p = .000$ ), visual and verbal memory ( $p = .004$ ), and reading ( $p = .000$ ) and spelling ( $p = .000$ ). ANCOVA results for the 15pt discrepancy group, again correcting for IQ ( $p = .000$ ) and gender ( $p = .005$ ), suggests weaknesses in attention ( $p = .000$ ), visuo-perceptual skills ( $p = .022$ ), visual and verbal memory ( $p = .000$ ), and reading ( $p = .000$ ) and spelling ( $p = .000$ ).

**Conclusions:** Overall, our results confirm our hypotheses and suggest that reading skills, certain executive functions, memory, and visual perceptual skills are all highly related to math development in children who underperform in mathematics.

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### E. MATUTE, Y. CHAMORRO & G. AGUILERA. Literacy effect on language task performance.

**Objective:** The aim of the present study was to analyze literacy effect on language tasks performance.

**Participants and Methods:** 135 healthy adults were assessed; 60 illiterates (24 men, 36 women, mean age = 48.17 years  $\pm$  17.44) and 75 literates (37 men, 38 women, mean age = 45.96 years  $\pm$  18.86). Several language tasks, that are common in adult neuropsychological assessment, were used: Word, non-word, and phrase repetition, object and picture naming, verbal semantic fluency (animal category), following oral commands and arithmetic problem solving. Performance on those tasks was compared between literate and illiterate adults groups. Analyses of variance were carried out and the effect size was calculated for each comparison.

**Results:** Significant differences were found on almost all tasks, except for word repetition and object naming. On the other tasks, the illiterate group underperformed the literate group. The most pronounced effect size was found on the following oral commands, verbal fluency, and arithmetic problem solving tasks.

**Conclusions:** There is a strong relation between literacy and performance on the verbal neuropsychological tests that are commonly used in clinical neuropsychology, though object naming and word repetition were not affected by literacy. Thus, these two tasks could be considered as sensitive tools that are free of educational effects and, therefore, may be useful for assessing clinical populations with low educational levels. Correspondence: *Esmeralda Matute, PhD, Instituto de Neurociencias, Universidad de Guadalajara, Francisco de Quevedo 150, Guadalajara 44130, Mexico. E-mail: ematute@cencar.udg.mx*

### T.P. MECCA, C.A. MORÃO, P.B. SILVA, D.G. OLIVEIRA & E.C. MACEDO. Cognitive Profile of Adults with Developmental Dyslexia on WAIS-III.

**Objective:** The present work aimed at verifying the cognitive profile of dyslexic adults comparing their performance with the performance of good-reader adults in scales and subtests of WAIS-III.

**Participants and Methods:** Thirty-one Brazilian dyslexic adults and thirty-one good readers matched by gender, age and educational level, all with IQ > 80 participated in the study. In the Dyslexia group, all participants met the diagnostic criteria for Reading Disability according to DSM-IV-TR and presented low measures of reading and phonological awareness.

**Results:** ANOVA indicated significant differences between groups only for Verbal IQ measure ( $F(1,60) = 4.913; p = 0.030$ ). When subtests were taken into consideration, it was possible to observe significant differences between groups in Picture Completion, Coding, Matrix Reasoning, Similarities, Letter-Number Sequencing and Vocabulary. The Dyslexic group obtained lower results in all these measures. We also verified differences between Verbal IQ and Execution IQ in dyslexics, with poor performance in Verbal IQ ( $t(30) = 4.024; p < 0.001$ ). However, this difference was not observed in the control group ( $t(30) = 1.701; p = 0.099$ ).

**Conclusions:** These findings corroborate other studies which found lower performance in verbal tasks than in execution tasks in dyslexics, and also differences between measures of Verbal IQ in dyslexics and good readers. It has been observed that adult dyslexics present higher level of difficulties in tasks that required processing speed, phonological loop working memory, fluid reasoning, categorization by semantic association, expressive vocabulary, memory and visual discrimination. In conclusion, the identification of this cognitive profile can assist the neuropsychological assessment of adults with learning difficulties.

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### N. PEREIRA, A. COSTA & M. GUERREIRO. Cognitive Training Effects In Children With Reading Difficulties.

**Objective:** Attention deficit hyperactivity disorder (ADHD) is a frequent disorder like dyslexia in both of which co-occur reading disabilities. This study investigates the efficacy of cognitive training in reducing reading difficulties in children with reading disabilities.



**Participants and Methods:** 42 children, with ages between 5 and 11 years, divided into three groups: a control group of 8 children, a group of 15 children with dyslexia and another of 19 children with ADHD. All participants were submitted to neuropsychological evaluation to assess cognitive functions such as attention, executive function, memory, working memory and visuo-perceptive functioning. Reading performance was measured by the number of errors done while reading, number of correct words read within a minute and reading velocity. After the first psychological evaluation all children were submitted to cognitive training during 6 months to improve higher brain functions. At the end of this phase they were reevaluated to determine the efficacy of cognitive training on reading performance.

**Results:** Statistically significant differences were observed between groups for episodic memory ( $p < 0.05$ ), verbal abstract reasoning ( $p < 0.001$ ), semantic memory ( $p < 0.05$ ), sustained attention ( $p < 0.05$ ), visual memory ( $p < 0.05$ ), executive functioning ( $p < 0.05$ ), visuo-perceptual functioning ( $p < 0.05$ ), number of correct words read in a minute ( $p < 0.05$ ) and reading velocity ( $p < 0.05$ ). Significant differences were also demonstrated before and after cognitive training for verbal abstract thinking ( $p < 0.05$ ), visuo-perceptive functioning ( $p < 0.05$ ), number of correct words read in a minute ( $p < 0.05$ ) and reading velocity ( $p < 0.05$ ). Reading performance correlates significantly with improvements in executive function, verbal memory, episodic memory, working memory and visuo-perception function.

**Conclusions:** Cognitive function enhancement improves reading performance in children with reading disabilities.

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#### **A. SCHEPER, J. CUPERUS & E. BAAS. Auditory and neurocognitive factors relating to language learning in Dutch SLI.**

**Objective:** Children with SLI show problems in various aspects of auditory and neurocognitive processing, such as auditory attention and phonological working memory (Schwartz, 2009). It remains unclear how these factors influence language learning. Are there different profiles to be found in the population with SLI with respect to processing of information. And what are the effects of specific training on auditory, neurocognitive and language parameters in SLI (McArthur, 2008).

**Participants and Methods:** Dutch school-aged children with SLI in the age of six to twelve years are referred to the Speech and Language Department of Royal Kentalis, since they show little progress despite intervention as usual. In order to typify the children with SLI diagnostic questionnaires BRIEF, CBCL/TRF and CCC-2-NL are used. Word comprehension and naming skills in SLI are tested. Language-related deficits are investigated by the Dutch Test for Central Auditory Processing, TEACH, NWR and digit span.

62 children with SLI between 6 and 12 years of age are recruited by the Centre for Speech and Language Disorders of Royal Dutch Kentalis. These children with SLI are included to follow a specific language learning intervention of 1080 minutes during 8 weeks. The specific intervention includes communication based, language based (auditory training, phonological awareness, word finding strategies) and neurocognitive based (attention, memory, planning) therapy.

**Results:** The results will be shown by correlation analysis between auditory and neurocognitive processing and atypical language skills in Dutch children with SLI. The effectiveness of specific training on auditory, neurocognitive and language parameters in Dutch children with SLI will also be investigated.

**Conclusions:** Although there is a strong relationship between language impairments and language-related deficits in auditory and neurocognitive processing, the results of this study will provide evidence of the role of auditory and neurocognitive processing in naming skills by Dutch SLI. Correspondence: *Annette Scheper, Speech & Language Centre, Royal Dutch Kentalis, Castilielaan 8, Eindhoven 5629 CH, Netherlands. E-mail: a.scheper@kentalis.nl*

#### **M. VANDER VLUGT, M. SITSKOORN, H. VANDER VLUGT & H. VANDER VLUGT. Alexia without agraphia in an eight-year-old girl.**

**Objective:** An eight-year-old girl was referred to us with signs of alexia without agraphia. So far this syndrome is only described in adults after an infarct of the left posterior cerebral artery.

**Participants and Methods:** A full neuropsychological exam was performed with additional tests in order to make sure this was a case of pure alexia or a case of visual agnosia.

**Results:** Anamnestic no specific problems were reported. As of the first grade she complained about stomach ache and the inability to read. She said to be able to identify (is see) letters but could not give a meaning to the visual image. Her WISC IQ was average although her scores on incomplete figures (4) and symbol comparison (1) suggested a more general visual perceptual problem. A consulted ophthalmologist concluded amblyopic schoolgirl syndrome. Writing sentences was no problem; however she could not read what she had written. The VMI (Beery) and her drawings were above average. Because these results made no sense we prepared for a Visual Evoked Potential Study. After the summer holidays however her reading problems were spontaneously recovered and the stomach ache was successfully treated with antibiotics.

**Conclusions:** Synonyms for the Amblyopic School Girl Syndrome are Psychogenic Visual Disturbance, Hysterical Amblyopia, Visual Conversion Reaction, Ocular Conversion Reaction, Psychogenic Amblyopia. Different options explaining the above problem are possible. However all options are related to some kind of stress. It takes an experienced therapist to discover and to treat the underlying cause. In this case there are multiple indications that the stress was school related. The problems developed during the school year and spontaneously recovered during the summer holidays. Changing teacher and teaching her according the advices based upon the conclusions of the neuropsychological exam prevented relaps of her problems.

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#### **T. FREIRE, T.D. GONÇALVES & P.A. PINHEIRO CRENITTE. Long Latency Auditory Evoked Potentials (LLAEP) in the Study of Reading and Writing Disorders – A Systematic Review.**

**Objective:** Recently, studies have strengthened the contribution of LLAEP in the investigation of cognitive skills for the appropriate development of reading and writing. The LLAEP reflect the neuroelectric activity of the auditory pathway. They bring important contributions to the investigation of some cognitive abilities involved on the auditory processing (attention, discrimination and memory), essential skills to the proper development of reading and writing. It is admitted that individuals with learning disorders may present delay in the development of listening skills. Considering these findings the LLAEP could be an objective index to offer more information about the individuals with learning disorders. Therefore, this study aimed to investigate if the LLAEP is a tool that shows differences between children with reading-writing disorders comparing to normal children.

**Participants and Methods:** Through a systematic review, papers published until January 2013 was included from Web of Science, PubMed and Scielo databases following a comprehensive search strategy, using the keywords combination (terms checked in Mesh database): Learning Disorders and Event-Related Potentials; Learning Disorders and Evoked Potentials; Dyslexia and Event-Related Potentials, P300; Dyslexia and Evoked Potentials, Auditory.

**Results:** Fifty-six studies were found matching all the inclusion criteria, 44 studies showed that there is a positive consensus about the applicability of the LLAEP. The PEALL measure in individuals with learning disorders shows a decreased in amplitude and increase in latency indices compared with subjects without disorders. Only 12 studies showed no statistically significant differences between the groups.

**Conclusions:** Evidence suggests that LLAEP is a tool that shows differences between children with reading-writing disorders compared to normal. The use of LLAEP as a means of complementary assessment of reading and writing disorders could bring important contributions to clarify the alterations on this population.

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## Genetics/Genetic Disorders

### T.D. GONÇALVES, T. FREIRE & P.A. PINHEIRO CRENITTE. Related Aspects to the Candidate Susceptibility Genes for Developmental Dyslexia: A Systematic Review.

**Objective:** To investigate what are the most related candidate genes with developmental dyslexia (DD) described in the literature in the last 5 years.

**Participants and Methods:** Through a systematic review, were consulted online electronic databases (PubMed, ISI Web of Science and Scielo), and were searched papers latest five years, using the search terms “dyslexia” and “genetic”. Studies eligible for inclusion in systematic review had to fulfill the criteria: (1) case-control study or Trait Disequilibrium Test (TDT) family design, (2) confirmed diagnostic of dyslexia. Were excluded no control population, duplicate of previous publication, animal studies, reviews, and unpublished reports.

**Results:** After an extensive search, a total of 132 potentially relevant publications about genetic of dyslexia, only 23 publications met the inclusion criteria. Most of the found studies (16 studies - 57%) are concentrated in Germany and England. There is no published work with the population of South America. Thus, the most studied gene was DCDC2 (10 studies), and that 7 found no association of the gene with dyslexia, 3 found this association. The second most studied gene was the KIAA0319 (7 studies), and that 5 found association with dyslexia and only 2 not found. The third most studied gene is the DYX1C1 (6 studies), and that 3 found association with dyslexia and 3 not found. Then, with two studies are ZNF804A genes (both found association with dyslexia) and CMIP (one study found the association and the other not found). The remaining genes had only 1 study, and was found association with dyslexia in the FOXP2 gene, DGKI, GRIN2B, CYP19A1, MC5R, DYM and NEDD4L, and no association with dyslexia genes in MRPL19/C2ORF3, ROBO1, CNTNAP2, TTRAP, THEM2, VMP (NRSN1) and ATP2C2.

**Conclusions:** In this study, it was found that KIAA0319 gene shows the most consistent evidence of linkage for DD, and is located in a genomic region (chromosome 6p23–21.3).

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### J. EGGER, W. VERHOEVEN, I. FEENSTRA, S. WALVOORT & N. DE LEEUW. Impaired executive function, weak motor skills, and a rare form of epilepsy in an intellectually disabled girl with a 8q12.3q13.2 microdeletion.

**Objective:** Whole genome microarray techniques are the primary tool for the etiological assessment in intellectually disabled patients and have led to the discovery of several causative novel microdeletions.

**Participants and Methods:** Extensive neuropsychological, neurological, psychiatric and genetic workup was performed in a 9-years-old female patient with a history characterized by delay of psychomotor and speech development, mild to moderate intellectual disability and persistent sleep disturbances since the age of two.

**Results:** Besides lowered intelligence, impaired inhibitory control and executive function were found as well as weak language and motor skills. MRI-scanning of the brain revealed no abnormalities. EEG demonstrated frequent epileptiform activity centroparietal bilaterally with marked increase during sleep corresponding with continuous spike-waves during slow sleep (CSWS) syndrome, more specifically Electrical Status Epilepticus in Sleep (ESES). Several dysmorphic features were noticed including hypertelorism, downslanting palpebral fissures, a long, pear shaped nose, and low set, posteriorly rotated ears. Furthermore, she had a pectus excavatum, bilateral flat feet, and a sandal gap. Array-CGH demonstrated a 3.57 Mb de novo microdeletion in chromosome 8q12.3. Anti-epileptic treatment (sulthiame) resulted in a marked improvement of the patient's sleep pattern and consequently of her behaviour.

**Conclusions:** This de novo 8q12.3q13.2 microdeletion syndrome is characterized by a specific combination of neuropsychological dysfunction including impaired language and motor skills and a rare form of juvenile epilepsy (CSWS). Given the patient's neuropsychological pro-

file, it was advised to avoid overestimation of cognitive and language capacities, and to use educational and learning strategies based on modelling rather than on verbal instruction. Regular follow-up to monitor development by means of repeated neuropsychological assessments was planned.

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### M. HERBEN-DEKKER, B. KREMER & J.M. SPIKMAN. Emotion Recognition and Decision Making in Huntington's Disease.

**Objective:** Huntington's disease (HD) is a hereditary neurodegenerative disease that causes progressive disturbances of motor function, cognition and behaviour. Cognitive disorders and behavioural changes are diverse and often precede clinical (motor) onset of the disease (Craufurd & Snowden, 2002). In clinic, family members of HD patients often mention alterations in social-emotional function and decision making, which have a great impact on their independence and social life. Deficits in emotion recognition have been found in HD (Sprengelmeyer, 1996) and some studies showed impaired performance of HD patients on decision making tasks (Stout, 2001). We wanted to investigate if impaired emotion recognition could be predictive for impaired decision making in HD. Identification of these problems early in the disease course may facilitate adequate care.

**Participants and Methods:** 29 Huntington's disease patients in different stages of disease; average CAG repeat length 43.20 (SD= 2.75), age; M=45.97 years (SD= 11.40) were compared to 29 healthy controls, matched for age and educational level.

All subjects completed the Ekman 60 Faces test (Ekman, 1978) and the Iowa Gambling Task (Bechara, 1994). Disease stage of HD patients was determined on the basis of the Unified Huntington's Disease Rating Scale (UHDRS) motor score.

**Results:** Data collection has just been finished and our first analyses show a significant impairment for HD patients in the recognition of (mainly the negative) emotional expressions, compared to the controls. Further cross-sectional comparisons for the IGT measures will be carried out with student's t-tests as well. Pearson correlations and regression analyses will be carried out for analysing the relation between the two measures. Age and disease stage will be taken into account as covariates.

**Conclusions:** All results and conclusions will be presented on the poster. Correspondence: *Meike Herben-Dekker, MSc, Neurology; neuropsychology; UMCG, Hanzeplein 1, JIPK, AB 50, Groningen 9700 RB, Netherlands. E-mail: m.herben-dekker@umcg.nl*

### D. LIN, H. LIU, C. HO & M. CHIANG. Metabolic Profiling Studies in Children with Angelman Syndrome.

**Objective:** Angelman syndrome (AS) is a neuropsychiatric disorder that is characterized by autistic behavior, absence of speech, seizures, ataxia, and severe intellectual impairment. Recent studies have indicated the GABAergic dysfunction in CNS, suggesting Angelman syndrome as one of the metabolic disorders. Emerging evidences show that impaired metabolism may have a pathophysiological role in many neuropsychiatric disorders. Up to date, the metabolic profiles have not been studied in children with AS.

**Participants and Methods:** In this study we performed gas chromatography-mass spectrometry based metabolomic profiling in children with AS. Fasting serum carnitine, urinary amino acids and urinary organic acids levels were measured in 8 individuals with molecularly confirmed AS.

**Results:** There were deficiency of total carnitine and free carnitine, and imbalance of ester-to-free carnitine ratios, suggesting a possible underlying impairment of carnitine utilization and mitochondrial energy metabolism. The assessments of urinary metabolites in AS showed disturbances in levels of gamma-aminobutyric acid (GABA), essential amino acids, branch-chain amino acids, and glutamate:glutamine (Glu:Gln) ratio. The disturbed marker metabolites indicated an imbalance in metabolic pathway involving metabolism of energy, neurotransmitter and fatty acid.

**Conclusions:** It was concluded that the children with Angelman syndrome children had evidence of altered metabolic homeostasis. Further study of these metabolites may facilitate the development of more efficient therapeutic strategies for Angelman syndrome and diseases involving neuropsychiatric disorders.

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## Autism Spectrum Disorders

**E. BARENDSE, M. HENDRIKS, G. THOONEN, R. KESSELS & A. ALDENKAMP. The Utility of Standardized Measures of Executive Functioning in High Functioning Adolescents with an Autism Spectrum Disorder (ASD).**

**Objective:** Adolescents with Autism Spectrum Disorder (ASD) often show executive function (EF) deficits. These deficits may contribute to impaired adaptive behavior in high functioning ASD adolescents, but few studies have actually investigated this. We examine EF abilities in high functioning adolescents with ASD, both in daily life and in a laboratory setting, and compare these results with ASD symptomatology.

**Participants and Methods:** EF abilities of 24 high functioning adolescents with ASD were compared with matched controls. ASD symptoms were measured using the Autism Diagnostic Observation Schedule (ADOS). EF abilities in everyday behavior were measured using the Behavior Rating Inventory of Executive Function parent reports (BRIEF). Neuropsychological assessment was also conducted in all participants, measuring the EF constructs attention, inhibition, working memory, cognitive flexibility and planning.

**Results:** Results. Significant group differences with small effect sizes were found on the WISC-III estimated IQ [ASD  $M=118.8$ ,  $SD=5.9$ ; control  $M=112.3$ ,  $SD=6.5$ ]. A significant group effect was found on the BRIEF [ $p<.001$ , partial  $\eta^2=.69$ ], with adolescents in the ASD group having higher scores than controls. Subsequent analyses showed significant group effects with large effect sizes on all BRIEF subscales. The groups did not differ on most measurements of the EF tasks, except for a small difference on attention. No significant correlations between the BRIEF and the ADOS were found.

**Conclusions:** Though parents report EF deficits in daily life in adolescents with ASD, these deficits could not be demonstrated by neuropsychological measurements. A relationship with ASD symptomatology could not be found. The findings of this study are discussed in relation to the role of compensation techniques of high functioning individuals with ASD and the ecological validity of neuropsychological tasks.

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**M. DE VRIES & H.M. GEURTS. Inhibitory Control & Working Memory in Children with Autism: An Individual Difference Approach.**

**Objective:** Findings on working memory (WM) and inhibition autism spectrum disorders (ASD) are inconclusive. This is largely due to small sample sizes, diversity in age ranges, and differences among methods used. Potential individual differences in performance within the heterogeneous ASD group are often ignored. Therefore, we examined whether or not children with ASD show WM and inhibition deficits with a classical WM and inhibition task, in a large sample size, considering individual differences.

**Participants and Methods:** Seventy-seven children with ASD and 45 typically developing (TD) children performed an n-back task. Seventy-four children with ASD, and 43 TD children performed a stop task (8-12 years,  $IQ>80$ ). Besides traditional group comparisons, within the ASD group children with and without WM and/or inhibition deficits were compared on cognitive ability, symptom severity, and social and disruptive behavior.

**Results:** Traditional group comparisons (repeated measures ANOVA with group (ASD, and TD) as between subject factor, and WM load as within subject factor) revealed that children with ASD increased more in errors on the n-back task with increasing WM load than TD children. On the stop task (ANOVA with group as between subject factor) children with ASD had longer stop-signal reaction times than TD children. Within the ASD group (ANOVA with presence or absence of WM and/or inhibition deficits as between subject factor), children with WM and/or inhibition deficits (35%) had more conduct and oppositional defiant behavior than children without these deficits.

**Conclusions:** The ASD group, but not all children within this group, showed WM and inhibition deficits. The children with these deficits showed more conduct and oppositional defiant behavior. Hence, studying children with ASD as a homogeneous group seems insufficient and individual differences need to be taken into account when studying cognition in ASD.

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**H. GEURTS, S. VAN DEN BERGH & L. RUZANNO. Is there an inhibitory control deficit in people with autism?**

**Objective:** There is a substantial amount of data providing evidence for and against the idea that people with autism encounter inhibitory control deficits. In efforts to gain a more comprehensive perspective of inhibitory control in autism we will review the recent literature by presenting a qualitative as well as a quantitative analysis (i.e., a meta-analysis).

**Participants and Methods:** Our review included 43 studies (published between 2002 and 2012) with a combined sample size of 1221 people with autism (M age 14.4 years), 1467 typically developing (TD) controls (M age 13.9 years), and 447 clinical controls (M age 12.3 years). For the quantitative analysis we calculated Hedges'  $g$ , a standardized effect size, for each inhibition task in each study. For these analysis a random effects model was chosen. Two study characteristics were implemented as independent variables: (1) age and (2) inhibition domain.

**Results:** The qualitative analyses revealed that inhibition problems might be most observable in children with autism and only for specific aspects of inhibitory control, namely suppression of irrelevant information. The quantitative analyses revealed only a small difference between people with autism in comparison to TD controls. In contrast to the qualitative analysis, findings suggest increased difficulty in prepotent response inhibition among individuals with autism, and not for suppression of irrelevant information. In addition, there was a significantly large degree of heterogeneity between studies and age could not explain this heterogeneity.

**Conclusions:** Irrespective of their age, people with autism seem to encounter only minor inhibition problems. Future efforts to explain the large heterogeneity of these finding by defining more detailed task characteristics is needed to deepen our understanding of inhibitory control in individuals with autism.

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**S. KOOLEN, C. VISSERS, J. EGGER & L. VERHOEVEN. Can Monitoring in Language Comprehension in Autism Spectrum Disorder be Modulated? Evidence From P600 to Semantic Implausibilities.**

**Objective:** Individuals with Autism Spectrum Disorder (ASD) generally show impairments in language comprehension. It is often assumed that these difficulties reflect a linguistic deficit. We propose, however, that language difficulties result from atypical cognitive control processes. Recent psycholinguistic research suggests that one aspect of cognitive control, namely monitoring, prevents integration of erroneous linguistic. Therefore, quality of language comprehension depends largely upon monitoring. The present aim was to examine the inclination of people with and without ASD to monitor their perception of higher-level (semantic) aspects of language, and above all to examine whether monitoring of semantic perception could be modulated with instructions.

**Participants and Methods:** We recorded event-related potentials in 18 high-functioning adults with ASD and 18 matched controls. Our focus was on P600, assumed to reflect monitoring. We compared monitoring responses to semantically implausible input in a free reading condition with those in an instructed condition. In the free reading condition, participants were asked only to read the sentences. In the instructed condition, participants were instructed to focus on semantic implausibilities.

**Results:** In the free reading condition, control participants showed a monitoring response as tapped by P600 to implausible input, whereas no P600 was observed in participants with ASD. In the instructed condition, however, both participants with ASD and without ASD demonstrated a monitoring response to semantic implausibilities.

**Conclusions:** The results suggest that individuals with ASD are less inclined than typical individuals to monitor their perception of higher-level linguistic input. Importantly, this inclination can be enhanced with instructions. The findings support our hypothesis that the comprehension problems in ASD do not reflect an absolute deficit in the ability to process language, but a difference in the tendency to exert cognitive control during language processing.

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#### A.G. LEVER & H.M. GEURTS. Working Memory in Adults and Elderly with Autism Spectrum Disorders.

**Objective:** Autism spectrum disorders (ASD) are associated with impairments in communication and social interaction and with repetitive and stereotyped behaviors. One of the cognitive accounts on ASD is the Executive Functioning theory. Executive functions are cognitive processes involved in regulating, controlling and managing our goal-directed behavior, such as working memory (WM). Previous research on WM in ASD is inconclusive and studies on WM in adults and elderly with ASD are scarce. Therefore, this study aims to investigate how adults and elderly with ASD perform on a WM test in comparison to people without ASD and to explore the effect of age.

**Participants and Methods:** We compared the WM performance of 36 adults with ASD (age 22-70 years) and 59 gender and IQ matched typically developing controls (age 20-73 years) during a n-back task including 3 experimental conditions (0-, 1-, 2-back).

**Results:** Two repeated measure ANOVAs, assessing accuracy rates and reaction times (RTs), were conducted with group (2 levels) as between-subject factor and load (3 levels) as within-subject factor, and with age as covariate. We found that accuracy diminished with increasing WM load. However, both groups performed equally well, even when controlling for age. When WM load augmented, RTs increased as well. Individuals with ASD were overall slower in their responses, although there was not an interaction effect with load. Age did however influence RT performance. Further analyses revealed that age affected performance on a 1- and 2-back condition but not on a 0-back condition.

**Conclusions:** These findings indicate that adults and elderly with ASD perform similarly, although slower, to controls on WM and that age has a comparable effect on adults with and without ASD. So there is no indication for an accelerated aging effect in ASD. However, our results are preliminary as we are still collecting data. We expect to include 60 participants per group in July 2013.

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#### S. MOUGA, J. ALMEIDA, C. CAFÉ, F. DUQUE & G. OLIVEIRA. Adaptive Functioning of Children with Autism Spectrum Disorders (ASD): a Study with the Vineland Adaptive Behavior Scale (VABS) at Different Intellectual Levels versus Non Autism Population.

**Objective:** ASD are neurodevelopmental disorders that besides impairment in social interaction, compromise adaptive functioning limiting social inclusion. The relevance of Intellectual Quotient (IQ) versus ASD core deficits in acquisition of personal and social daily skills remains unclear. We studied the influence of ASD diagnosis versus other neurodevelopmental disorders (OND) on adaptive behavior besides IQ.

**Participants and Methods:** The sample consisted of 228 school-aged children (mean±SD=144±36 months; 185M/43F): ASD (ADI-R/ADOS positive; N=125), OND (no clinical ASD criteria; N=103). These two groups were subdivided in four, taking into account the classification of intellectual disability (ID) of the CID-9 (ID=IQ<70), and matched by Full-Scale IQ: ASD with no ID [N=80]; ASD with ID [N=45]; OND with no ID [N=54]; OND with ID [N=49]. The functional profile by ID in communication, daily living skills (DLS), socialization (SOC) and adaptive behavior composite (ABC) was compared. Statistical analysis was performed comparing the standard scores (SS) of VABS within the clinical groups and between the four subgroups. Significance level ( $\sigma$ )=0.05.

**Results:** T-test showed significant differences between diagnosis (ASD/OND) for DLS ( $p=.034$ ) and SOC ( $p=.042$ ). The com-

parisons in the subgroups based on ID classification showed a differential profile on VABS. The ID subgroups differ significantly in DLS ( $p=.011$ ), SOC ( $p=.028$ ) and ABC ( $p=.041$ ); ASD group with lower SS as expected. In NID subgroups the same was observed, however difference only was significant in SOC ( $p=.028$ ).

**Conclusions:** We can conclude that with VABS evaluation the socialization impairment remains a distinctive factor of ASD versus OND, independently of ID. However, co-occurring ID conditions result in further debilitating effects on overall functioning and adjustment, especially in ASD. These results have significant clinical and educational implications, enhancing the relevance to focus the intervention on teaching the daily live activities as early and intensively as possible to the ASD population.

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#### TBI (Child)

#### R.J. CASE, N. STARKEY, V. FEIGIN, S. BARKER-COLLO & K. JONES. Mild Traumatic Brain Injury at School: Teacher Perspectives and Educating Educators.

**Objective:** The consequences of Mild Traumatic Brain Injury (mTBI) in pediatric populations is controversial due to lack of research in this area and conflicting findings within the literature. The New Zealand-based Consequences of Brain Injury in Childhood (COBIC) study has addressed a number of the methodological issues that arose in previous studies of mTBI in childhood, with findings suggesting that children with mTBI are significantly more likely to experience emotional, behavioural, social, cognitive and academic difficulties when compared to non-injured peers. In the second stage of this study, we sought to examine the impacts of mTBI on school functioning from the perspectives of teachers and education providers. Additionally, we investigated professional development approaches for educationalists with a focus on in-class identification and intervention strategies for pediatric mTBI.

**Participants and Methods:** 20 primary school teachers participated in individual interviews regarding understanding and experience of child TBI at school. A thematic content analysis approach was employed in order to elucidate major themes. Findings were used to design a professional development workshop for teachers to enhance knowledge and skills relating to management of mTBI at school, which was then evaluated by teachers utilising qualitative methods.

**Results:** Results of the thematic content analysis revealed that teachers: are likely to underestimate the potential impact of mTBI on child functioning; report feeling under-supported by medical practitioners and psychologists in relation to supporting children with mTBI; and, perceive a lack of basic information regarding mTBI in their training and professional development.

**Conclusions:** The majority of educators are responsive to increased education regarding the neuropsychological effects of mTBI in pediatric populations. The design and implementation of an educational intervention with a neuropsychological basis designed to enhance pedagogical strategies is discussed.

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#### T. SILBERG, R. ELIAHU, E. VAKIL, J. AHONNISKA-ASSA, A. BREZNER & T. PILOWSKY. Verbal Memory Abilities among Children with Severe TBI: the Differential Effect of Age on the Rey AVLT.

**Objective:** The Rey Auditory Verbal Learning Test (AVLT) is a sensitive measure for evaluating verbal memory abilities among children following traumatic brain injury (TBI). The seven composite scores derived out of the test reflect a verity of verbal memory process, including learning, interference, retention and retrieval efficacy (Vakil et al., 2010). These composite scores are also reported to be age sensitive. The current study's aims were: (1) to compare performance on the Rey AVLT between pediatric TBI patients and normal controls; (2) to examine the effect of age on Rey AVLT performance among children with TBI; and (3) to examine the effect of injury severity, age at injury, IQ and executive functions (EF) on Rey AVLT performance.

**Participants and Methods:** The Hebrew version of the Rey AVLT was administered to 67 children (42 males) following severe TBI ( $M=12.3$ ,  $S.D.=2.7$ ; age range 8-17 years), and to 67 matched controls. Children were divided into two groups according to their age at assessment (under and above 12 years). The effect of age at injury, time since injury, IQ and EF on Rey AVLT performance was analyzed in the TBI group. **Results:** The TBI group was impaired in almost all composite scores, compared to controls. A significant interaction was found between age at assessment and performance on the Rey AVLT, with the older TBI group demonstrating significantly lower scores on the composite scores compared to matched controls. Such difference was not found between the young TBI group and matched controls. Injury related variables, time since injury and IQ level did not explain performance in the TBI patients. However, the EF correlated with learning and interference scores.

**Conclusions:** Our results support previous reports which show profound memory impairments in the Rey AVLT following pediatric TBI and resemble memory disorders associated with frontal lobe deficits. The Rey AVLT impairment seems to be age sensitive, and may be related to EF limitations which are easier to detect at older age.

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**T. SILBERG, D. TAL, A. BREZNER, M. LEVAV & Y. RASOVESKY. Parents and teachers reporting on behavioral, emotional and cognitive difficulties among children with severe TBI: the proxy challenge.**

**Objective:** (TBI) relies heavily on descriptions obtained through proxy-reports. The different informants offer a unique point of view on the child's behavior. However, in the case of children with TBI, the reliability of these reports can differ depending on the level of adjustment of the child and his environment to the new chronic state. The current study goals were to examine the agreement between parents and teachers in the Child Behavior Checklist (CBCL) and the Behavioral Rating Inventory of Executive Functions (BRIEF). We examined whether the level of agreement was related to child's and injury characteristics, as well as to the length of time that has passed since injury.

**Participants and Methods:** A sample of 50 parents and 50 teachers of children following severe TBI ( $LOC>6hr$ ;  $GCS<10$ ) was collected as part of a comprehensive neuropsychological evaluation. Children were evaluated at least one year post injury ( $M=22$  months;  $SD=14.7$ ).

Both parents and teachers completed the CBCL and BRIEF questionnaires. Summary scales were used in order to examine the level of agreement between raters using paired-t test, intraclass correlation coefficients (ICCs), and Bland Altman plots.

**Results:** Level of agreement on the total summary scale was higher for the CBCL than for the BRIEF questionnaire. When the entire sample was examined ICCs were low-to-moderate ( $ICC=0.2-0.65$ ) among raters on the different summary scales. However, when agreement was examined according to time since injury, ICC's were higher ( $ICC=0.6-0.9$ ) among children evaluated at least two years post injury.

**Conclusions:** As interventions following TBI are based on child's cognitive, behavioral and emotional state, it is important establishing different assessors' perspectives. However, we would like to suggest that following childhood TBI there is a change in the perception of the child's status that is related to the length of time since injury. The nature of this observed change is to be further investigated.

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**N.J. STARKEY, D. WILLIX-PAYNE, R. CASE & K. DOOLAN. Executive Function, Social Competence and Quality of Life in Children One Year After Mild Traumatic Brain Injury.**

**Objective:** Mild TBI accounts for up to 98% of all childhood brain injuries but there is on-going debate around whether these types of injuries result in longer-term difficulties. This study was conducted to investigate the effects of mild TBI on executive function, social competence and quality of life in children (age 5-15 years) one year after injury.

**Participants and Methods:** Children with mTBI were identified as part of a prospective population based study of the incidence and outcomes

of brain injury in New Zealand (the BIONIC study). One year after the injury, parents completed a range of questionnaires including the Behaviour Rating Inventory of Executive Function (BRIEF), the Strengths and Difficulties Questionnaire (SDQ) and the KINDL quality of life scale regarding their child's current functioning and behaviour. A group of TBI free children (matched on age and gender) were also recruited for comparison purposes.

**Results:** Findings indicated that parents of those with mTBI ( $N=56$ , 24 female, 32 male) rated their children as having greater executive function problems (BRIEF Behaviour Regulation Index, Metacognition Index and Global Executive Composite), more Total Difficulties (SDQ), and poorer overall quality of life than those in the comparison group (all  $p's <.01$ ). Both groups obtained similar scores for peer problems, prosocial behaviour (SDQ) and friendships (KINDL). A significantly higher number of children with mTBI scored in the clinically significant range on the behavioural regulation index of the BRIEF (21% vs 5%;  $p=.013$ ), the total difficulties from the SDQ (19% vs 5%;  $p=.022$ ) and overall quality of life (19% vs 5%;  $p=.022$ ).

**Conclusions:** Whether these behavioural differences were present prior to the index TBI is yet to be investigated. Nonetheless these findings suggest that children with mTBI and their families may need more support than previously recognised, to help them cope with and manage on-going child behaviour problems.

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**M. STUDER, B. GOEGGEL SIMONETTI, A. JOERIS, S. BERGER, M. STEINLIN, C. ROEBERS & T. HEINKS. Subtle attentional problems and elevated postconcussive symptoms in children after mild traumatic brain injury.**

**Objective:** Although recent studies have repeatedly shown that mild traumatic brain injuries (mTBI) only subtly affect children's neurocognitive functioning, there is growing evidence, that children with mTBI display more postconcussive symptoms (PCS) in terms of somatic, cognitive and emotional complaints in the weeks after injury.

**Participants and Methods:** The aim of this ongoing prospective short-term longitudinal study was to focus on working memory and attentional skills as well as on the trajectory of PCS in children (age 6-16 years) after mTBI and mild orthopedic injuries (OI). PCS were rated by the parents of mTBI children ( $n=46$ , mean age at injury: 10.9 years) and OI children ( $n=35$ , mean age at injury: 10.3 years) at four points in time  $T_0$  = at injury,  $T_1$  = 1 week after,  $T_2$  = 4 weeks after,  $T_3$  = 16 weeks after injury. Working memory performance and sustained attention were measured at  $T_2$  and  $T_3$ .

**Results:** Preliminary results of this study reveal that in the first weeks after the injury, parents of children after mTBI observe significantly more PCS compared with parents of the OI patients. While working memory performance is comparable between mTBI and OI children at both times ( $T_2$ ,  $T_3$ ), mTBI children present with more commission errors during the sustained attention test. Furthermore, a significant negative relationship between the PCS score and working memory performance at  $T_3$  has been found for the mTBI group only.

**Conclusions:** The results of this study show that in the weeks following the incident, mTBI children present with subtle attentional problems but no working memory impairment in standardized cognitive testing. The negative relationship between the elevated PCS ratings of parents of mTBI children and working memory performance at  $T_3$  might indicate that in everyday life working memory problems actually may exist and possibly affect school performance in some children.

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## Emotional Processes

**T.B. KOK, A. KINGMA, O. TUCHA, W.J. POST, E. DE BONT, J. SCHIEVING, C. GIDDING, J. LEMIERE, S. VAN GOOL, K.J. OOSTROM, D.C. VAN VURDEN, E. VRIJLANDT, P. MERKUS & W.A. KAMPS. Social cognition and executive functioning in newly diagnosed pediatric brain tumor patients.**

**Objective:** Little is known about the development of social cognition (SC) in children treated for a brain tumor (BT). Some studies conducted

many years after diagnosis and treatment show deficits in SC in these patients but the cause is still unclear. To evaluate the effect of treatment (tumor resection and/or neurotoxic treatment) on early and late SC, it is essential to assess SC as early as possible in the course of treatment. The aim of this study was assessing SC and related functions in newly diagnosed BT patients, aged 5 to 13 years.

**Participants and Methods:** 15 BT patients from 4 Dutch and Belgian pediatric oncology centres were administered a standardized neuropsychological battery including tests on SC (facial expression recognition & theory of mind), executive functioning (EF: working memory & cognitive flexibility) and intelligence. 18 controls with cystic fibrosis (CF) from 2 Dutch CF centres were administered the same battery. Furthermore, parents and teachers completed questionnaires on EF. All BT patients were assessed within 5 months of diagnosis and before neurotoxic treatment. 8 patients (53%) were also assessed before tumor resection. Test performance of BT patients was compared to CF patients and normative data using nonparametric procedures.

**Results:** Performance of BT patients on measures of SC, EF and IQ was average and did not significantly differ from CF patients or normative data. All ratings on EF were normal for both BT and CF patients, though teachers indicated significantly more problems than parents on scales of behavioural regulation and metacognition in both patient groups.

**Conclusions:** Based on this sample of newly diagnosed BT patients, we may conclude that performance on social cognitive, executive and IQ tests within 5 months of diagnosis and before adjuvant therapy is within the normal range. To our knowledge, this is the first study investigating SC early after diagnosis. Follow-up evaluation will be performed 3 years after diagnosis.

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## Cancer

### A. MEISSNER, I. MESKAL, G.J. RUTTEN & M.M. SITSKOORN. Predictors of Subjective Cognitive Complaints in Brain Tumor Patients after Brain Surgery.

**Objective:** Life expectancy of surgically treated brain tumor patients is increasing. However many patients report subjective cognitive complaints. Subjective cognitive complaints are interfering with the ability to maintain a normal socio-professional life and lower the quality of life. This study aims to prospectively investigate cognitive and psychological factors underlying subjective cognitive complaints in brain tumor patients after brain surgery.

**Participants and Methods:** Patients with a brain tumor (N=89) were tested one day before and three months after surgery. Of the 89 patients 48%(43) underwent brain surgery for resection of a meningioma, 14%(12) a low grade glioma, 28%(25) patients a high grade glioma, and 10%(9) patients for removal of a metastasis. Objective cognitive performance in several domains was measured by a computerized test battery (CNS Vital Signs: psychomotor speed, processing speed, complex attention, executive functioning, verbal and visual memory). Depression- and anxiety symptoms were collected with the Hospital Anxiety and Depression Scale (HADS). Subjective cognitive complaints after surgery were estimated by means of the Cognitive Failure Questionnaire (CFQ). To investigate the significance of cognitive and psychological factors to subjective cognitive complaints, a multiple regression analysis was conducted, using the backwards elimination method.

**Results:** Serious subjective cognitive complaints were reported by 22%(20) of the patients (CFQ  $\geq$  43). Level and severity of complaints did not differ among the patient groups. The model showed that enhanced depressive symptoms and reduction of visual memory performance from pre- to post surgery are significant predictors of subjective cognitive complaints.

**Conclusions:** Awareness of these predictors might help clinicians in selecting patients who are vulnerable for subjective cognitive complaints after surgery and to provide them with timely and proper care.

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### S. MENNING, M.B. DE RUITER, W. BOOGERD, D.J. VELTMAN, L. RENEMAN & S.B. SCHAGEN. Pretreatment fMRI During Planning and Memory in Breast Cancer Patients.

**Objective:** Cognitive function in breast cancer (BC) patients may be compromised before the start of adjuvant chemotherapy (CT). Four task-fMRI studies showed some pretreatment alterations, but had a small sample size and/or did not include cancer-specific controls. Here we report fMRI results of two tasks in a relatively large sample of BC patients scheduled to receive CT (CT+), BC patients not indicated to undergo CT (CT-) and healthy controls (HC).

**Participants and Methods:** Baseline recruitment for this prospective study is near complete. Here, we report results from a selected sample of subjects matched on age and IQ. 33 CT+ (50.5 $\pm$ 8.6 yrs; IQ 101.8 $\pm$ 12.8) and 33 CT- (52.1 $\pm$ 7.7 yrs; IQ 103.8 $\pm$ 13.7) were assessed post-surgery, but before adjuvant treatment. 32 HC (51.4 $\pm$ 7.5 yrs; IQ 105.9 $\pm$ 10.6) were also tested. Each assessment included neurocognitive tests and 3T multimodality MRI. This included an fMRI version of the Tower of London (TOL) assessing planning ability. Memory encoding and retrieval was measured with of a visual paired associates task.

**Results:** Performance was within normal range with no significant group differences. For the TOL, CT+ showed hypoactivation of dorsolateral prefrontal cortex (DLPFC) and lateral parietal areas compared to HC. With increasing task difficulty CT+ patients showed hypoactivation of DLPFC compared to CT-. During memory encoding, inferior parietal areas were more active in the CT+ group compared to both other groups. No significant group differences were found for memory retrieval.

**Conclusions:** Although we found no indications for pre-treatment cognitive impairment in BC patients, we did observe differences in brain activation during planning and memory encoding, but not memory retrieval, using fMRI. This finding stresses the need for baseline assessment when studying the effects of adjuvant treatment on brain function and structure. Our follow up measurements will show whether the brain regions in which we observed baseline differences are most vulnerable to the effects of CT.

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### M.M. STOUTEN-KEMPERMAN, M.B. DE RUITER, W. BOOGERD, L. RENEMAN & S.B. SCHAGEN. Late Effects of Cancer Treatment on Cognitive Function and White Matter in Breast Cancer Survivors.

**Objective:** Adjuvant chemotherapy (CT) for breast cancer (BC) is associated with cognitive problems and also with alterations in brain structure. In a previous study we found detrimental effects on white matter (WM) of patients exposed to high-dose adjuvant CT (Hi-CT) compared to patients who only received radiotherapy (RT), 10 years post-treatment. We now extended these measurements to BC survivors exposed to conventional-dose adjuvant CT (Con-CT) approximately 10 years ago and healthy controls (HC). Our aim is to compare neurotoxicity profiles of different treatment strategies.

**Participants and Methods:** Twenty Con-CT (60.5 $\pm$ 5.7 yrs) and 20 HC (58.9 $\pm$ 3.9 yrs) were assessed using neurocognitive tests and 3T MRI (Diffusion Tensor Imaging (DTI) and 1H-MR Spectroscopy (MRS)). Data were compared to 17 Hi-CT (57.1 $\pm$ 5 yrs) and 15 RT only patients (58.2 $\pm$ 5.8 yrs) previously assessed. An overall cognitive impairment score was calculated and used to classify participants as being cognitively impaired or not. Specific treatment comparisons were analyzed.

**Results:** In the Hi-CT group, 26.3% of patients were cognitively impaired. This was 12.5% in the Con-CT, 0% in the RT only and 3.7% in the HC group. This difference was not statistically significant between groups. DTI revealed a significantly higher mean diffusivity (MD) in the Hi-CT compared to the Con-CT and RT only group in several anterior and posterior brain areas. A higher MD was also found in the RT only group compared to the HC group in anterior areas of the brain. MRS showed that only Hi-CT was associated with a reduction of N-acetyl aspartate (NAA).

**Conclusions:** Percentually, there were more BC survivors who received CT who were cognitively impaired compared to RT only and HC, years after end of treatment. Furthermore, our imaging findings suggest widespread negative Hi-CT effects on WM compared to other treatments (including Con-CT), as evidenced by increased MD and lower NAA, the latter being suggestive of impaired axonal function. The effects of RT only are less pronounced.

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### Forensic Neuropsychology

#### M.J. HERKOV. Intellectual and Achievement Differences in Delinquent and Sexual Offending Adolescents.

**Objective:** Previous research has shown that adolescent sex offenders differ from other delinquent youth on a number of personality correlates. However, little research has been done comparing these groups on measures of cognitive function. Such data is important in that sex offender treatment programs rely heavily on manualized procedures that require increased cognitive ability compared to more behavioral approaches used with general delinquents. This research examines intellectual and achievement functioning in groups of general delinquents and sexual offending youth.

**Participants and Methods:** Participants were 220 male adolescents between the ages of 13 and 17 years old, who were referred for psychological evaluation following adjudication of a criminal offense, but prior to placement in a treatment center. Adolescents were divided into Delinquent-D (n=126) and Sex Offender-SO (n=94) groups and administered as series of psychological and cognitive tests including the WASI Vocabulary, Similarities, Block Design and Matrix Reasoning subtests as well as the WRAT-3 Spelling, Math and Reading subtests.

**Results:** Results indicated that both groups performed below average on virtually all measures of cognitive and achievement functioning (FSIQ D= 84 SO= 89; VIQ D=83 SO=86; PIQ D=87 DO=92; WRATR D= 85 SO=90; WRATM D= 78 SO=85; WRATS D=83 SO=92). However, t-test analysis found significant differences between groups with D scoring lower than SO in terms of FSIQ ( $p<.002$ ), PIQ ( $p<.021$ ) and WRATR ( $p<.049$ ).

**Conclusions:** While both groups performed below non-delinquent peers, the SO scored higher than D on most measures and more closely resembled normal cognitive functioning with all scores within one standard deviation of the mean. These findings support the use of manualized treatment and cognitive approaches in the treatment of SO which can capitalize on these cognitive strengths.

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#### E. HODGES, H. WILLIAMS, H. MEADHAM & A. MEWSE. Parenting, head injury and aggression: Predictive pathways of offending in male young offenders.

**Objective:** Adolescence is a risk period for offending and head injury (HI), with rates of HI in young offender populations frequently exceeding those in the community. Poor parenting practices have been associated with increased risk of offending and development of reactive and proactive aggression.

**Participants and Methods:** This study explored the relationships between parenting practices, reactive and proactive aggression, HI and offending in a sample of male young offenders from a Young Offender Institute (n=98) using self report data.

**Results:** History of at least one HI was reported by 73.5%, with 61.1% reporting a knock out from their worst HI. Poor supervision emerged as a key predictor: predicting knock out history, indicators of offending and reactive and proactive aggression. Repeated HI was predictive of reactive aggression and a knock out history predicted earlier age of first offence.

**Conclusions:** The impact of HI on outcomes via neuropsychological sequelae or as a "marker" for contextual risk factors such as poor supervision and reactive aggression are examined.

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### Psychopathology/Neuropsychiatry (Other)

#### I. FRAMPTON, H. WILLIAMS, T. HODGSON, B. LASK & K. NUNN. Testing the Insula Hypothesis Of Anorexia Nervosa: fMRI Studies.

**Objective:** Recent neuroscience hypotheses predict that young people with anorexia nervosa will have an underlying abnormality of function in neural networks involving the insula cortex. We have therefore designed a study to test this hypothesis using functional neuroimaging techniques.

**Participants and Methods:** Participants completed computerized tasks of mental rotation, inhibition, body image and switching, designed to load on insula networks, while their brain response is analysed using functional magnetic resonance imaging (fMRI). Statistical parametric mapping is used to explore group differences in brain activation patterns between young people in the acute stage of anorexia nervosa (n = 21) compared with age matched control participants.

**Results:** Significant group differences were observed on all tasks. 'Cold' information processing tasks (mental rotation and switch tasks) had greater between-group differences than the 'hot' eating disorder-related tasks (food word stroop and body image tasks).

**Conclusions:** Our findings suggest that dysregulation of insula networks could be a risk factor for the development of an eating disorders. Correspondence: Huw Williams, Exeter University, Washington Singer Labs, Exeter EX44QG, United Kingdom. E-mail: w.h.williams@exeter.ac.uk

#### H. AI, E. OPMEER, J. MARSMAN, M. VAN TOL, S. WOUDESTRA, N. VAN DER WEE, M. VAN BUCHEM, D. VELTMAN & A. ALEMAN. A longitudinal fMRI study to the neural changes related to recovery from major depressive disorder.

**Objective:** Episodic memory deficits in patients with major depressive disorder (MDD) have been found to be associated with dysfunction of the hippocampus. Increasing evidence has shown reduced structural hippocampal volume in depressive patients, which is still present after remission, suggesting that this is a trait rather than a state characteristic of MDD. However, to our knowledge it is not yet known whether hippocampal activation during emotional memory processing would change with recovery of depression.

**Participants and Methods:** Thirty-six patients and twenty-one healthy controls underwent functional magnetic resonance imaging (fMRI) twice, with two years in between. During scanning, participants performed an event-related, subject-paced, emotional word encoding and recognition paradigm. Depressive severity was measured using the Montgomery-Åsberg Depression Rating Scale (MADRS) at both days of scanning. Based on the MADRS scores of the second measurement (S2), seventeen patients were in remission (RE-patients) and nineteen were not (NONRE-patients). A multi-level approach was used in the analyses. On first level, the difference in brain activation between the two scan sessions was calculated. On second level, we grouped the contrast maps of the time difference in a repeated measure ANOVA with group and emotional condition as factors.

**Results:** The bilateral hippocampus was chosen as our region of interest. NONRE-patients showed an increase in activation over time in the hippocampus during emotional words recognition ( $p< 0.05$ , FWE corrected).

**Conclusions:** Activation of the hippocampus increased over time in patients who did not recover from MDD, which might suggest that a longer period of being depressed leads to an increase in hippocampal activation since they did not show an increase in depression severity.

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#### A. HENDRIKS, G. JANSSEN, M. KAARSEMAKER, H. DE MEY & J. EGGER. The Relation Between Social Experience and Perspective Taking: Assessing Deictic Relational Responding Skills in Social Anxiety Using Relational Frame Theory.

**Objective:** One of the abilities involved in social cognition is perspective taking. According to Relational Frame Theory (RFT), perspective taking skills are based on the derivation of relations of perspective, and are learned and practiced in social interactions. Pronounced deficits in the flexibility of these skills have been found in several populations lacking social experience, such as people with autism, schizophrenia and social anhedonia. To examine the role of social experience more closely, the present study assessed flexibility of perspective taking in a socially anxious population.

**Participants and Methods:** We included 13 socially anxious participants and 14 healthy controls in our study, with both groups receiving measurements of intelligence, social anxiety, avoidance and anhedonia,

and perspective taking. For the latter, we used a mental attribution task and a computerized version of the Barnes-Holmes protocol. This protocol targets interpersonal (I-You), spatial (Here-There) and temporal (Now-Then) perspective taking relations in varying levels of complexity (simple, reversed and double-reversed).

**Results:** The results indicated that there was a significant difference between groups regarding accuracy on reversed trials of the deictic framing protocol ( $F [1, 25] = 16.87; p < .001$ ), which remained significant after controlling for intelligence ( $F [1, 24] = 4.605, p = .042$ ). We also found significant negative correlations between accuracy on reversed trials, and measures of social anhedonia (Pearson's  $r = -.574; p = .002$ ) and social anxiety (Pearson's  $r = -.662; p = .000$ ).

**Conclusions:** These results indicate that socially anxious individuals experience some difficulties in perspective taking when a reversal in perspective is required, and that social experience could indeed play a role in perspective taking deficits. Future research should focus on remediate perspective taking relations in clinical groups, to benefit social cognition and functioning.

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### L. OLABARRIETA LANDA, N. IBARRETXE-BILBAO, O. RILO CANO, C. SCHRETLEN, M. VARVARIS, J. PEÑA LASA & N. OJEDA DEL POZO. Altered White Matter Connectivity Relates to Semantic Fluency in Bipolar Disorder Relatives.

**Objective:** Verbal fluency (VF) deficits have been found among bipolar disorder (BD) patients but not in BD relatives. Previous investigations have demonstrated white matter (WM) alterations in some areas of the brain in BD and their relatives compared to controls, but to date there are no studies that correlate white matter (WM) and cognitive functions in BD relatives. We aimed to investigate the relationship between performance on VF and cerebral WM fractional anisotropy (FA) in BD patients and relatives.

**Participants and Methods:** We recruited 32 stable outpatients with BD (mean age=42) and 32 first degree relatives (FDR) (mean age= 44). Subjects were given an extensive battery of neuropsychological tests, and were scanned using diffusion tensor MRI on a Siemens 3T scanner. VF was measured with semantic and phonemic subtest from Calibrated Ideational Fluency Assessment (CIFA). Whole-brain voxel-wise regression analysis of semantic and phonemic fluency and cerebral WM fractional anisotropy FA data was performed using TBSS (Tract-Based Spatial Statistics), part of FSL software.

**Results:** There were significant differences between BD patients and FDR in gender, but not in age and years of education. After controlling for gender, BD patients performed worse than FDR on VF, and there were significant differences in semantic fluency ( $p = .048$ ) but not in phonemic fluency ( $p = .087$ ). No correlations existed between score on VF and FA in the clinical group. In FDR, however, a significant positive correlation ( $p_{corrected} = .016$ ) was found between semantic fluency and a large cluster including WM areas of cerebellum and brain stem, WM frontal lobe, cingulum, fornix and corpus callosum.

**Conclusions:** Our study shows group differences in semantic fluency but not in phonemic fluency. Moreover, we have found correlations between WMFA and performance on semantic fluency in FDR. This suggests a contribution of those tracts in semantic fluency in FDR of persons with BD.

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### H. JONES, R. TESTA, N. ROSS, M. SEAL, C. PANTELIS & B. TONGE. An Investigation of Pervasive, Social and Interpersonal Difficulties in Childhood: Clinical, Cognitive and Behavioural Features.

**Objective:** Preliminary evidence suggests that Schizotypal Personality Disorder (SPD) emerges in childhood and is a neurodevelopmental disorder. Comparisons with autism spectrum disorders (ASD) have also been made given similar symptomology and clinical presentation. This study aimed to assess the clinical utility of a newly developed assessment tool that measures SPD features in children and characterise the neuropsychological profile of SPD in childhood.

**Participants and Methods:** The Melbourne Assessment of Schizotypy in Kids (MASK) is a semi-structured interview comprising a 57-item

checklist derived from DSM-IV-TR criteria for SPD. The MASK is scored using information obtained from the child and their parents. A total of 63 children (16 SPD, 15 High Functioning ASD and 32 typically developing controls) between 5 and 12 years of age (M 9.63 SD 2.06) were administered a battery of neuropsychological measures and the MASK.

**Results:** Children with SPD scored significantly higher on the MASK than children with ASD and typically developing controls. A discriminant function analysis revealed two functions that significantly differentiated the groups, with positive symptoms (i.e. unusual perceptual experiences or magical thinking) relating to the SPD group and social symptoms (e.g. poor social skills and social anxiety) relating to both the SPD and ASD groups. A series of ANCOVA's and MANOVA's revealed that, independent of IQ, the SPD group had mild verbal memory deficits, in addition to attentional set-shifting and higher-level executive difficulties.

**Conclusions:** The current investigation lends further support to the emergence of SPD in childhood and indicates that the MASK is an effective clinical tool for identifying this disorder. While these children present with social difficulties that are similar to ASD's, they also present with positive symptoms that are not observed in autism. In addition to these clinical features, children with SPD likely have deficits in multiple cognitive abilities that underpin learning.

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### D.L. MATALLANA, A. IRAGORRI, P. REYES, F. URIZA, J.M. SANTACRUZ, P. MONTANES & C. DE SANTACRUZ. Bipolar Affective Disorder And Behavioural Frontotemporal Dementia: Where Is The Link?

**Objective:** Behavioural Frontotemporal dementia (bvFTD) includes great constellation of psychiatric and behavioural symptoms and the differential diagnosis with bipolar affective disease (BAD) may be challenging. Whereas a cognitive profile appearing in the course of BAD has been identified, recent theories regarding the neuropathology of BAD suggest that both neurodevelopmental and neurodegenerative processes may play a role. Since MRI has provided significant insight into the structural, functional, and connectivity abnormalities associated with BAD, research assessing longitudinal changes has been more limited and current clinical, neuropsychological and cerebral imaging data are inconclusive, but similarities with bvFTD might be highlighted. Therefore, this research aims to describe and characterize the neuropsychiatric, cognitive and imaging profiles of three groups of patients.

**Participants and Methods:** Ten bvFTD, 10 BAD and 10 BAD prior bvFTD patients were recruited from the FTD database of a Colombian Memory Clinic (75 patients, all variants) and had a consensus diagnosis by neurologists, neuropsychologists and psychiatrists. All patients had complementary neuropsychological and psychiatry depth interviews and assessment. Additionally, patients had a MRI study, to obtain a structural image T1 sequence and neural tracts using data collected by diffusion tensor imaging (DTI).

**Results:** Depth interviews, qualitative and conceptual categories conducted showed differences between groups. Several neuroimaging analyses with T1 sequences showed, as well, differences regarding cortical thickness estimation, segmentation of brain structures and volumetric cortical loss.

**Conclusions:** Patients with bvFTD after a premorbid clinical history of BAD are not as unusual as thought. Psychiatric symptoms with poor response to therapy, rapid deterioration, qualitative retrospective clinical features and brain structural changes, among others, can be a sign of FTD and patients are at higher risk of misdiagnosis.

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### S. SCHOUWS, H. COMIJS, A. BEEKMAN, A. DOLS & M. STEK. Is there a faster decline in cognitive performance in elderly with bipolar disorder? A 5 year follow-up study.

**Objective:** Older individuals with bipolar disorder may exhibit greater cognitive decline over time compared to mentally healthy elderly. This cognitive impairment seems to be consistent over a relatively short time of two years in a former study. Presently, we aimed to investigate neurocognitive performance in bipolar elderly and healthy controls over a period of five years.



**Participants and Methods:** Comprehensive neuropsychological tests were applied to 54 euthymic elderly outpatients with bipolar disorder and to an age and education-matched comparison group of 44 euthymic elderly without mood disorders or memory complaints at baseline and five years later. Neuropsychological functioning and change in cognitive functioning over time were compared.

**Results:** The results on all neurocognitive measures at baseline and at follow up compared to the healthy elderly and the associations of variables such as age at onset and vascular risk factors with cognitive decline will be presented.

**Conclusions:** A better understanding of the course of cognitive impairment in older bipolar patients may contribute to optimal treatment of bipolar disorder.

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**M. SERRA-BLASCO, S. DE VITA, M. RIVAS, J. DE DIEGO-ADELIÑO, D. PUIGDEMONT, A. MARTÍN-BLANCO, E. ÁLVAREZ, V. PÉREZ & M.J. PORTELLA. Cognitive Function in Treatment-Resistant Depression Treated with Deep Brain Stimulation of Cg25. Objective:** The aim of the study is to evaluate cognitive function before and after Deep Brain Stimulation (DBS) of subcallosal cingulate gyrus (SCG) to determine the impact of continuous stimulation on the main cognitive domains.

**Participants and Methods:** Eight patients with treatment-resistant depression (TRD) were implanted for DBS in SCG [1]. Neuropsychological battery included RAVLT for memory; TMT-B, Verbal Fluency, Working Memory and TOL for executive function; Category Test and Vocabulary for language and Digits, Symbol Digits and TMT-A for processing speed. Patients were evaluated before surgery and after 15 months of stimulation. A matched group of eight patients with a first depressive episode was also evaluated twice to control for possible learning effects. Repeated measures ANOVAs for all cognitive domains were applied.

**Results:** The results showed significant group and time effects for memory ( $F=4.47, df=3, 12, p=.025$  and  $F=9.95, df=3, 12, p=.001$ , respectively), and a group effect for language ( $F=5.83, df=2, 13, p=.016$ ). First episode patients demonstrated better performance than TRD patients, but both groups improved 15 months after. The rest of cognitive domains did not show significant main effects, indicating no differences between groups or over time.

**Conclusions:** The results support cognitive safety of DBS of SCG, as no worsening of cognitive function was detected and memory improved in all patients, which could ameliorate their psychosocial functioning [2]. The conclusion raised should take into account the small sample size and the fact that all TRD patients received electroconvulsive therapy before DBS but not after implantation.

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**S. KARK, K. STAVITSKY, S. DELUCA, G. LAFLECHE & Y. BOGDANOVA. Poor Sleep Quality is Related to PTSD, Cognitive Difficulties, and Quality of Life in OEF/OIF Veterans with Blast Exposure.**

**Objective:** Sleep disturbance, a core feature and a risk factor for PTSD, has been associated with cognitive difficulties and compromised quality of life. We examined the relation between objective and subjective sleep quality, PTSD symptom severity, self-reported cognitive difficulties, and quality of life in returning veterans with blast exposure and current cognitive complaints.

**Participants and Methods:** Thirty-seven OEF/OIF veterans underwent one week of actigraphy (ACT) and were administered the PTSD Checklist-Military (PCL-M), Pittsburgh Sleep Quality Index (PSQI), Dysexecutive Questionnaire (DEX), Attention Rating and Monitoring Scale (ARMS), and measures of community integration and satisfaction with life. Participants were divided into PTSD (PCL-M  $\geq 50$ ;  $n=20$ ) and no-PTSD (PCL-M  $< 50$ ,  $n=17$ ) groups.

**Results:** Nearly all of the participants (92%) were categorized as poor sleepers (PSQI  $> 6$  and disturbed ACT-measured sleep at least 3 times/week). Veterans with PTSD scored significantly higher on the PSQI, and had marginally lower ACT-measured Sleep Efficiency and

Total Sleep Time. ACT Sleep Efficiency and PSQI sleep quality were significantly associated with PTSD symptom severity and self-reported cognitive difficulties (DEX and ARMS). The PSQI and ACT Total Sleep Time were strongly related to the reported quality of community integration, and the PSQI was also significantly associated with life satisfaction.

**Conclusions:** Veterans with PTSD had subjectively poorer sleep quality. More severe sleep disturbance was associated with higher levels of PTSD and cognitive difficulties, as well as decreased extent of community reintegration and satisfaction with life. These findings highlight the prevalence of sleep difficulties in returning veterans and the relation between poor sleep, cognition and quality of life. As sleep disturbances may also negatively affect treatment outcome, this study highlights the need for early and effective sleep-focused interventions.

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**I. VAN OOSTROM, M. VAN BEEK, P. VAN EIJNDHOVEN, J. JANZING & I. TENDOLKAR. The Relationship Between Memory Functioning and Hippocampal Volume as a Function of Electroconvulsive Therapy for Treatment Resistant Patients with Depression.**

**Objective:** Electroconvulsive therapy (ECT) is one of the most effective treatments for major depressive disorder, but our understanding of how ECT works is limited to date. Memory deficits are common side effects, especially in the first days after ECT. Aim of our study was to examine the relationship between changes in memory functioning and hippocampal volume after ECT in patients with major depressive disorder.

**Participants and Methods:** 14 unmedicated patients diagnosed with major depressive disorder who were therapy refractory and eligible for ECT according to the Dutch guidelines (2010) were included in the study. Episodic memory was assessed using the Rey Auditory Verbal Learning Test within one week pre and one week post ECT course. Patients underwent a whole brain MRI scan (T1 weighted 3D MPRAGE), also within one week before and one week after the ECT course. ECT was administered twice a week bilaterally at the temporal window with a brief pulse.

**Results:** Patients demonstrated a non-significant decrease in verbal recall from pre to post ECT ( $p < 0.1$ ), as well as a significant increase in hippocampal volume adjusted for intracranial volume ( $p < 0.05$ ). At the group level, the decrease in verbal recall was significantly related to the increase in hippocampal volume ( $p < 0.05, r = -.6$ ). The patients also reported a significant decrease in depressive symptoms from pre to post ECT as assessed by the Hamilton Rating Scale ( $p < 0.01$ ).

**Conclusions:** Impaired memory functioning as side effect of ECT may be mediated by ECT-induced structural changes in the hippocampus. These structural changes may result from mechanisms like neurotrophic upregulation processes.

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**W.L. ZHANG, E.M. OPMEER, L. VAN DER MEER, W.A. NOLEN, H.G. RUHE & A. ALEMAN. Brain Activation During Self-Reflection in Bipolar Disorder.**

**Objective:** It has been suggested that patients with bipolar disorder (BP) have a negative self-image, which may be related to self-reflection problems leading to an inaccurate self-representation. However, it has to our knowledge not yet been investigated whether BP show abnormal brain activations during self-reflection.

**Participants and Methods:** Seventeen BP (diagnosis confirmed with the MINI-Plus interview) in a euthymic state and twenty-one healthy controls (HC) matched for gender, education and age, performed a self-reflection task during functional magnetic resonance imaging (fMRI). The task consisted of sentences referring to the self, a close other or general knowledge (semantic). Three contrasts were defined for each subject: other > semantic; self > semantic; self\_negative > self\_positive. A 2(group)  $\times$  2(condition) ANOVA was performed. In addition, a t-test was performed for group differences on the self\_negative > self\_positive contrast to test the emotion-specific effects. The threshold was set at  $p < 0.05$  FWE corrected.

**Results:** Behaviorally, BP attributed more negative ( $t=2.43$ ,  $p=.02$ ) and less positive sentences ( $t=3.79$ ,  $p=.001$ ) to themselves compared to HC. There were no behavioral differences in judging the other-sentences. In HC, the cortical midline structures, dorsolateral prefrontal cortex and inferior parietal lobule/angular gyrus were activated during both self- and other-reflection compared to semantic. There was no group difference in activation for self>semantic. However, BP showed less activation for other>semantic in the posterior cingulate cortex (PCC) than HC ( $t=4.86$ ,  $p$  FWE = .038). There were no significant group difference for the contrast self\_negative>self\_positive.

**Conclusions:** A negative bias was observed in BP, but without detectable differences in brain activation. Therefore, the negative bias might be related to a psychological process, without a neural substrate. However, BP showed less PCC activation during other-reflection, suggesting disturbances in the reflection network.

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### Hemispheric Asymmetry/Laterality/Callosal Studies

#### J. ABBOTT, G. CUMMING & A.K. LINDELL. The Perception of Positive and Negative Facial Expressions in Unilateral Brain-damaged Patients: An Updated Meta-Analysis.

**Objective:** To examine the nature of facial emotion perception in unilateral brain damage patients and determine the extent that valence moderates the hemispheric specialisation of emotional processing. This was achieved by updating a meta-analysis that assessed unilateral brain-damaged individuals' performance on facial emotion identification tasks according to valence with data from a new clinical experiment.

**Participants and Methods:** Six meta-analyses assessing the identification of facial emotion according to valence and brain damage laterality were conducted. The meta-analyses encompassed data from 5 published articles (as per the original analysis) plus new clinical data from 72 participants: 18 with a right-sided stroke, 18 with a left-sided stroke, and 36 healthy volunteers.

**Results:** Both right and left hemisphere damage impaired emotion identification for positive ( $d=-1.17$ ,  $p<.01$  and  $d=-.33$ ,  $p=.01$ , respectively) and negative ( $d=-2.07$ ,  $p<.01$  and  $d=-0.68$ ,  $p<.01$ , respectively) emotion. However, right hemisphere damage prompted more pronounced impairment than left hemisphere damage across valence. These results parallel those of the original meta-analysis, however, the additional data reduced the magnitude of the effect sizes as well as the amount of variance so greater statistical precision was obtained.

**Conclusions:** Consistent with the previous meta-analysis the results show that right and left hemisphere damage impair emotion identification, with right hemisphere damage prompting a more pronounced impairment across valence. Thus the results confirm that while both hemispheres are involved in emotion perception, the right hemisphere is dominant. In contrast to the original meta-analysis, the current results suggest that both right and left hemisphere damage impair negative emotion perception, whereas right hemisphere damage impairs positive emotion perception more than left hemisphere damage. Thus both hemispheres are involved in negative emotion perception, however the right hemisphere preferentially processes positive.

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#### A.J. NUCHE BRICAIRE, D. TREJO MARTINEZ, O.A. CONTRERAS LIZARDO, J. MARCOS ORTEGA, A.I. ANSALDO & J.F. SILVA PEREYRA. Education Level Effects on Language Organization in the Healthy Elderly.

**Objective:** Older adults tend to display less lateralized brain activation patterns with respect to younger ones during memory, language and naming tasks, probably as a product of a global brain reorganization

mechanism (HAROLD model, Cabeza, 2002). However, education level (EL) could be critical instead of age for explaining such different patterns. We aimed to take this account by comparing neural correlates underlying picture naming in older-healthy literates with high and low-EL.

**Participants and Methods:** 19 older adults (female=10; mean age=64.1, SD=4.2) were divided into two groups based on EL (9 Low-EL with a maximum of 6 years of education and 10 High-EL with 16 years minimum). Event-related fMRI experiment was carried out while participants performed a picture-naming task (90 images of objects and actions). A control condition was included in order to control visual and motor brain activation.

**Results:** There were no significant differences between groups regarding behavioral performance. Brain imaging analyses using SPM8 showed that High-EL group significantly activated the medial frontal lobe bilaterally, the right posterior cingulate gyrus (BA29,30) and the left ventral posterior lateral and medial thalamus. In contrast, the Low-EL group significantly showed a weak and sparse pattern of activation. They mainly activated the temporo-parietal cortex bilaterally, the left caudate and the right anterior cingulate gyrus. The comparison between groups showed clusters in the temporo-parietal bilateral regions and the right posterior cingulate.

**Conclusions:** Although brain activation pattern of the High-LE group was stronger regarding the pattern of the Low-EL group, our results support the HAROLD model. But in terms of level of education instead of age, comparison between groups only displayed activation of the cingulate gyrus. Probably this region could be involved in the neural bases of how academic training organizes the language function even in the elderly.

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### TBI (Adult)

#### G.N. YEATES. Characterising Mentalising Impairments following Acquired Brain Injury and their Clinical Significance.

**Objective:** Mentalising following acquired brain injury (ABI) is often assessed using story vignettes such as the Recognition of Faux Pas Test (RFPT, Stone et al, 1999). Total RFPT scores aggregate a range of different representations (e.g., 1st versus 2nd order; epistemic versus affective; intentionality). These aggregates may mask important sub-component differences, reducing the sensitivity of these measures in detecting mentalising impairments. This study aimed to identify an alternative scoring system with increased sensitivity and specificity.

**Participants and Methods:** 70 survivors of ABI and 40 matched controls completed the RFPT. Survivors additionally completed measures of executive functioning, attention, working memory, social cognition and mood. Responses on the RFPT were analysed for accuracy and emotional valency of intentionality representations for faux pas (FP) perpetrators: "why did they say it?"

**Results:** Survivors were significantly worse than controls on both total scores and intentionality representations with a greater effect size for the latter. Significant between-group differences were found for intentionality error type (no reference to the perpetrators' intentions towards another or the FP committed intentionally for positive or negative reasons). Intentionality error type scores correlated with other neuropsychological and mood measures.

**Conclusions:** This data support a clinical priority in assessing and working with survivors' representations of others' intentionality during social ambiguity or transgressions. The sensitivity of the RFPT and similar measures may be optimised through the quantification and categorisation of intentionality representational error. Survivor psychological distress related to representations of others' intentionality should be targeted by psychotherapeutic and social cognition interventions.

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**Symposium 1:  
Parkinson's Disease: Evidence for Early Stage  
Cognitive, Executive, and Social Changes**

**Chair: Paul J. Eslinger**

**4:00–5:30 p.m.**

**P.J. ESLINGER, P.J. ESLINGER, S.J. DUFF CANNING, J. KOERTS & E. KALBE. Parkinson's Disease: Evidence for Early Stage Cognitive, Executive, and Social Changes.**

**Symposium Description:** Although motor symptoms are the presenting complaints of patients diagnosed with Parkinson's disease (PD), the first few years after diagnosis are often marked by increasing cognitive and behavioral concerns. This occurs at a time when motor symptoms can be relatively stabilized with medical treatment and patients maintain many of their usual activities. While cognitive and behavioral changes are well-known to occur in PD, the characterization and causes of early stage alterations are not as clear. Given that a high percentage of patients progress to dementia, it is important to delineate early cognitive phenotypes, their impact on daily activities, and the trajectories of change that lead to increasing disability. This symposium is organized to present critical analysis of the evidence supporting the types of cognitive impairments that occur early in the course of PD and current criteria for identification of mild cognitive impairment and dementia. Special emphasis is placed on evidence regarding executive function impairments in the lab and in everyday life as well as the potential mitigating effects of self-awareness and cognitive reserve on these impairments. Analysis will also focus on the emerging evidence concerning social cognition in PD, particularly theory of mind and moral decision-making, while identifying gaps in knowledge and areas for future research. These topics will be further appraised with a summary critical analysis and panel discussion.

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**S.J. DUFF CANNING. Characterization and Diagnosis of Cognitive Dysfunction in Parkinson's Disease.**

**Objective:** Cognitive changes are a fundamental feature of Parkinson's disease (PD). Executive dysfunction is common and can be detected early in the disease course. However, declines in other cognitive domains, including visuospatial, memory and language, are also observed. For some individuals these cognitive changes remain mild, however, cumulative prevalence studies suggest that up to 80% of PD patients will develop dementia (PDD). There is growing interest in the PD literature to identify factors that may be predictive of those who decline to dementia. Indeed, the Movement Disorder Society recently published diagnostic criteria for PD Mild Cognitive Impairment as a means to identify those PD patients who may be in a transitional state between normal cognition and dementia. Similarly, there is growing recognition that there is considerable heterogeneity in the cognitive phenotypes associated with PD and that particular phenotypes may be predictive of cognitive decline. This presentation will review the current state of knowledge in the characterization of cognition in PD. The application and limitations of newly published PD MCI criteria will be discussed in the context of a large cohort of PD patients followed in a prospective, longitudinal study of cognition. Emerging evidence pertaining to cognitive phenotypes and their possible prognostic utility will be discussed. Finally, there are several unmet needs in this area and future directions for research will be proposed.

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**J. KOERTS. Awareness of and Compensation for Executive Dysfunctions in Patients with Parkinson's Disease.**

**Objective:** Executive dysfunctions are frequently observed in Parkinson's disease (PD) and affect patients' functioning and quality of life. There are however several key issues that require further exploration including: (1) considerable individual differences in executive dysfunc-

tions among PD patients; (2) executive functioning applied in daily life is difficult to measure objectively; and (3) patients' experiences with executive impairments in daily life. These issues will be examined in light of three recent studies from our group as well as broader neuropsychological evidence.

A first study explored whether individual differences in executive dysfunctions might be explained by cognitive reserve theory, which states that high intellectual abilities provide a buffer against the development of cognitive impairments. It was discovered that executive functioning is influenced by cognitive reserve in PD, i.e. patients with low cognitive reserves show more executive dysfunctions than patients with high cognitive reserves.

In a second study a new approach was applied to measure executive functioning in daily life. Patients were presented with a multi-task test in which goals were specified, but not the approach to achieve them. PD patients planned and executed tasks more sequentially than in parallel. Furthermore, moderate PD patients appeared to take their impairments into consideration when planning task execution, a compensation which could not be detected in a mild PD sample. Hence, PD patients appear to develop some insight into their executive dysfunctions. This was confirmed by a third study confirming that PD patients were aware of problems with executive functions in daily life and reported considerably more problems than healthy elderly.

Thus PD patients can become more aware of executive dysfunctions in daily life and develop compensation techniques. However, cognitive reserve needs to be considered when monitoring the evolution of executive dysfunctions in PD.

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**E. KALBE & J. ROSEN. Theory of Mind and Moral Decision-Making: Evidence for Dysfunctions in Patients with Parkinson's Disease.**

**Objective:** Possible impairments in the socio-emotional domain in patients with Parkinson's disease (PD) have attracted increasing interest recently. Among these functions, theory of mind (ToM) is understood as the ability to infer other people's mental states such as beliefs or desires. Another function is moral decision making, which can broadly be defined as deciding within the context of socialized perceptions of right or wrong. Both functions are important prerequisites of social interaction – and have been discussed to be linked to each other (especially in a way that ToM is integrated in the moral decision making process). Evidence exists that impairments in both of these functions may occur in PD patients, but that subdomains, e.g. cognitive versus affective ToM, are affected in different stages of the disease, possibly depending on the progression of dopamine depletion in different parts of the striatum and associated dysfunctions in frontostriatal circuits. In this overview, currently available data on dysfunctions both in ToM (for which more studies exist) and moral decision-making (for which data from our own group will be presented) will be reviewed, associations with impairments in other neuropsychological domains, especially executive dysfunctions, will be discussed, and possible underlying neural mechanisms will be outlined. Evidence for the impact of these dysfunctions on patients' everyday life will be presented. Finally, as knowledge in this area of research is far from being complete, possible directions for further research will be discussed.

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**Symposium 2:  
Social Decision-making during Adolescence**

**Chair: Lydia Krabbendam**

**4:00–5:30 p.m.**

**L. KRABBENDAM, S. BURNETT HEYES, J. DERKS, N. LEE & B. GÜROGLU. Social Decision-making during Adolescence.**

**Symposium Description:** Adolescence is a period characterised by major changes in social behaviour, as well as the maturation of the areas

of the brain involved in social cognition. During adolescence, friendships with peers become more intense, social relationships become more important, and peer acceptance becomes a powerful motivator for adolescents to conform to patterns of behaviour that receive approval from their peer group. As a result, adolescents' social environment becomes increasingly influential in their decision-making process. In recent years the application of game theoretical approaches has enabled the development of behavioural paradigms to study how adolescents make decisions in social situations. Use of social dilemmas, such as the Dictator Game and Trust Game, has the potential to elucidate the mechanisms of adolescent decision-making, as well as further the understanding of social behaviours such as trust, fairness considerations and prosociality.

This symposium highlights ongoing research in the field of social decision-making during adolescence. Stephanie Burnett Heyes will present results on the role of social ties in cooperative investment within adolescent social networks. Jeffery Derks will discuss adolescent trust and trustworthiness in social interactions and how these concepts are influenced by gender and social value orientation. Nikki Lee will describe how risk-taking behaviour in the presence of peers predicts the amount of trust adolescents show in others. Berna Güroglu will conclude by discussing the neural correlates of fairness related to adolescent social decision-making. Lydia Krabbendam will provide commentary on the symposium as a discussant.

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### S. BURNETT HEYES, Y.R. JIH, P. BLOCK & J.Y. LAU. Cooperative Investment in Adolescent Social Networks.

**Objective:** A multitude of changes in social attitudes and social behaviour occur during adolescence. One notable change is the development of nuanced prosociality, with age-associated increases in prosocial moral reasoning and strategic cooperation. The current study investigated cooperation in two established UK school-based adolescent networks.

**Participants and Methods:** Social ties were mapped exhaustively in a Year 9 (13-14yrs) and a Year 12 (16-17yrs) class using a social network questionnaire that assessed multiple aspects of peer relationships. A modified Dictator Game played with all network members yielded a behavioural measure of cooperation. We used an analytic technique that takes into account statistical interdependence among observations to assess the relationship between bidirectional social ties and cooperative investment.

**Results:** In both networks, out-link strength (social ties reported by a participant toward peers) predicted investment – that is, adolescents invested more in individuals to whom they reported stronger ties. However, in only the older adolescent group did the difference between out- and in-link strength predict investment – that is, only older adolescents invested more in individuals who reciprocated strong ties. This is consistent with the notion that nuanced prosociality develops throughout adolescence. In the Year 12 network, but not in the Year 9 network, cooperative investment takes into account the extent to which authentic social ties are reciprocated.

**Conclusions:** This ecologically valid experimental paradigm accounts for the strength of social ties within authentic social networks and has potential to further the understanding of adolescent cooperative dynamics and the development of nuanced prosociality.

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### N. LEE, J. DERKS & L. KRABBENDAM. Risk-taking Behaviour in Social Situations Predicts Trust during Adolescence.

**Objective:** Trust plays an integral role in daily interactions within an individual's social environment. This is especially true during adolescence, when social relationships become increasingly important. Trust in social interactions also involves risk: an interaction partner's decisions and behaviour can affect your own outcomes. However, previous research has been unable to find a relationship between trusting decisions in social interactions and general risk-taking attitudes and behaviour (Eckel & Wilson, 2004; Houser, Schunk & Winter, 2010). The current study hypothesised that risk-taking in social situations may be a better predictor of trust in others.

**Participants and Methods:** Participants were 106 mid-adolescents (Mean age = 15.2; SD = .51; 51% female), who played 10 one-shot Trust Games against anonymous partners. Five games were played as trustor, a measure of trust towards others and 5 as trustee, a measure of trustworthy behaviour. They also completed 30 trials of the Balloon Analogue Risk Task (BART) in one of two conditions. Participants in the control condition completed the task on their own, while participants in the peer condition completed the task in the presence of an age-matched peer (classmate).

**Results:** Risk-taking by adolescents in the peer condition predicted initial investment in the trust game: those who took more risk in the presence of their peers also showed higher levels of trust in their interaction partners. Risk-taking by adolescents in the control condition was not related to subsequent trust behaviour. Trustworthiness was not related to risk-taking in either group: risk-taking behaviour was not predictive of the amount returned to the interaction partner when adolescents played the role of trustee.

**Conclusions:** These results suggest that trust decisions in investment games such as the Trust Game are influenced by a specific type of risk-taking behaviour, namely risk-taking in social situations.

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### B. GÜROGLU & G. WILL. Neural correlates of Fairness Related Decision-making.

**Objective:** The development of fairness preferences is an intriguing question in the social sciences. Animal studies on equity preferences in monkeys suggest that fairness has its roots in human biology. Studies have shown that equity preference increases strongly between the ages of 3 to 8 (Fehr et al., 2008). Here we examined the development of fairness preferences in ages 10-25 and in a neuroimaging study we focused on brain regions involved in equity choices in young adults.

**Participants and Methods:** We assessed fairness preferences with three equity games (Fehr et al., 2008), each involving a dichotomous choice for the distribution of goods. In these games a 1/1 equity choice (1 for participant /1 for other player) was pitted against 1/0 (making equity a Prosocial choice), against 2/0 (making equity a Sharing choice), and against 1/2 (making equity an Envy choice).

**Results:** Behavioral results showed that Prosocial choices increased with age and Envy choices decreased with age across adolescence. In the neuroimaging study the frequency of Prosocial choices was 82%, Sharing choices was 40% and Envy choices was 61%, showing that young adults' behaviour deviated from the equity norms on a substantial number of trials. Preliminary fMRI results show that across games, there was more activation in regions associated with violating social norms, such as the dorsal medial prefrontal cortex (dmPFC) and the insula, when deviating from equity. Further, dorsal anterior mPFC was more active during inequity in the Sharing game, whereas ventral anterior mPFC was more active during equity in the Prosocial game. When choosing inequity in the Envy game (which is beneficial to the other player), activation was found in the posterior parietal cortex, dmPFC, bilateral insula and dorsolateral PFC.

**Conclusions:** Together, the findings show activation in brain regions previously associated with social cognition when choosing other-beneficial inequity. Findings will be discussed in relation to brain development during adolescence.

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### J. DERKS, N. LEE & L. KRABBENDAM. Adolescent Trust and Trustworthiness: The Role of Gender and Social Value Orientation.

**Objective:** Trust is a central concept in human social behaviour. In the increasingly complex social world of adolescents, trust is an essential feature of healthy social development. This study examined the influence of gender and social value orientation on trust during adolescence. We expected boys to be more trusting than girls and girls to be more trustworthy than boys. For social value orientation, we expected prosocials to be more trusting and more trustworthy than proselves. In addition, we hypothesized that gender and social value orientation would be independent predictors of trust, but not of trustworthiness.

**Participants and Methods:** In the present study, 208 adolescents (Mage = 15.1, 50% girls) completed a Trust Game and the Triple Dominance Measure for social value orientation. In the Trust Game, the participants played both the role of the trustor (to measure trust) and the role of the trustee (to measure trustworthiness).

**Results:** As expected, boys were more trusting than girls. However, no significant gender difference was found in trustworthiness. With regards to social value orientation, girls were significantly more prosocial than boys. Similar to results in adult populations, prosocial adolescents were found to be both more trusting and trustworthy than prosocials. Regression analyses showed that gender and social value orientation independently predicted trust (but not trustworthiness). Thus, even though girls were more prosocial than boys and prosocials were more trusting, boys were more trusting than girls.

**Conclusions:** Overall, the results point to gender typical patterns of trust behaviour in adolescence and to a clear preference in prosocials for cooperation. Moreover, the results confirm that gender differences in adolescent cooperation are complex and cannot simply be explained by differences in prosocial orientation.

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### Symposium 3: Prospective Memory Development across the Lifespan: Exploring Underlying Mechanisms

Co-Chairs: Mareike Altgassen, Esther van den Berg

Discussant: Judi A. Ellis

4:00–5:30 p.m.

**M. ALTGASSEN, E. VAN DEN BERG, J.A. ELLIS, P.G. RENDELL, D. WILLIAMS, K.M. SCHNITZSPAHN, N. KANT & A. HERING. Prospective Memory Development across the Lifespan: Exploring Underlying Mechanisms.**

**Symposium Description:** Prospective memory refers to memory for future intentions such as remembering to attend meetings on time, check your blood sugar level before dinner or to pass a message to a friend when you see him next. Prospective memory is of crucial importance for the development and later maintenance of autonomy and independent living. Research indicates that the development of prospective memory across the lifespan follows an inverted u-shaped function with prospective memory performance improving from childhood to young adulthood and declining again from young to old adulthood. Research indicates the involvement of executive functions, retrospective memory, and most recently also suggested the involvement of theory of mind in the development of remembering delayed intentions. However, so far there is no integrative theory that encompasses possible developmental mechanisms underlying this rise and fall of prospective memory across the lifespan. In this symposium we will discuss novel evidence from different age and clinical groups and including behavioral and neuronal data. We will address possible mechanisms and moderating factors. We will discuss the implications that these results have for prospective memory theory as well as everyday memory functioning across the lifespan.

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**P.G. RENDELL, C. TERRETT, S. RAPONI-SAUNDERS, J.D. HENRY & M. ALTGASSEN. Prospective Memory during a Virtual Week in Children with Autism.**

**Objective:** Prospective memory (PM) refers to memory for future intentions and is involved in many daily tasks like keeping appointments and turning of appliances. Thus PM is frequently linked to the development of independence, but there has been little PM research involv-

ing children. The two studies involving children with autism suggest any difficulties they have may vary according to PM task features: Compared to controls children with autism performed poorer on a time-based task in one study but no different in event-based task in another study. The present study investigated PM task features in children with autism using a version of Virtual Week revised for children. Virtual Week simulates activities and PM tasks from daily life in a board game format and importantly, allows for the systematic investigation of different PM task parameters (event- and time-based; regular and irregular).

**Participants and Methods:** Children aged between eight and twelve were included, 25 with a diagnosis of high functioning autism (HFA) and 25 typically developing controls. The two groups were matched on age, gender and IQ.

**Results:** The results indicated that for time-based PM, children with HFA were moderately worse than controls on regular and irregular tasks. For event-based PM, children with HFA were substantially worse than controls on regular tasks but the groups did not differ on irregular tasks.

**Conclusions:** In Virtual Week, the regular compared to irregular tasks have low and high retrospective memory demands. Thus findings suggest that poorer retrospective memory in children with HFA relative to controls is unlikely to explain the pattern of results identified. Further research is needed to explain why the poorer performance on most PM tasks was eliminated with irregular rather than regular event-based tasks. This includes investigating the possibility that when a PM task is triggered by an event, the performance of HFA children is enhanced by the novelty of irregular relative to the routine of regular tasks.

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**D. WILLIAMS. Time-Based and Event-Based Prospective Memory in Autism Spectrum Disorder: Strengths, Weaknesses, and Compensatory Strategies.**

**Objective:** Event-based “prospective memory” (EBPM) involves remembering to carry out an intention upon the occurrence of a specified event (e.g., remove a pan from the stove when the timer goes off). Time-based prospective memory (TBPM) involves remembering to execute an intention at a particular time-point (e.g., remove the pan in 10 minutes time). Both forms may rely on theory of mind, because both require the encoding, storage, and retrieval of an intention. However, TBPM relies more heavily than does EBPM on executive control mechanisms, given that no event is present to cue retrieval.

We explored EBPM and TBPM among individuals with autism spectrum disorder (ASD). ASD is a developmental disorder that is characterized by both diminished theory of mind and executive dysfunction. Although there are, therefore, strong reasons to predict prospective memory deficits in ASD, very little research has explored this.

**Participants and Methods:** Study 1: 21 children with ASD and 21 age- and IQ-matched comparison participants completed TBPM and EBPM tasks, as well as measures of set executive functioning and theory of mind.

Study 2: 18 adults with ASD and 18 age- and IQ-matched comparison participants completed novel TBPM and EBPM tasks, plus measures of working memory.

**Results:** Study 1: A significant Group × Task interaction emerged; children with ASD showed significantly diminished TBPM, despite showing non-significantly superior EBPM than comparison participants.

Study 2: Participants with ASD showed diminished TBPM, but undiminished EBPM.

**Conclusions:** Together, these studies suggest that ASD is characterised by diminished TBPM, but undiminished EBPM. However, analyses of cognitive correlates of EBPM task performance, as well as of self-report measures, suggest that compensatory strategies may be employed by people with ASD to perform well on EBPM tasks, despite limited underlying competence. The implications of these results for theories of prospective memory, and for our understanding of ASD, will be discussed.

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**K.M. SCHNITZSPAHN, C. THORLEY, L. PHILLIPS & M. KLIEGEL. Mood Effects on Prospective Memory Performance in Young and Older Adults: The Mediating Role of Monitoring Behaviour.**

**Objective:** While first studies suggest that task valence influences age differences in prospective memory, no study so far tested mood effects on prospective memory performance in young and older adults. Thus, the principal objective of the present study was to approach this open question and address three specific research aims: 1) test for age differences in the effects of mood on prospective memory, 2) examine underlying cognitive mechanisms, 3) include the full mood range (i.e., positive and negative mood compared to a neutral condition) within the same study.

**Participants and Methods:** Mood was induced in young and older adults using film clips. Subsequent prospective memory performance was measured with a time-based task.

**Results:** While performance in the negative and positive mood group was impaired in the young, mood did not affect performance in the elderly. Moderated mediation analyses showed that the mood effects in the young were mediated by time monitoring.

**Conclusions:** The present results suggest that mood effects on prospective memory performance are mediated by monitoring behaviour. This held true for both positive and negative mood states. Most importantly, mood only impaired prospective memory performance in young adults, but did not affect prospective memory performance in older adults. Better emotion regulation is discussed as possible explanation for the absence of mood effects in the older adults.

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**N. KANT, M.J. VAN ZANDVOORT, E. VAN DEN BERG, L.J. KAPPELLE, C.J. FRIJNS & A. POSTMA. Functional Correlates of Prospective Memory in Stroke.**

**Objective:** An often heard complaint of stroke patients is their inability to carry out actions they intend to execute in the future: a failure of what in literature is referred to as prospective memory (PM). Research in healthy participants on this subject indicates that multiple cognitive operations are involved. In the current study, the role of different cognitive functions in event-based (focal) versus time-based (non-focal) PM was investigated. Also, the nature and extent of PM (dys)functioning in stroke was studied.

**Participants and Methods:** Thirty-nine chronic stroke patients were included and their cognitive profile was compared with 56 matched control participants. Examination included focal (event-based) and non-focal (time-based) PM tasks and standard neuropsychological measures of retrospective memory, attention/executive functioning, and processing speed.

**Results:** Time-based (non-focal) PM was associated with all tested cognitive domains, and only retrospective memory contributed significantly to event-based (focal) PM. Active monitoring behaviour was related to better time-based PM performance. 41% of the stroke patients showed PM failure. PM was more often impaired than processing speed (23%) and attention/executive functioning (15%), and not more or less than retrospective memory (33%).

**Conclusions:** The results are in line with the idea that focal (event-based) PM is relatively simple and involves automatic processing. Non-focal (time-based) PM relies on self-initiated retrieval, supported by several cognitive functions. The role of processing speed has not been investigated before, which calls for further attention. These findings stress the complexity of PM and its sensitivity to neural damage. It therefore should be routinely assessed in clinical practice.

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**A. HERING, N. WILD-WALL, M. FALKENSTEIN, K. ZINKE & M. KLIEGEL. Exploring the Underlying Neural Mechanisms for the Development of Prospective Memory across the Lifespan.**

**Objective:** Prospective memory (PM) refers to the ability to remember and successfully execute delayed intentions. PM is associated with executive functioning and is critical for successful functioning in everyday life. Development of PM is characterized by an inverted U-shaped pattern. Although there is evidence explaining this pattern on a behav-

ioral level, the underlying neural mechanisms, however, are still unclear. The aim of the present study was to investigate event-related potentials (ERP) that are associated with cue detection (such as occipital-parietal N300) and intention retrieval (such as prospective positivity) in PM across the lifespan.

**Participants and Methods:** We investigated three age groups: adolescents (12-14 years), young adults (20-30 years), and older adults (65-75 years). All participants completed a computerized PM task where they had to judge two words as belonging to the same category or not. Additionally, participants had to remember to press a certain key when the words appeared in a certain color.

**Results:** Results supported the behavioral pattern of PM development across the lifespan. Further, analyses indicated differences between event-related potentials of interest (e.g. N300, prospective positivity).

**Conclusions:** Results were discussed on a behavioral level regarding development of prospective memory across the lifespan. Furthermore, neural correlates of cue detection and intention retrieval were integrated to explain the behavioral findings.

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**J.A. ELLIS. Underlying Mechanisms of Prospective Memory Development across the Lifespan - An Integrative Discussion.**

**Objective:** The talk will discuss the presentations of the symposium and will consider implications that the results have for prospective memory theory as well as everyday memory functioning across the lifespan.

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**Invited Address:**

**Cognitive Neuropsychiatry of Hallucinations**

**Presenter: André Aleman**

**5:30–6:30 p.m.**

**A. ALEMAN. Cognitive Neuropsychiatry of hallucinations.**

Hallucinations are complex perceptual experiences that occur in the absence of external stimulation of the relevant sensory organ. These experiences, prevalent in several psychiatric and neurological disorders, can be highly distressing and burdening for patients. In this talk, I review the findings regarding the cognitive and neural basis of hallucinations. Special attention is paid to hallucinations in schizophrenia, which have attracted most research attention. Studies show that the cognitive underpinnings of hallucinations include self-source-monitoring deficits and executive and inhibitory control dysfunctions as well as distortions in top-down mechanisms, perceptual and linguistic processes, and emotional factors. With regard to findings from neuroimaging, the primary and secondary sensory cortices have been implicated, as well as language regions (in the case of verbal hallucinations), anterior cingulate, parahippocampal gyrus and thalamus. Besides activation studies, recent investigations are beginning to shed light on altered connectivity patterns between key nodes in networks underlying hallucinations. Neuroimaging has also inspired neuropsychological treatment strategies, more specifically neuromodulation using repetitive transcranial magnetic stimulation (rTMS).

Such stimulation has been targeted at aberrant activity in speech perception regions that have been shown to be hyperactive. rTMS has been shown to reduce auditory hallucinations in several studies. However, not all studies have confirmed such effects, and a number of remaining questions will be discussed. Finally, directions for future research will be discussed, including a number of consensus-set goals proposed by the International Consortium on Hallucination Research.

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## THURSDAY MORNING, JULY 11, 2013

**Invited Address:  
Cognitive Reserve****Presenter: Ian Robertson****8:45–9:45 a.m.****I. ROBERTSON. Cognitive Reserve.**

The gap between symptoms and pathology in many brain disorders has been explained by 'cognitive reserve' – a set of variables including education level which putatively allow the brain to adapt to damage by maintaining cognitive function. I propose here a hypothesis that repeated stimulation of the noradrenergic system over a lifetime mediates the effects of cognitive reserve on cognitive function. Noradrenaline has a key role in mediating the neuroprotective and neuroplasticity-affording effects of environmental enrichment on the brain and recent longitudinal evidence in aging strongly supports this hypothesis.

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**Symposium 4:  
Retraining of Cognitive Functions after Acquired  
Brain Injury: Old Wine in New Bottles?**

**Chair: Caroline Van Heugten****10:00–11:30 a.m.**

**C. VAN HEUGTEN, R. PONDS, A. RAZ, J. MURRE, W. STURM, B. WILSON, J. EVANS, J. SPIKMAN & L. FASOTTI. Retraining of cognitive functions after acquired brain injury: old wine in new bottles?**

**Symposium Description:** Cognitive rehabilitation after brain injury can be defined as 'any intervention strategy or technique to enable patients and their families to reduce, compensate, live with, pass by, manage or accept the cognitive deficits due to brain injury' (Wilson, 1997). In the seventies and eighties of the last century cognitive rehabilitation studies were directed at investigating the effects of cognitive retraining aimed at restoring the lost cognitive function. In most studies forms of cognitive retraining were computer-based tasks related to cognitive functions. These studies showed that the performance on trained tasks and untrained tasks related to the training material improved. Unfortunately these studies led to disappointing results in terms of improving the level of daily life functioning, societal participation and quality of life. In the first review on the effectiveness of cognitive rehabilitation it is stated that 'sole reliance on repeated exposure and practice on computer-based tasks without extensive involvement and intervention by a therapist is NOT recommended' (Cicerone et al, 2000). A shift was seen towards the compensatory approach instead of the restorative approach.

The past few decades the notion of brain plasticity appeared and the common belief now is that the brain shows some degree of self-repair and spontaneous recovery; in addition, structural and functional brain changes have been shown after (intensive) training. These new insights have led to a second wave of studies investigating the effects of cognitive retraining after brain damage, especially in the areas of working memory and selective attention. The question is whether these studies indeed explore new boundaries and new life can be breathed into the restorative approach or whether these studies merely represent old wine in new bottles. In this symposium an overview of new evidence on cognitive retraining will be given and a debate will be held in order to answer this question.

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**C. VAN HEUGTEN. Cognitive Retraining for Patients with Brain Injury.**

**Objective:** The fast few years studies investigating the effectiveness of (computerized) brain training after brain injury have been performed. These studies are mostly aimed at the cognitive domains of attention and working memory. In this presentation, an overview of these rehabilitation programs and evaluation studies will be given.

**Results:** In the domain of attention the most well known treatment program is the Attention Process Training which has been evaluated in some small, nonrandomized evaluation studies in TBI and a large post-stroke randomized clinical trial. In addition, there is a version for mild deficits (APT-II) and it has been tested in children treated with radiation after cancer. In the domain of working memory Cogmed is currently the most widely used and studies treatment program. Cogmed training has been evaluated in a non-randomized pilot study on stroke patients and a randomized cross-over study on a mixed sample of patients with acquired brain injury. In addition, the effects of Cogmed training on daily life functioning have been investigated.

**Conclusions:** Although these studies seem promising, generalization to daily life functioning is still limited.

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**J. MURRE. Online Brain Training and Testing of Older Adults and Patients with Cognitive Impairments.**

**Objective:** Online brain training in various forms is currently popular by elderly computer users. A recent review of the literature by our group, however, indicates that effects of brain training on cognition are neither robust nor consistent, and that transfer and sustained effects appear limited. We also found that there were a number of successful studies, which had the following characteristics: (i) they included flexibility and novelty as features of the training and (iii) they tailored the training adaptively to the level and progress of the individual. In this presentation, I will briefly review this literature and then present the results of one of our ongoing research projects with online brain training and testing using a version of a commercial web site that has been made suitable for elderly participants and CVA patients who have mild cognitive impairments. The training capitalizes on characteristics (i) and (ii) to increase the chances of success. The research design also includes covariance-based MRI methods in linking structural and functional changes in the brain to individual differences in neurocognitive efficiency and trainability in order to help uncover the underlying mechanisms.

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**A. RAZ. Brain Training.**

**Objective:** Train-the-brain program are in vogue. Putatively safe and effective for improving cognitive performance in both health and disease, products purported to train the brain appeal to consumers and healthcare practitioners. In an increasingly health-centered society, these applications constitute a burgeoning commercial market. And yet, sparse evidence leaves many claims concerning the impact and duration of such brain training largely unsubstantiated. On the other hand, at least some scientific findings seem to support the effectiveness and sustainability of training for higher brain functions such as attention and working memory. My presentation will highlight cognitive training approaches. Specifically, I will sketch the relative merits and shortcomings of these programs, which often appeal to parents who must choose between side-effect-laden medication and less conventional options. Whether brain training can be a stand-alone treatment or an adjunct to pharmacotherapy will guide the crux of my talk as I outline promising future prospects and describe what training outcomes are plausible in line with available data. The main issue centres on an overarching question I will address: Is brain training likely to realize its potential and revolutionize education and rehabilitation or is it more likely to remain shrouded in controversy?

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**W. STURM. Evidence-based Attention Retraining.**

**Objective:** Attention deficits after brain damage are very frequent and cause – if they remain undetected and untreated – a considerable impairment of quality of life and even have a negative impact on the outcome of other therapy measures. Attention deficits are not a unitary syndrome. Both clinical and experimental neuropsychological studies provide ample evidence for separable attention aspects. Even if contemporary neuropsychological views of attention favour its implementation in widespread cortical and subcortical networks, numerous studies have shown that specific attention functions can be impaired selectively by focal brain damage. For the assessment of these specific attention deficits sophisticated computerized neuropsychological test procedures are inevitable. As pointed out in evidence based therapy guidelines set up for attention rehabilitation in Germany during the last years, attention functions have to be trained specifically, taking into account the quality of the impairment. Especially with impaired elementary attention functions (alertness, vigilance) the application of too complex training procedures can lead to even further impairment. Contrary to other cognitive domains, at least some attention domains can be influenced positively by stimulation therapy, even without training the patient in using specific strategies. Besides an improvement of formal aspects of attention, attention therapy seems to have a positive influence on everyday functions like car driving, movie watching etc.

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## Paper Session 2: Memory

10:00–11:30 a.m.

**A.M. POREH. Bridging the gap between modern neuroscience and the clinical assessment of memory.**

**Objective:** The talk will briefly review the current state of the art of memory research followed by a review of the current measures used by clinicians to this domain. The gap between two science and practice will be explained and new measures and methodologies will be introduced.

**Participants and Methods:** A human equivalent of the Morris Maze Test will be described and several studies using this test to examine normal controls ( $n=100$ ), patients with alcohol abuse ( $N=30$ ) and cases of patients with dementia will be presented. A new form of the Anna Thompson story recall will also be introduced.

**Results:** The presentation will show how methodologies combined with new non-linear statistical curve fitting models can provide new insights into the understanding of memory impairment and its link to particular brain damage.

**Conclusions:** Current procedures for the assessment of memory no longer fit with our understanding of how human memory works. Using new computer based tests and non-linear methodologies clinicians can bridge this gap and provide new insights into the structures and functions of human memory.

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**F. CONSTANTINIDOU, E. PASTEFANAKIS, D. KASSELIMIS & P. SIMOS. Factors Implicated in Age-related Decline of Verbal Learning Among Healthy Adults and Patients with Mild Cognitive Impairment: Education and Primary Memory Capacity.**

**Objective:** The present study sought to determine if the rate of age-related decline in verbal memory is mediated by verbal working and/or moderated by participant formal education in healthy older adults and in adults with mild cognitive impairment (MCI).

**Participants and Methods:** The 665 healthy participants aged 17-80 years (mean = 42.66, SD = 17.00 years; 340 women and 325 men) and 81 patients with MCI were recruited from 8 broad geographic areas in Greece and the broad Nicosia area in Cyprus. Measures of primary short-term and working memory capacity (digits forward and backwards) and secondary memory (Auditory Verbal Learning Test [AVLT]) were used.

**Results:** The SPSS macros developed by Hayes (2013; models 58, 59, and 4) were implemented for moderated mediation regression proce-

dures. Although Education affected both primary and all AVLT indices (with the exception of slope and proactive interference) directly, formal schooling did not moderate the rate of age-related decline. The effects of age on free recall performance, however, were in part mediated by its effect on working memory capacity. Findings were similar among MCI patients although mediation effects were stronger (as indicated by significant moderation effects of Clinical Group).

**Conclusions:** Results suggest that the rate of age-related decline in AVLT recall indices is mediated by working memory capacity. Further, in persons who display poor secondary verbal memory capacity (MCI group) age-related memory decline is expected to advance more rapidly for those who also display relatively poor verbal working memory capacity.

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**M. VERFAELLIE, E. RACE, K.F. LAROCQUE & M.M. KEANE. Medial Temporal Lobe Contributions to Short-Term Memory for Faces.**

**Objective:** The role of the medial temporal lobes (MTL) in short-term memory (STM) remains a matter of debate. While imaging studies commonly show hippocampal activation during short-delay memory tasks, evidence from patients with MTL lesions is mixed. It has been argued that apparent STM impairments in amnesia may be attributable to long-term memory contributions to performance. Here we examine the performance of MTL amnesic patients on a delayed matching-to-sample (DMS) task for faces that meets both a traditional delay-based criterion for classification as a STM task and a recently proposed distractor-based criterion for classification as a STM task.

**Participants and Methods:** In Experiment 1, we assessed whether DMS for faces qualifies as a STM task by evaluating in non-amnesic individuals the effect of extensive processing of delay-period distractor stimuli. In Experiment 2, we administered the task without distraction to MTL amnesic patients. In Experiment 3, we manipulated in non-amnesic subjects the extent of relational processing required by the distractor task and compared interference effects associated with configural judgments (gender) and featural judgments (teeth visibility).

**Results:** In Experiment 1, extensive processing of delay-period distractor stimuli disrupted performance of non-amnesic individuals, thus qualifying the task as a STM task. In Experiment 2, MTL amnesic patients were impaired at delays as short as 8s, within temporal range of delay-based STM classification, in the context of intact perceptual matching performance. In Experiment 3, non-amnesic participants' performance was disrupted more by a relational than a featural distractor task.

**Conclusions:** These findings demonstrate an impairment in STM for faces in amnesia that may reflect a deficit in MTL-mediated relational processing.

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**M. IRISH, S. EL WAHSH, J.R. HODGES & O. PIGUET. The neural substrates of recent and remote autobiographical memory - insights from frontotemporal dementia.**

**Objective:** Autobiographical memory (ABM) refers to the recollection of personally relevant memories across the lifespan. A distributed network of brain regions underpins the capacity for ABM retrieval, however, debate exists regarding the permanent or time-limited role of the hippocampus in this process. The neural substrates of ABM retrieval are those harbouring significant pathology in frontotemporal dementia (FTD).

**Participants and Methods:** Here, we explored the neural correlates of recent and remote ABM deficits on the Autobiographical Interview in 11 behavioural variant FTD (bvFTD), 10 semantic dementia (SD), 15 Alzheimer's disease (AD) patients, and 20 matched Controls. Whereas bvFTD patients showed equivalent deficits for recent and remote retrieval, dissociations were evident in AD and SD. AD patients showed disproportionate deficits for recent relative to remote memory, whereas SD patients showed the converse profile.

**Results:** Voxel-based morphometry analyses of structural neuroimaging revealed important commonalities and differences in the brain re-



regions necessary for recent and remote ABM. Remote ABM correlated with extensive lateral temporal regions, as well as medial prefrontal cortex integrity. Recent ABM retrieval was associated to a lesser extent with similar regions, as well as the posterior parietal and occipital cortices. Irrespective of time period, the posterior hippocampus was implicated in ABM retrieval.

**Conclusions:** Our study reveals important insights into the neural underpinnings of recent and remote ABM retrieval. Regions specialised for semantic processing appear particularly important for remote memory, whereas, sensory-perceptual and visual processing regions are differentially implicated for recent memories. Finally, our findings corroborate the view that the hippocampus plays a permanent role in the retrieval of self-referential memories across the lifespan.

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**Invited Symposium:  
Neurocognitive Disorders in HIV-1 Infected Patients:  
The Role of Neuroimaging Factors, Ageing, and  
Psychosocial Variables**

**Chair: Roy Kessels**

**Discussant: Ben Schmand**

**10:00–11:30 a.m.**

**R.P. KESSELS, B. SCHMAND, R.K. HEATON, T. SU & M.D. KOPELMAN. Neurocognitive Disorders in HIV-1 Infected Patients: The Role of Neuroimaging Factors, Ageing, and Psychosocial Variables.**

**Symposium Description:** With combination antiretroviral therapies (cART) the course of HIV infection has improved dramatically and brain abnormalities have become less frequent as a result. However, studies show that in 30-60% of HIV-1-infected patients cognitive deficits are found, commonly referred to as HIV-Associated Cognitive Disorders (HAND). With respect to severity, HAND may range from mild and sub-clinical to severe (as is the case in HIV-associated dementia). The underlying mechanisms are, however, less clear. Neuroimaging reveals white-matter abnormalities and fronto-striato-thalamo-cortical dysfunction that may underlie deficits in the major cognitive domains. Other factors, such as affective disorders, substance abuse and symptom validity, have also been examined in relation to the presence of HAND. Furthermore, recent studies have been investigating the hypothesis of accelerated cognitive ageing in HIV-1 affected individuals, as cART has resulted in longer survival. This symposium will provide an overview of research on HAND, focusing on the profile of neuropsychological impairments, neuroimaging, aging, and psychosocial factors.

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**R.K. HEATON, S. LETENDRE, A.C. COLLIER, D. CLIFFORD, B. GELLMAN, C. MARRA, S. MORGELLO, J. MCARTHUR, A. MCCUTCHAN, D. SIMPSON, D. FRANKLIN & I. GRANT. Overview of HIV Associated Neurocognitive Disorders (HAND): Findings from the Six-Site CNS HIV Anti-Retroviral Effects Research (CHARTER).**

**Objective:** We will provide an overview of HIV-Associated Neurocognitive Disorders (HAND), using data from a large sample of HIV-infected (HIV+) adults recruited without exclusions from six university-based clinical settings in the U.S.

**Participants and Methods:** All participants (N=1555) received standardized, comprehensive neuropsychological (NP) and neuro-medical assessments at baseline, and comparable, semi-annual follow-up assessments were conducted with a subset of this group (n=438). Published international criteria were used to classify participants with respect to HAND status and three levels of comorbidity (conditions other than HIV that could affect CNS functioning and NP test results). NP change status was defined using published, regression-based norms.

**Results:** At baseline, HAND was present in 40% of participants with minimal comorbidities (n=843) and 59% of those with moderate comorbidities (n=473); an 83% NP impairment rate was seen in participants having severe comorbidities (n=239) that preclude HAND diagnoses. Prior history of severe immunosuppression and failure to achieve viral suppression on anti-retroviral treatment (ART) increased risk for HAND, but only in participants with minimal comorbidities. NP decline over an average follow-up of 36 months occurred in 23% of participants. Such decline was predicted by comorbidity level (minimal to severe) and by time-dependent treatment status (on-off), degree of immunosuppression, and HIV viral load.

**Conclusions:** The current era of combination ART has witnessed greatly improved life expectancy and medical morbidity in HIV+ people, but mild-to-moderate forms of HAND remain highly prevalent. History of serious immunosuppression increases risk for HAND throughout the disease course, and should be minimized by early and consistent use of ART. Comorbidity levels should be carefully assessed and monitored because higher levels of comorbidity increase risk for HAND and further NP decline over time.

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**T. SU, G.J. GEURTSSEN, M.W. CAAN, J. SCHOUTEN, F.W. WIT, P. PORTEGIES, P. REISS, C.B. MAJOIE & B. SCHMAND. Neuropsychological and Neuroimaging Status of Middle-aged HIV-infected Males with Suppressed Infection on Combination Antiretroviral Therapy (cART) Compared to a Representative Control Group.**

**Objective:** HIV-associated neurocognitive disorders (HAND) have been reported to remain common (15-50%) in the cART era. We collected brain MRI scans and neuropsychological measures in HIV infected patients and controls to gain more insight into the prevalence, risk factors and pathogenesis of HAND.

**Participants and Methods:** Middle-aged chronically HIV-infected males (N=74, ≥ 45 years, median age : 52.6, mean estimated HIV-infection duration: 12.9 years) with suppressed viraemia on cART (median plasma HIV-RNA: 1.6 log copies/ml, mean CD4 count: 621/mm<sup>3</sup>, median years since start ART: 11.4) were compared to HIV-uninfected men (N=50) comparable in age, ethnicity, education and lifestyle behavior. All participants had neuropsychological assessment covering six cognitive domains and underwent structural T1-weighted MRI scanning.

**Results:** HIV-infected patients and uninfected individuals differed on information processing speed (manova; F=2.663, p=.036). Patients were slower on Trail Making Test, part A (F=7.436, p=.007). Six patients (8%) fulfilled the Frascati criteria of HAND, as opposed to one (2%) of the control subjects (p=.147, one-tailed). Voxel-based whole brain comparison between groups, correcting for age and intracranial volume showed diffuse grey matter volume reduction on whole brain level (p < .001) in the HIV-infected group. No single cluster of voxels was significantly different between the groups.

**Conclusions:** Chronic HIV-infection in middle-aged patients, in spite of effectively suppressed viraemia on cART, was associated with psychomotor slowness and minor brain alteration. Whether this may be a reflection of accelerated brain ageing will be explored during longitudinal follow-up. Furthermore, there was no significant difference in the prevalence of HAND which was much lower than has been reported previously.

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**M.D. KOPELMAN, K. TOWGOOD, R. HAYNES, M. PITKANEN, A. FRADERA, R. KULASEGARAM, F. ZELEYA, J. DUNN & G. BARKER. A Longitudinal Study of the Effects of Ageing and HIV-1 Infection on Cognitive Performance.**

**Objective:** To examine the cognitive effects of ageing in HIV and non-HIV participants, and their neuroimaging correlates.

**Participants and Methods:** We recruited 40 HIV-positive participants and 42 HIV-negative participants. All participants were elected for absence of concomitant pathologies. Subjects were subdivided into two age groups: 20-40 and 50-75. We administered a battery of neuropsychological tests, and neuroimaging was performed: structural volumetric MRI, DTI, ASL, and FDG-PET.

**Results:** A worse performance in the HIV-positive participants compared to the HIV-negative group was found on visual recall memory only (but this did not survive Bonferroni correction).

HIV was associated with reduced medial and superior frontal grey matter volume and reduced PET glucose uptake in the same region, and with decreased rCBF and glucose uptake in anterior cingulate.

**Conclusions:** These imaging findings may be markers of future cognitive decline. This is now being examined longitudinally.

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**M. JANSSEN, O. MEULENBROEK, M. BOSCH, B. GÓRAJ, S. STEENS, P. KOOPMANS & R. KESSELS. Cognitive Performance and the MoCa in Relation to Global Brain Atrophy in HIV-1-Infected Adults on cART.**

**Objective:** cARTs have improved the course of illness for HIV infection dramatically. Nevertheless, mild to moderate cognitive deficits are still observed frequently among HIV-1 infected patients. The aim of this study is to extensively examine cognitive functioning in combination with symptom validity and brain atrophy, as well as to investigate the use of a short cognitive screen in a group of patients on cART.

**Participants and Methods:** 60 HIV-1-Infected patients on cART for at least one year and HIVRNA < 50 copies/ml were included. All participants underwent extensive neuropsychological assessment, including symptom validity testing, measuring 8 cognitive domains and a short cognitive screen, the Montreal Cognitive Assessment (MoCa). Also, all participant underwent structural T1-weighted MRI scanning, performed on a 3.0-T system.

**Results:** After controlling for age and estimated IQ and taking underperformance into account, multiple hierarchical regression analyses showed a significant contribution of global brain atrophy (Brain Parenchymal Fraction, BPF) in the variance on the cognitive domains Information processing speed ( $\beta = .30, p < .05$ ), Attention/Working memory ( $\beta = .32, p < .05$ ), Executive functioning ( $\beta = .30, p < .05$ ) and Motor ( $\beta = .43, p < .05$ ). There was no difference in BPF between participants above ( $N=29$ ) and below ( $N=28$ ) the cut-off ( $\leq 26$ ) of the MoCa ( $t=1.2, p=.24$ ). 2% Of the patients were classified as neuropsychologically severely impaired, 42% as mildly impaired and 56% showed normal performance.

**Conclusions:** Cognitive performance in HIV-1-infected patients is clearly related to the amount of global brain atrophy that cannot be explained by age, estimated IQ and underperformance. No difference in global brain atrophy was found between participants who scored below and above the cut-off of the MoCa, questioning the use of short cognitive screens for complex syndromes such as HAND. Future analyses will also include a matched control group to examine the specificity of these results for HIV-1 infected patients.

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**Poster Session 2:  
Aging/Dementia/HIV**

**11:30 a.m.–1:00 p.m.**

**Aging**

**J.B. ALLEN. Quality vs. Quantity of Education as a Predictor of Premorbid Intellectual Ability.**

**Objective:** In clinical practice, years of education is often incorporated with other demographic information as a way of predicting overall premorbid intellectual capacity. Often, this procedure is utilized without regard to race, ethnicity or the quality of education received. However, there has been increasing awareness of the value in using norms that

correct for the quality of education as well as the quantity of educational attainment alone. The current study assessed multiple aspects of education quality on several reading measures as well as subjective report of educational experience in a sample of older White and African American individuals.

**Participants and Methods:** The study included 100 participants (55 African Americans individuals; 38 White individuals; 7 multiple/other ethnicity) with a mean age of 70.98 years. Overall the sample included 29 males and 71 females with a mean of 13.9 years of formal education and no significant history neurological disease. Participants were interviewed individually as a way of gathering subjective ratings of educational quality and background. Each participant also received a battery of cognitive and literacy tests in an attempt to better predict current intellectual functioning.

**Results:** A number of significant findings emerged from regression analysis suggesting that unique aspects of literacy testing (PIAT-Reading) actually outperformed other more commonly used methods of premorbid IQ estimation. Comprehension) may improve methods of predicting premorbid ability. Indeed, the PIAT-Reading subtest correlated more highly ( $r=.77, p<.001$ ) with WASI-based FSIQ than other more frequently used measures of reading recognition. Perhaps most interestingly, subject reports of high school education quality correlated significantly with FSIQ ( $r=.41, p<.001$ ).

**Conclusions:** Regression models including subjective education quality will be discussed for clinical utility.

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**F. GARCIA, X. ORTIZ, A. GARCIA & P. VALDEZ. Analysis of the Components of Attention in Elderly People.**

**Objective:** A decrease in several cognitive processes, such as attention, memory and executive functions, has been observed in elderly people. Attention has four components: tonic alertness, phasic alertness, selective attention and sustained attention. The aim of this study was to analyze the components of attention in elderly people.

**Participants and Methods:** Participants were 22 elderly people with no history of neurological or sensory disorders and able to perform their activities of daily living. Two age groups were studied: a younger group, 60-70 years old ( $n=12, 8$  females, 4 males) and an older group, 71-81 years old ( $n=10, 6$  females, 4 males). A Continuous Performance Task was used to assess the components of attention.

**Results:** The younger group had a higher percentage of correct answers compared with the older group in all components of attention. Tonic alertness (younger group  $95.52 \pm 4.42\%$  of correct responses, older group  $85.41 \pm 7.13\%$ ,  $U=12, p<0.001$ ); phasic alertness (younger group  $79.48 \pm 26.98\%$ , older group  $45.93 \pm 29.11\%$ ,  $U=19.5, p<0.01$ ); selective attention (younger group  $81.25 \pm 10.41$ , older group  $51.30 \pm 16.40\%$ ,  $U=5.5, p<0.05$ ); and the general stability index of sustained attention (younger group  $1.54 \pm 0.87$  standard deviation, older group  $2.32 \pm 0.39$ ,  $U=19.5, p<0.01$ ).

**Conclusions:** People older than 70 years show a decrease on all components of attention. This result may explain the increase in errors and accidents observed at this age.

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**T. HATTA, A. IWAHARA, T. HATTA, J. HATTA, E. ITO, C. HOTTA, K. FUJIWARA, A. KAWAKAMI & K. YOSHIZAKI. Cognitive and Cerebro-cerebellar Functions in Middle and Later-middle Aged People: Evidence From the Yakumo Study.**

**Objective:** To examine the developmental changes and sex differences in cognitive and cerebro-cerebellar function among middle and later-middle aged healthy community dwellers.

**Participants and Methods:** Participants: Healthy community dwellers aged upper from 50 years old to 89 years old ( $N=339$ ) participated in this study.

**Methods:** Participants were given the Nagoya University Cognitive Assessment Battery (NU-CAB) and the stabilometer measurement for the assessment of cognitive and cerebro-cerebellar functions as a part of the Yaumo study.

**Results:** To examine the relation between age and sex, ANOVAs (age by sex) were conducted for each cognitive test item in NU-CAB and stabilometer indices. Significant interactions between age and sex were found in the indices of moved distance in the stabilometer measurement, memory test, letter fluency test, Money road test, but not in semantic fluency test, D-CAT (digit cancellation) test items.

**Conclusions:** The results showed the cognitive and cerebro-cerebellar functions in relation to age and sex among upper middle and later-middle aged people were not unique but it depends on the different facets of cognitive function. A possible mechanism to interpret these results is proposed.

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**A. IWAHARA, T. HATTA, Y. UEMATSU, M. SHIBA, S. HATTORI, M. BUYO & M. ARITA. Carotid Intimal Medial Thickness and Cognition in Middle Aged and Older Adults Without Clinical Vascular Disease: Evidence from Minabe Study in Japan.**

**Objective:** Though clinical cardiovascular and cerebrovascular diseases are established risk factors for cognitive decline and dementia. Increased carotid artery intimal media thickness (IMT) is a non-invasive marker of systemic arterial disease. Increased IMT has been associated with sub-clinical vascular disease. Carotid IMT has also been associated with concurrent decrements in cognitive function, but little research has examined between carotid IMT and cognitive decline in Japan. The purpose of this study was to confirm the relationship between carotid IMT and neuropsychological test performance in Japanese population.

**Participants and Methods:** Participants were 978 community-dwelling middle aged and older persons without dementia. They underwent initial carotid ultrasonography and neuropsychological test. The real-time automated border detected Carotid ultrasound (GM-7200A by Panasonic) was used to determine the presence of plaque. The cognitive functions were measured by means of logical memory test, D-CAT (digit cancellation test) and verbal fluency test.

**Results:** Participants were divided into two age groups (middle age or old age) and three IMT groups (low, middle or high) based on the mean and the standard deviation of carotid IMT. ANCOVA was conducted to investigate the effect of carotid IMT on the decline of cognitive functions, using sex and education as covariate, age group and IMT group as independent variables, and scores on the cognitive tasks as dependent variables. A significant interaction was shown for the score on logical memory test and D-CAT.

**Conclusions:** Older participants with greater carotid IMT displayed great decline in performance of neuropsychological test for memory and executive function. Our data collected in Japan confirmed that Increased IMT was associated with significantly lower performance in cognitive function. The results suggest that carotid IMT may be useful to predict cognitive decline among community-dwelling individuals without vascular and neurological disease.

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**R.G. KNIGHT, H.S. TSUI, N.J. CUTFIELD, M. SKEAFF & J.A. MCMAHON. Prediction of Dementia and Decline in Memory: A 10-year Follow-up.**

**Objective:** A cohort (n = 276) of healthy persons aged 65+ with elevated Homocysteine levels administered a range of cognitive tests in 2002 (Time 1), was followed up a decade later (Time 2). Our primary aim was to determine if the presence of the APOE E4 allele predicted decline in memory in the survivors or the incidence of Alzheimer's disease (AD) in the cohort. Our secondary aim was to examine the presymptomatic test scores of the individuals who later developed AD.

**Participants and Methods:** A total of 128 survivors were retested and 10 persons with AD who had no clinical or psychometric evidence of dementia 10 years previously were identified from hospital records. Decline in memory performance was assessed by change in scores from test to retest on the Rey Auditory Verbal Learning Test (RAVLT) on Trials 1 to 5 (Total RAVLT), and the score on the delayed recall trial.

**Results:** An analysis of covariance found that the presence (n = 26) or absence (n = 86) of the APOE E4 allele did not predict change in mem-

ory scores in survivors. The Time 1 scores of the 10 patients who developed AD were compared with 50 age and sex matched healthy survivors on the Trail-Making Test, Category and Verbal Fluency, and the RAVLT. The only significant group differences were on Total RAVLT, and on delayed RAVLT List recall and recognition. The abnormality of the probable AD patients' individual scores on the Total RAVLT relative to matched healthy cohort survivors' (n=5) scores at baseline was estimated using procedures described by Crawford and Garthwaite (2002). Using this method, two AD patients were found to have abnormally low scores pre-morbidly. However, 80% of the healthy patients who developed AD had one or more APOE E4 alleles versus only 25% in the 50 healthy survivors.

**Conclusions:** APOE status is a risk factor for dementia but is not associated with decline in learning and memory in the normal elderly.

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**B.H. LEE, K.S. DO, J. CHA, G.H. KIM, J.H. KIM, H.S. KIM, J.M. LEE, H.J. AHN, J. CHIN, M.K. SUH & D.L. NA. Resting state functional connectivity in normal cognitive aging.**

**Objective:** Cognitive aging may be accompanied by change in the baseline brain networks. Although the difference has been reported in the functional connectivity of resting state network between younger and older people, studies tended to focus on default mode network (DMN) and were conducted without considering the performance level of cognitive tests. This study aimed to explore age-related changes of functional connectivity using resting state fMRI with four resting state network related cognitive function and investigate whether there are difference between high and low performers in older adults.

**Participants and Methods:** 69 elderly (60-82 years) and 41 young adults (23-35 years) underwent the resting state fMRI procedure using 3T MRI. They were classified as high or low performer based on their composite z score of neuropsychological tests. Degrees of connectivity were calculated by correlation coefficients between spontaneous activity of seeds and other voxels across the time series. Degree of functional connectivity in the four cognition-related resting state networks (DMN, executive control network: ECN, dorsal attention network: DAN, salience network: SN) were analyzed with seed-to-voxel approach comparing the degree of connectivity in two age groups each divided into two performance levels.

**Results:** Degrees of functional connectivity of DMN and DAN had increased more in younger compared to older adults, whereas those of ECN and SN showed opposite pattern of increase in older compared to younger adults. Despite the small differences, in older adults, high performer showed the increased functional connectivity of ECN with the middle frontal area compared to low performer.

**Conclusions:** The change of resting functional connectivity depicts the functional reorganization of the brain related with normal cognitive aging. Increased connectivity of ECN and SN in older adults as well as increased connectivity of ECN in high-performing older adults partly supports the compensation mechanism.

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**K. CHEANG. A Case Series of Depressed Elderly (>64 years) presenting in a General Hospital in Singapore.**

**Objective:** A recent national survey highlighted the considerable treatment gap for depression (59.6%) in modern Singapore. Asians tend to focus on physical features of a disease than the psychological ones, which might contribute to the relative lack of disease pick up by physicians. Literature suggests a distinct clinical entity of depression among the elderly, with a different clinical presentation from adults.

This retrospective case series was undertaken to understand the clinical features and management decisions of elderly patients presenting with depression in Singapore.

**Participants and Methods:** Inter-departmental referrals to the Department of Psychological Medicine of Tan Tock Seng Hospital from 1/1/2011 to 31/3/2011 for the management of patients ages above 64 with the diagnosis of depression were collated for case description.

**Results:** A total of 40 inpatients ages 65 to 104 years (mean 76.2 years) were recruited. 14 (35%) were male and 26 (65%) were female. 70% of them does not have a co-existing psychiatric diagnosis. The highest number of referrals were from the department of General Medicine (42.5%) followed by Geriatric Medicine (25%). Most of the elderly were admitted for infection (20%), followed by equal proportions of those admitted for cardiovascular problems (12.5%), recurrent falls (12.5%), psychiatric issues (12.5%), and orthopedic problems (12.5%).

**Conclusions:** As the population of Singapore ages, clinicians should be mindful that depression often co-exist with medical co-morbidities, and the complex interaction amongst the two entities.

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#### **M. MANARD & F. COLLETTE. Does Fluid Intelligence and Executive Functioning Protect from Age-related Decline in Cognitive Control?**

**Objective:** Age-related studies on cognitive control suggest a decline in proactive control whereas reactive control remains intact (Braver, Gray, & Burgess, 2007). This study was designed to investigate the potential influence of fluid intelligence (Raven's Advanced Progressive Matrices) and general executive functioning (Executive composite score from executive assessment) on cognitive control abilities during normal aging.

**Participants and Methods:** Cognitive control was assessed using a computerized version of the Stroop paradigm in which proactive and reactive control processes were pseudo randomly engaged by varying the amount of interference across the task. Thirteen young and 27 older adults were included in this study.

**Results:** In the whole sample, results confirmed a significant age-related decline in proactive control. However, when older adults were divided in high- and low fluid intelligence subgroups, only older adults with low fluid intelligence showed a significant decline in proactive control compared to younger adults and this difference disappeared for older adults with high fluid intelligence level. When older adults were distinguished according to high and low executive capacities, the analysis revealed that, compared to the young ones, older adults with low executive functioning showed a general cognitive control decline (proactive and reactive processes). However, differences disappeared when young adults were compared to older adults with a high executive functioning. Accuracy results suggested that older adults have a slower but spared access to goal-representations that are necessary to correctly manage interference.

**Conclusions:** So, this study confirmed the previous results obtained by Braver et al. (2007), but also suggest an influence of fluid intelligence and executive resources that seems important to take into account to investigate age-related decline in reactive and proactive cognitive control processes.

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#### **D. MCCAIDE, A.J. GUASTELLA, N.T. CHEN, S.J. LEWIS & S.L. NAISMITH. Visual Processing and Emotion Recognition in Mild Cognitive Impairment: An Eye-Tracking Study.**

**Objective:** There is initial evidence to suggest that very early deficits in emotion recognition are evident in individuals with mild cognitive impairment (MCI), even prior to the onset of dementia. However the mechanisms underlying this deficit are unclear. It is not known whether individuals with MCI visually explore emotional facial stimuli in the same way as healthy older adults or whether differences in visual processing strategies exist. Research undertaken explores potential mechanisms underlying emotion recognition deficits within individuals 'at risk' for developing dementia by examining emotion processing and visual processing of facial stimuli in individuals with Mild Cognitive Impairment (MCI).

**Participants and Methods:** Nineteen individuals with non-amnesic MCI (8 males, 11 females; mean age = 63.5 years), 14 individuals with amnesic MCI (5 males, 9 females; mean age = 67.9 years) and 20 healthy controls (8 males, 12 females; mean age = 64.2 years) were assessed using an emotion recognition test. A novel eye-tracking paradigm was also used to investigate participant visual processing strategies whilst viewing images of faces on a computer screen.

**Results:** Whilst individuals with amnesic MCI (aMCI) were significantly less accurate in the recognition of angry faces compared with healthy control subjects, analyses of eye gaze revealed that the groups did not differ in the visual processing strategies adopted.

**Conclusions:** Very early changes in facial emotional processing exist for individuals with aMCI. However, visual processing strategies cannot account for these deficits, hence it hypothesized that emotion recognition deficits reflect initial stages of temporal lobe pathology in aMCI individuals.

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#### **T. MIHALJCIC, R. STOLWYK, J. PONSFORD & T. HAINES. Investigating the Impact of Reduced Awareness of Functional Impairment on Rehabilitation Engagement in the Older Hospitalised Population.**

**Objective:** Many effective intervention and prevention strategies are available to reduce falls risk in the older population. However, adherence to these programs can be inconsistent due to some older people minimising or denying their falling risk. The aim of this study was to examine awareness of falls risk and functional ability in the older hospitalised population, and the impact of reduced self-awareness on rehabilitation engagement.

**Participants and Methods:** Eighty participants aged over 60 years (M=78.4, SD=8.0) were recruited along with their treating physiotherapist and occupational therapist (OT). Self-awareness was measured using the discrepancy between patient and physiotherapist ratings on a newly developed fall risk awareness questionnaire. Rehabilitation engagement was measured using the physiotherapist and OT-rated Hopkins Rehabilitation Engagement Rating Scale (HREERS), and the participant-rated modified Motivation for Rehabilitation Questionnaire (MOT-Q).

**Results:** The results suggest differing levels of self-awareness in this population. Three cohorts of participants emerged: underestimating ability and overestimating falls risk (10.5%), good self-awareness of ability and falls risk (56.6%), and overestimating ability and underestimating falls risk (32.9%). Correlation analyses revealed significant associations between reduced self-awareness of fall risk and reduced OT-rated patient rehabilitation engagement (HREERS) (Pearson  $r = -.510$ ,  $p < 0.05$ ) and also reduced patient-rated motivation for rehabilitation (MOT-Q) (Pearson  $r = -.303$ ,  $p < 0.05$ ).

**Conclusions:** These results indicate that some older individuals lack self-awareness of personal falls risk and that this can compromise rehabilitation engagement. Further research is required to investigate the causes of poor self-awareness in this population and develop effective intervention strategies to improve self-awareness.

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#### **M. PALMIERO, D. DI GIACOMO & D. PASSAFIUME. How dimensions of creativity change across years: implications for dementia.**

**Objective:** In these last decades, the number of people affected by dementia has increased. Increasing age is one of the most important risk factors for dementia. Thus, the issue of age-related changes in cognitive abilities has been explored to better promote active aging and implement stimulation programs for people with dementia. In this study, the issue of how different dimensions of creativity change across years was faced.

**Participants and Methods:** Five age-groups were recruited (25 healthy participants per group, aged 20-30, 30-40, 40-50, 50-60, or 60-70 years). All participants were assessed on the alternative uses task, which asks to describe many different uses of common objects, and on the creative mental synthesis task, which asks to mentally compose a creative object assembling basic stimuli. The alternative uses task allows to compute four indices of divergent thinking: fluency (the number of ideas), flexibility (the number of categories that encompass ideas), originality (the uniqueness of ideas), and elaboration (the number of details provided with ideas). The creative mental synthesis task allows to compute two indices of creativity: originality (the extent to which the object is new and not based on something else already existing); appropriateness (whether the object can be used in a specific context).

**Results:** Results generally showed that participants aged 20-30 and 30-40 years were better than age-groups of 40-50, 50-60, and 60-70 years in all indices of creativity. No difference was found among older age-groups.

**Conclusions:** These results show that people in their 20's and 30's express their best creative potential, that drops in 40's and stabilize until 70's. Yet, the stabilization of creative abilities in aging would suggest that if cognitive abilities are spared, creativity can be still developed, with implications for dementia. Indeed, promoting creativity could be an alternative strategy to reduce the risk of dementia, or even enhance copying abilities in the setting of dementia.

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**M.A. PIMONTEL, M.E. REINLIEB, L.C. JOHNERT, E. GARCON, J.R. SNEED & S.P. ROOSE. The External Validity of MRI-defined Vascular Depression.**

**Objective:** We examined the baseline clinical and neuropsychological profile of 38 patients from a larger, double-blind, randomized, 12-week clinical trial comparing nortriptyline to sertraline for the treatment of depression in older adults. Ten participants had a deep white matter hyperintensity (DWMH) volume in the highest quartile of the distribution, meeting the quantitative criterion for MRI-defined VD. Fourteen patients met the qualitative criterion for MRI-defined VD, based on a DWMH score of  $\geq 2$  on the Fazekas' modified Coffey rating scale.

**Participants and Methods:** We examined the baseline clinical and neuropsychological profile of 38 patients from a larger, double-blind, randomized, 12-week clinical trial comparing nortriptyline to sertraline for the treatment of depression in older adults. Ten participants had a deep white matter hyperintensity (DWMH) volume in the highest quartile of the distribution, meeting the quantitative criterion for diagnosis of MRI-defined VD. Fourteen patients met the qualitative criterion for MRI-defined VD, based on a DWMH score of  $\geq 2$  on the Fazekas' modified Coffey rating scale.

**Results:** The clinical and neuropsychological profile of patients with MRI-defined VD was consistent across both the quantitative and qualitative method for identifying the syndrome. Compared to patients with non-vascular depression, patients with MRI-defined VD were older and more likely to be female. These patients had a higher score on the Cumulative Illness Rating Scale for Geriatrics, more severe psychomotor retardation on the Hamilton Rating Scale for Depression and the Purdue Pegboard, and more impairment on the response inhibition component of the Stroop Color and Word test.

**Conclusions:** Patients with MRI-defined VD have a distinct clinical and neuropsychological profile. Taken together with previous research establishing the internal validity of MRI-defined VD, these findings support the notion that MRI-defined VD represents a unique and valid subtype of late-life depression.

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**M.C. TIERNEY, J. CHARLES, L. JAAKIMAINEN, R. UPSHUR, R. MOINEDDIN, G. NAGLIE, K. SHULMAN & R. SHAM. Factors Influencing the Accuracy of Primary Care Physicians' Recognition of Cognitive Impairment in Their Older Patients.**

**Objective:** Primary care physicians (PCPs) have difficulty recognizing cognitive impairment in their patients, reducing the opportunity for early treatment of reversible causes and determining their patients' safe management of complex activities of daily living. Our purpose was to investigate those factors that influenced the sensitivity of these judgments.

**Participants and Methods:** During a 2-month period, all eligible consecutively seen patients  $>65$  years from one family practice of 13 PCPs, were invited into the study. Patients were excluded if they had a diagnosis of dementia or had been previously worked up for cognitive impairment. PCPs indicated if they were concerned about their patients' cognition ( $n=46$ ), if the patient or the family was concerned ( $n=107$ ) or if there were no cognitive concerns ( $n=376$ ). Accuracy of PCP judgments was compared against an independent neuropsychological reference standard administered to 263 patients.

**Results:** PCP's judgments of cognitive concern showed a sensitivity of 60% and specificity of 86%. Improvement in sensitivity (83%), without an unacceptably low specificity (74%), was obtained when patients were classified as impaired by either the PCP or a Mini Mental State Examination score  $<27$ . Regression analyses indicated that the odds of true positive recognition of cognitive impairment, in patients who were impaired, were increased when PCPs had more cognitively impaired patients in their practice and when the patient reported a poor memory. The odds of false positive errors in patients who were not impaired increased when the patient had diabetes, reported a poor memory, and that they seldom drank alcohol.

**Conclusions:** These findings suggest that the accuracy of PCPs' judgments of cognitive impairment improves with mental status testing and exposure to cognitively impaired patients. Mental status testing may assist PCPs in screening for cognitive impairment and may help to distinguish between cognitive impairment and poor health, patient complaints and behavioral patterns.

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**A. VERMEIJ, J. HUMANN, O. MEULENBROEK, A.H. VAN BEEK, O. VAN DE REST, J.A. CLAASSEN & R.P. KESSELS. Cerebral and Vascular Factors May Predict Memory Performance in Healthy and Pathological Aging.**

**Objective:** Aging is associated with several changes to the structure and function of the brain and vasculature. This study aimed to investigate the relationship between cerebral and vascular factors that may play a role in the development of Mild Cognitive Impairment (MCI) and Alzheimer's disease (AD), and associated cognitive impairments.

**Participants and Methods:** Participants were 27 healthy older adults ( $76.3 \pm 4.1$  years), 21 MCI patients ( $71.8 \pm 9.2$  years) and 22 AD patients ( $73.0 \pm 6.8$  years). We rated the degree of medial temporal lobe (MTL) atrophy on coronal T1-weighted MRI, and white matter hyperintensities on transverse T2-FLAIR MRI images. We measured blood pressure (BP) and cerebral blood flow velocity (CBFV, Transcranial Doppler) under resting conditions, and calculated cerebrovascular resistance (CVR). Additionally, participants performed the Dutch equivalent of the Rey Auditory Verbal Learning Test.

**Results:** Both structural and vascular measures predicted memory performance. Specifically, when corrected for age and education, low performance on the memory task was associated with high rates of atrophy ( $r = -.588$ ) and white matter degeneration ( $r = -.450$ ) as well as higher CVR ( $r = -.314$ ). AD patients compared to healthy controls exhibited higher rates of both MTL atrophy and white matter lesions. Furthermore, CVR was higher in patients (both MCI and AD) than in controls. Since we did not observe differences in CBFV between groups, this seems to be related to heightened mean BP in the patient groups.

**Conclusions:** These results suggest reciprocal interactions between structural pathology, vascular changes and cognitive performance during aging and support the idea that cerebrovascular dysfunctions may cause AD.

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**L. ZAMARIAN, C. KREMSER, T. BENKE, M. PERTL, C. SCHIDEK, B. SEIFERT & M. DELAZER. Effects of Age and Prior Arithmetic Competence on Arithmetic Skill Acquisition.**

**Objective:** Previous studies have suggested that age differences in skill acquisition may be related to factors such as slowed associative learning or decline in processing speed. Our study investigated for the first time whether the level of prior competence modulates age differences in arithmetic skill acquisition. Following a neuroimaging study with younger adults only (Grabner et al., 2009), we expected overall stronger benefits from arithmetic training for lower competent adults than for higher competent adults.

**Participants and Methods:** 28 younger adults (mean age 25) and 25 older adults (mean age 63) were trained for 5 consecutive days on complex multiplication problems ( $28 \times 3 = ?$ ). Prior arithmetic competence was defined on the basis of performance with complex multiplication at pre-training.

**Results:** Overall, lower competent adults profited more from practice than higher competent adults. The main effect of age was neither significant in the analysis of RTs nor in the analysis of accuracy rates. The investigation of the interaction between age and prior competence indicated that younger adults and older adults with higher competence had comparable speed and accuracy improvements with practice. Differently, accuracy improvements were higher for younger adults with lower competence than for equally competent older adults. Age differences in speed improvements did not reach significance.

**Conclusions:** Results of younger adults are in line with a neuroimaging study by Grabner et al. (2009) showing stronger benefits from arithmetic training for lower competent adults than for higher competent adults. However, Grabner et al. (2009) did not assess older adults. As performance on complex multiplication implies the use of computation algorithms, arithmetic fact retrieval, and, importantly, executive control, we suggest that a decline in executive function in some older adults may play a role in prior competence as well as in learning. [Financial support: TWF-2010-1-993.]

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### Dementia (Alzheimer's)

**A. AL SALMAN, S. WAHASS, A. ALTAHAN, H. BALUBAID, F. ALGERESHAH & J. EVANS. Characteristics of the Normative Data for the Arabic Version of the Addenbrookes Cognitive Examination.**

**Objective:** Arabic is the native language of more than 250 million people worldwide. However, there has been very little in the way of development and validation of Arabic neuropsychological instruments. The Addenbrookes Cognitive Examination- Revised (ACE-R) is a brief cognitive screening tool that has been well validated for the assessment of cognitive impairments associated with dementia. The present study investigated the characteristics of an Arabic ACE-R, and involved data collection from both literate and non-literate participants in Saudi Arabia.

**Participants and Methods:** The ACE-R was translated and adapted for use in an Arabic cultural context. Three parallel versions were developed. Data was collected from two normative samples: (1) Healthy literate (N= 147); (2) Healthy illiterate (N= 283).

**Results:** Participants ranged in age from 50 to 85 (literate) and 50-80 (illiterate). Statistical outliers were removed. In both literate and illiterate groups there was a significant association between age and Arabic ACE-R score (literate  $\rho = -0.679$ ,  $p < 0.001$ ; illiterate  $\rho = -0.325$ ,  $p < 0.001$ ). Normative data were therefore derived for separate age bands. There was no gender difference in the literate sample (U=1060, Z=-.345,  $p = 0.730$ ). For the illiterate sample there was a significant gender difference (U=1480.5, Z= -4.843,  $p < 0.001$ ) but the actual difference was small (1-2 points on a 100 point scale) and so normative data were not split by gender. Fifth percentile cut-off points for derived for the literate sample (50's - 83; 60's - 71) and for the illiterate sample (50's - 72; 60's - 69; 70's - 66).

**Conclusions:** Previous studies have reported evidence of the validity and reliability of the Arabic ACE-R. This study provides normative data and cut-off points. The impact of age on Arabic ACE-R performance highlights the importance of age-adjusted normative data. For literate participants we speculate that the marked effect of age on Arabic ACE-R scores may be the result of changes in education in recent decades in Saudi Arabia. Correspondence: *Jonathan Evans, PhD, Mental Health & Wellbeing, University of Glasgow, Academic Centre, Gartnavel Royal Hospital, Glasgow G12 0XH, United Kingdom. E-mail: jonathan.evans@glasgow.ac.uk*

**M. ALEGRET, G. CUBERAS-BORRÓS, A. ESPINOSA, S. VALERO, I. HERNÁNDEZ, A. RUIZ, M. ROSENDE-ROCA, A. MAULEÓN, O. SOTOLONGO, J. CASTELL-CONESA, I. ROCA, L. TÁRRAGA & M. BOADA. A four-year follow-up of patients with Mild Cognitive Impairment searching for the neuropsychological, APOE  $\epsilon 4$  genotyping and functional neuroimaging predictors of conversion to Alzheimer's Disease dementia.**

**Objective:** To identify the neuropsychological, genetic and brain Single Photon Emission Computerized Tomography (SPECT) data that better predict conversion to AD dementia in patients with amnesic MCI.

**Participants and Methods:** From the initial 42 subjects with amnesic MCI assessed with neurological, neuropsychological and brain SPECT, 39 MCI (25 converters, 14 non-converters) were follow-up during a period of 4 years. Moreover, 35 MCI (22 converters, 13 non-converters) were APOE  $\epsilon 4$  genotyped. For the purpose of the present study, the neuropsychological and APOE  $\epsilon 4$  genotyping data from those MCI subjects who had converted to AD dementia at 4-year follow-up was compared with data from those who did not convert. The brain SPECT data was analysed by SPM3.

**Results:** At baseline, those MCI patients who had converted to AD dementia at the end of the study obtained statistically significant worse performances than non-converters MCI subjects in visual long-term memory and semantic verbal fluency performances, with higher frequencies of at least one APOE  $\epsilon 4$  allele. The Regression Analysis showed that visual retention remained statistically significant, with a total hit rate of 74%. Moreover, SPM analyses showed a lower brain perfusion in converters than non-converters MCI, mainly in precuneus region.

**Conclusions:** Low performances on visual long-term memory, and reduced brain perfusion in precuneus, increases the risk of conversion to AD dementia in amnesic MCI subjects.

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**I.C. CASTILLO, E. BOYCHEVA, ÁLVARO.S. FERRO, R.T. SORIANO, V. PUERTAS-MARTÍN, A.V. GALENDE, J.B. LEÓN & F. BERMEJO-PAREJA. Relationship Between Low Education and Dementia in the NEDICES Cohort: a Preliminary Analysis of the Cognitive Reserve Hypothesis.**

**Objective:** Low education is associated with higher risk of dementia, but use of years of schooling as proxy for cognitive reserve is controversial in some populations. We compared the validity of two educational measures (years of schooling vs. literacy) to analyse its dementia incidence risk at three years follow-up.

**Participants and Methods:** 2,330 cognitively normal elders using the Spanish MMSE-37 test were analyzed from the NEDICES (Neurological Disorders in Central Spain) baseline cohort (1994-5). Two educational measures were considered: (1) years of schooling; (2) formal Spanish census categories (illiteracy, can read-write, primary studies, and secondary or higher studies). Logistic regression (LR) models were carried out to analyse the association between education (years of schooling vs. literacy) and increased dementia risk (Odds Ratio, OR) at 3 years (1997-8). Age, sex and comorbidities were considered as covariates.

**Results:** Of the 2,330 patients assessed, 6% (n = 146) did not remember the years of schooling. 97% of illiterates (N = 270) and 99% of those who can read and write (N = 795) were overlapped from 0 to 7 years of schooling. The MMSE-37 showed a higher correlation with the formal education levels ( $r = .55$ ) than years of schooling ( $r = .44$ ). The LR showed that low literacy is a risk factor for dementia (OR = 6.53, 95% CI = 2.77-15.50,  $p < .001$ ) at 3 years interval. However, the years of schooling were not significant.

**Conclusions:** Literacy is a more accurate evidence of cognitive reserve than years of schooling in the NEDICES cohort.

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**G. COUTINHO, R. OLIVEIRA-SOUZA, J. MOLL, G. GARRIDO, F. TOVAR-MOLL & P. MATTOS. Is it possible to identify MCI and AD individuals using a 30-minute neuropsychological battery?**

**Objective:** To develop a brief neuropsychological battery (lasting up to 30 minutes) to discriminate among normal aging, MCI and dementia.

**Participants and Methods:** 131 consecutive referred elderly patients (39 clinical-controls, 31 with amnesic MCI and 61 with possible/probable AD) were diagnosed with a comprehensive (full) neuropsychological battery, MRI and clinical data. All of the results were blindly coded and evaluated latter with a subset of the tests to reclassify the subjects as MCI, dementia or clinical-control. Agreement rates between both batteries were calculated. We also used ROC curves to establish the sensi-

tivity and specificity of the brief battery for discriminating (i) clinical-control individuals from a group dementia and MCI patients; (ii) individuals with dementia from individuals without dementia; (iii) clinical-control individuals from a group of MCI. We compared performance of the three groups on all full battery tasks.

**Results:** All neuropsychological tests showed differences between clinical-control and dementia groups. The comparison between MCI and the other groups mainly showed memory differences. Agreement between brief and full batteries was substantial ( $\kappa = 0.805$ ). Analyses with ROC curves showed good sensitivity and specificity to discriminate non-demented (clinical control plus MCI groups) and AD group and also to discriminate clinical-control individuals from individuals with cognitive decline (MCI plus AD group). However, sensitivity and specificity significantly decreased when brief battery was tested to discriminate only normal and MCI diagnosis.

**Conclusions:** The use of a brief battery might not be indicated to discriminate MCI and clinical-control individuals, but its use might be adequate to discriminate less specific groups (demented versus non-demented and pathological [dementia and MCI] and non-pathological [clinical-control] groups).

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#### **D.I. CUCIUREANU & A. CUCIUREANU. Vascular mild cognitive impairment related to lacunar stroke.**

**Objective:** to investigate the relationship between mild cognitive impairment and risk factors for chronic asymptomatic cerebrovascular disease in middle age patients.

**Participants and Methods:** A sample of 86 consecutively evaluated subjects with MCI was follow-up for 1 year after a recruitment period of 4 year, in our neurological service. The patients, aged 55 – 60, had memory complaints, no anxiety, depression or causal medication, but 62 of them had vascular risk factors. All meet the operational criteria for MCI.

Patient were investigated by clinical examination, neuropsychological test, brain computed tomography, vascular related blood tests.

**Results:** the 86 patients were divided in 3 groups according to existing risk factors: 38 with hypertension and dislipidemic lab changes, 22 other vascular risk factors and 26 without vascular risk factors. All patients had a Mini-Mental State Examination score greater than or equal to 24. Neuropsychological examination by "Repeatable Battery for the Assessment of Neuropsychological Status" (RBANS) revealed in the third group a predominant memory impairment with relative sparing of other cognitive domains and in 2 other groups multiple domain non amnesic MCI. Combined analyze of cerebral computed tomography and neuropsychological examination concluded that hypertension and atherosclerotic group has white matter ischemic changes (leukoaraiosis) in 25 %, and asymptomatic lacunar stroke in 76 % cases.

**Conclusions:** asymptomatic ischemic brain damage can lead to MCI. We speculate that every patient with long term or incontrolatated vascular risk factors and minimal complain of memory loss must promptly be investigated with neuroimagic techniques.

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#### **M. DE WERD, D. BOELEN & R. KESSELS. Implementation of a Manual for Errorless Learning in Dementia Care.**

**Objective:** Errorless Learning (EL) is an instructional procedure that involves the reduction of errors during the learning. EL has been suggested to address the (relatively) spared implicit memory functioning, and has been studied in dementia. Compared to Errorful Learning (EF) or no treatment, EL has been suggested to be more effective in teaching patients with dementia meaningful everyday tasks. Applying EL in daily practice may assist patients with dementia to engage in daily activities more actively and independently. This, in turn, may result in more wellbeing and a higher degree of autonomy in patients, and a reduction in caregiver burden and professional care. The aim of the present study is to implement EL procedures in dementia care.

**Participants and Methods:** To examine the need for EL in dementia care we conducted interviews with professionals in nursing homes ( $n=45$ ) and performed a literature review on the effectiveness of EL, identifying  $n=26$  studies. Based on the results of the review and the interviews, an EL manual was developed to guide care-practitioners working with dementia patients. This manual was evaluated by professionals ( $n=19$ ) who provided feedback about the feasibility and applicability of EL.

**Results:** Interviews with caregivers working in clinical practice showed a great need for such a teaching method. Also, professionals believe that it is worthwhile to teach people with dementia meaningful activities. The results of our review show that EL is indeed effective in dementia, and these effects are often maintained over a prolonged period of time. In our EL manual, recommendations on the to-be-used EL elements and training intensity and specific examples of tasks are provided. This manual received positive feedback from care-professionals with respect to its feasibility, and was published as a professional guideline.

**Conclusions:** EL is an effective and feasible learning method in dementia care.

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#### **J. FOSTER, M. ALBRECHT, C. MASTERS & D. AMES. The Long-Term Impact of Closed Head Injury on Neurocognitive Functioning: Findings from the AIBL Study of Aging, Mild Cognitive Impairment and Dementia.**

**Objective:** It has been suggested that head injury is a significant risk factor for the subsequent incidence of dementia. However, relatively little work has been conducted on the long-term neuropsychological outcome of head injury. This was the focus of the present study.

**Participants and Methods:** We identified 52 people from within the AIBL database who had sustained a head injury involving loss of consciousness and who were free from any clinical signs of dementia or mild cognitive impairment at initial assessment. The performance of these individuals was contrasted with that of controls (matched on age, sex, education, APOE genotype and reading ability) on the AIBL neuropsychological test battery across three data collection time points (0 months, 18 months and 36 months). Bayesian hierarchical linear modelling was used to estimate the effect of head injury on overall performance and the effect of head injury on cognitive decline over time (0, 18, 36 months).

**Results:** There was no significant evidence for neuropsychological differences in the head injury group, relative to controls, nor was there any evidence for an increase in cognitive decline over time in head injured participants. However, there was a relationship between verbal episodic memory and i) the age that the head injury occurred and ii) the severity of the injury. Specifically, performance on the California Verbal Learning Test was spared for every year later in life that the head injury had occurred, while an increase in the duration of unconsciousness after head injury was associated with poorer performance on Logical Memory.

**Conclusions:** The results suggest that individuals who have sustained a closed head injury resulting in loss of consciousness, but who recover to a healthy level of cognitive functioning, do not experience wide-ranging deficits in cognitive ability. However, specific chronic associations with impaired episodic memory capacity may nevertheless be present.

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#### **E. GUZMAN-VELEZ, J. FEINSTEIN & D. TRANEL. Feeling Without Memory in Alzheimer's Disease.**

**Objective:** Patients with Alzheimer's disease (AD) typically have impaired declarative memory as a result of hippocampal damage early in the disease. In this study, we aimed to explore whether feelings can persist in patients with AD, even if declarative memory for what initially caused the feelings has faded.

**Participants and Methods:** Fifteen patients with probable AD and 15 healthy comparisons matched for age, sex and education were recruited. Participants underwent an emotion induction paradigm that involved watching film clips designed to induce either sadness or happiness. A test of declarative memory was administered shortly after the end of each emotion induction. Emotion rating scales were administered at 4 time points—immediately before and at 3 time points after emotion induction.

**Results:** Declarative memory for the film clips was impaired in patients with AD. One-tailed independent samples *t* tests showed that patients with AD recalled significantly less details for both the sad and happy films compared to NC participants ( $p < .0001$ ). Strikingly, AD patients reported elevated feelings of sadness and happiness for a prolonged time after the emotion induction, despite their impaired declarative memory. This outcome was especially prominent for the sadness induction, where patients reported experiencing elevated levels of sadness for up to 30 minutes after the induction, even when the patients had no recall for the films.

**Conclusions:** These results extend a previous finding of this type in patients with hippocampal amnesia (Feinstein et al., 2010). Our results indicate that even when patients with AD have severe declarative memory impairment, they may have prolonged experiences of emotions. This in turn has critical implications for the management and treatment of patients with AD, e.g., suggesting that positive or negative events may have a substantial and lasting emotional impact even if the patients forget what caused their feelings in the first place.

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**H. MARKOVA, K. VLCEK, I. GAZOVA, I. MOKRISOVA, J. CERMAN, E. LITERAKOVA, T. NIKOLAI, M. VYHNALEK, J. LACZÓ & J. HORT. Left-Right Discrimination and Mental Rotation Impairment Contribute To Spatial Navigation Impairment in Dementia, but Not in Mild Cognitive Impairment.**

**Objective:** Left-right discrimination (LRD) and mental rotation (MR) are components of a complex process of spatial navigation which has been found to be impaired even in the pre-dementia stage – in mild cognitive impairment (MCI). The aim was to evaluate separately these two essential components of spatial navigation (LRD and MR) in patients with MCI and dementia due to Alzheimer's disease (AD).

**Participants and Methods:** 10 patients with AD, 58 patients with MCI and 29 controls underwent the Standardized Road-Map Test of Direction Sense (RMT) and two versions of an experimental computer test of mental rotation (Menrot) – 2D and 3D; both consisting of pictures representing a virtual circular arena, in the 2D version from an overhead view, while in the 3D version from a first person view. In both versions the subject was asked to imagine himself standing with his back to a cue at the wall and to decide at which side (left or right hand side) a red circle on the arena floor is located.

**Results:** There were no differences between groups in sex and age, but only in years of education ( $p=.004$ ). The initial analysis of the RMT performances showed differences between AD and control groups ( $p=.001$ ); the MCI and control groups did not differ from each other ( $p=.194$ ). Subsequent sub-analysis indicated that the half-rotation turns (combining the strategy of LRD and MR except for 180 degrees rotation) were the best discriminator between AD and control groups ( $p<.001$ ). In the 2D and 3D Menrot the AD group differed from control group ( $p=.005$ ;  $p=.003$ ; respectively) in a number of correct hits; however, there were no differences between MCI and control groups.

**Conclusions:** Impairment of left-right discrimination and mental rotation in AD but not in MCI indicates that spatial navigation impairment found in MCI group could not be explained by these two components, which, however, may worsen spatial navigation deficit found in AD.

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**P. MONTANES, D. MATALLANA, P. REYES, L. ANDRADE & K. PALACIOS. Neuropsychological Profiles of Fronto Temporal Dementia and Alzheimer Disease.**

**Objective:** Fronto temporal dementia (FTD) usually appears in the pre senile age, with important familial, medical and social implications. The principal variants of FTD include the behavioral variant (FTDBv) and two linguistic variants: Semantic Dementia (SD) and Primary Progressive Aphasia (PPA). Several studies have attempted to address the issue of differential diagnosis of early stage FTD and Alzheimer disease (AD). However, there are many controversies. Our objective was to characterize the neuropsychological profiles of FTD and AD patients in our memory clinic.

**Participants and Methods:** The first study describes the profiles of 124 FTD, 110 AD patients and 118 controls in a component analysis of the neuropsychology protocol of the memory clinic (Hospital San Ignacio, Bogotá-Colombia). Assessment of all cases included neurological, geriatric and psychiatric examinations, routine blood examination and magnetic resonance imaging (MRI).

In a second study, semantic and linguistic tests were included and SD (7), APP(6) and AD patients (6) were studied.

**Results:** In the first study, although the neuropsychological memory clinic protocol is a good protocol to differentiate patients vs controls, and in some cases AD vs FTDBv, it is not to differentiate AD vs SD or APP.

In the second study, in which semantic and linguistic tests were included, the profiles of SD, APP and AD patients were better identified.

**Conclusions:** The overlapping clinical observations seen in these neurodegenerative diseases is discussed and the implications for patients, families and treatment decisions are analyzed.

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**D. PASSAFIUME, D. DI GIACOMO & L.S. DE FEDERICIS. Concepts Associations in Semantic Network: Verbal and Visuo-perceptual Differences in Normal and Pathological Aging.**

**Objective:** Semantic memory is one of the cognitive abilities that deteriorates early in the progression of Alzheimer's disease (AD). The underneath mechanism of the semantic difficulties has not been completely clarified. Some authors posit the progressive loss of concepts, whereas other researchers support the hypothesis that the semantic store is intact but the patients have difficulties in the voluntary access to it. In a previous paper we showed progressive disruption of the semantic network, specifically the breakdown of the associative categories: Superordinate, Attribute, Part/Whole, Contiguity, Function. We hypothesized that the semantic deficit in early AD might be due to the progressive disruption of the associations between concepts, starting from the most abstract associative category and progressing to the segregation of the concept..

**Participants and Methods:** We tested 60 subjects, divided in two groups (30 healthy elderly -NC; 30 mild Alzheimer's patients - AD), age ranged from 65 to 78 years, matched by sex and education, on two tests of semantic associations. A verbal test (Semantic Association Test) and a visuo-perceptual test (Visuo-perceptual Semantic Association Task) were developed in our laboratory to verify two hypothesis: 1) the semantic associative categories degrade differently in the healthy elderly group and in the AD group, and 2) there are differences in accessing to semantic network through visuo-perceptual/verbal pathways.

**Results:** A MANOVA for repeated measures showed significant difference between groups, between tasks and between associative categories, as well as an interaction between task x group.

**Conclusions:** Our results might be interpreted as suggesting the possibility that the semantic network in AD patients can be more efficient through a visuo-perceptual access than a verbal one

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**K. RADFORD, H. MACK, S. CHALKLEY, B. DRAPER, R. CUMMING, H. BENNETT, L. JACKSON PULVER & G.A. BROE. High Rate of Dementia in the Urban Aboriginal Population of Australia.**

**Objective:** The prevalence of dementia varies globally, across different demographic, socio-economic and cultural contexts. In Australia, the health and wellbeing of Aboriginal people lags behind the general population and has been described as the poorest of any Indigenous population in wealthy Western societies. The number of older Aboriginal Australians is increasing rapidly yet little is known about dementia in this population. This study aimed to determine the prevalence of dementia in the majority urban Aboriginal population.

**Participants and Methods:** We partnered with five city and rural Aboriginal communities to undertake a census of all Aboriginal men and women aged 60 years and over residing in these communities (N=555).



This was followed by a survey of the health, cognitive function, well-being and life history of consenting participants from the census (N=336; 61%; median age = 66 years). Participants were screened using three cognitive tests. Those scoring below designated cut-offs, and a 20% random sample of those scoring above (i.e., normal range), completed a medical assessment (blind to screening results), which formed the basis of "gold standard" clinical consensus determinations of dementia.

**Results:** The prevalence of dementia was 13.4% (95% CI 10.2%, 17.5%) with Alzheimer's dementia most common (56% of cases), followed by vascular dementia (23%) and dementia due to head trauma (12%). Standardised screening tests or a culturally specific tool performed similarly. Key potential predictors of dementia were explored, including age, education, stroke, head injury, smoking and alcohol.

**Conclusions:** Dementia prevalence is substantially higher in Aboriginal Australians compared to the general Australian population and many other nations or ethnic groups. There is an immediate need for provision of dementia education and appropriate services, as well as a move towards promoting successful ageing, both systemic and neural, from young ages onwards in this "at risk" population.

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#### **D. SHAKED, M. FARRELL, S. CINES, E. SULLO, J. KARLAWISH, M. CARY & S. CONSENTINO. Metamemory in Alzheimer's Disease and its Relationship to Indices of Executive Function.**

**Objective:** The neurocognitive foundation of disordered awareness of memory loss in Alzheimer's disease (AD) remains unclear. Existing work has pointed to associations between self assessment, executive functioning (EF), and the integrity of the cingulate cortex, a neural region critical in error monitoring. The goal of this study was to further understand the cognitive foundations of memory awareness by assessing the relationship between objectively measured metamemory and specific aspects of EF in AD. We hypothesized that aspects of EF related to error monitoring rather than information generation, organization, or the ability to maintain mental set would be correlated with metamemory.

**Participants and Methods:** A total of 75 patients with mild AD underwent metamemory assessment using a Feeling of Knowing task. Patients also completed a comprehensive battery of neuropsychological tests. Multiple aspects of EF were assessed including perseverations, perseverative distance, clustering, and rule violations on tasks of verbal and design fluency. Bivariate correlations and linear regression were used to measure the relationships between metamemory, specific EF indices, and neuropsychological performance more broadly.

**Results:** We found a significant correlation between metamemory and number of unique designs produced on the design fluency task ( $p=.038$ ).

**Conclusions:** The selective relationship between metamemory and design fluency suggests that memory awareness may in part rely on a highly specific aspect of EF related to performance monitoring. Although successful performance on both verbal and design fluency tasks require performance monitoring to avoid providing duplicate responses, perseverative answers on verbal fluency may in part reflect memory failures rather than monitoring failures. In contrast, as design fluency is a non-timed visually based task, participants are able to explicitly check (monitor) their previous designs to produce more unique designs.

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#### **P. SPAAN. Differentiating Between Early Alzheimer's Disease And Normal Aging At Very Old Age Using A Verbal Description Variant Of The Boston Naming Test.**

**Objective:** Word finding problems are highly common in normal aging and early Alzheimer's disease (AD). The Boston Naming Test (BNT) is by far most often used in clinical practice to investigate these problems. However, naming to verbal definitions of words may be more representative of word finding in auditory based discourse in daily life than visual object naming (BNT). Therefore, we constructed verbal descriptions of the BNT items to systematically compare visual and verbal naming performance (VsN and VbN, resp.). In two previous studies, two groups of 40 non-demented elderly subjects showed significantly

worse VbN than VsN, while items of both tests were identical and practice and sequence effects were controlled for. In the current study, we investigated whether the same pattern was found in early AD, whether our VbN test could differentiate between AD and normal aging, and which naming test differentiated best.

**Participants and Methods:** 14 early AD patients (76-90 yrs; mean age 84) and 14 age-, education- and gender-matched controls (NC) were administered our VbN test. To prevent practice and sequence effects, performance on our VsN test was derived from an earlier dataset, consisting of AD patients and NC carefully matched to the current patients and NC.

**Results:** GLM Repeated Measures ANOVA showed main effects for test (VbN worse than VsN:  $p<.001$ ) and group (AD worse than NC:  $p<.001$ ). Paired t test showed that VbN significantly differentiated between AD and NC ( $p<.001$ ). However, no GLM interaction effect test x group was found ( $p=.8$ ): VbN and VsN had similar differential ability.

**Conclusions:** Naming to verbal definitions seems more sensitive to word finding than picture naming, also in early AD. In the current subject sample of very old age, no ceiling effect occurred on the (easier) VsN test, which may explain why the differential ability between AD and normal aging of our VbN test was similar to the VsN test. VbN may still better differentiate in a younger elderly sample, which will be investigated in future research. Correspondence: *Pauline Spaan, PhD, Brain & Cognition / Clinical Neuropsychology, University of Amsterdam, Weesperplein 4, Amsterdam 1018 XA, Netherlands. E-mail: P.E.J.Spaan@uva.nl*

#### **M. WEINBORN, H. SOHRABI, R. BUCKS, G. SAVAGE, S. RAINEY-SMITH, K. ELLIS, D. AMES, C. MASTERS, C. SZOEKE, C. ROWE & R. MARTINS. Performance on the Wechsler Test of Adult Reading amongst individuals with dementia and declining cognition: a longitudinal study.**

**Objective:** The Wechsler Test of Adult Reading (WTAR) is an established measure estimating premorbid intelligence. However, its validity in individuals with dementia has not been adequately established. Initial validation studies in Alzheimer's disease (AD) found WTAR performance in early/mild AD was similar to a healthy comparison group, but reduced in more advanced AD (Psychological Corporation, 2001; McFarlane et al, 2006), but the studies were cross-sectional.

**Participants and Methods:** The Australian Imaging Biomarkers & Lifestyle Study of Ageing (AIBL) cohort completed the WTAR and Clinical Dementia Rating (CDR) three times over three years. Five demographically similar groups (baseline age M=75.65) were created based on longitudinal CDR score patterns.

**Results:** At baseline, those with mild dementia (Dementia: CDR=1, n=47) performed more poorly ( $p<.05$ ) than groups with Mild Cognitive Impairment (MCI; CDR=.5) that either remained stable (Stable MCI: n=55) or later declined (Declined MCI: n=61), as well as initially healthy individuals (CDR=0) who remained healthy (Stable Healthy: n=54) or later declined (Declined Healthy: n=35). All healthy and MCI groups performed similarly at baseline. A 3 (time) x 5 (group) ANOVA yielded a significant interaction ( $p<.05$ ), reflecting decreased WTAR performance over three years for the Declined MCI (M=2.5 items) and Dementia (M=4.5 items) groups, but not the other groups. Indeed, many in the Dementia (55%) and Declined MCI (33%) groups worsened such that they did not complete the final assessment, suggesting greater decline than reflected by the obtained group means from those able to be tested.

**Conclusions:** In summary, results indicate that WTAR performance remains stable through MCI but, contrary to results from previous studies, appears to decline substantially in the transition from MCI even to mild AD (CDR=1), and further worsens as AD progresses. This raises concerns about potentially underestimating premorbid function for individuals seen after clinically significant decline.

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#### **S. MOON. Gene Interaction and Structural Brain Change in Early-onset Alzheimer's Disease.**

**Objective:** This article investigates subjects ages 55 to 65 from the Alzheimer's Disease Neuroimaging Initiative (ADNI) and aims to broaden our horizons of understanding the early-onset (EO) cognitive impairment using neuroimaging biomarkers

**Participants and Methods:** The subjects who are between 55 and 65 years of age were divided in two groups EO-AD or EO-MCI for this study. 9 was early-onset AD (Male: 4, Female: 5) and 27 was early-onset MCI (Male: 15, Female: 12). The structural ADNI data (1.5T MRI) was parceled and the 20 most important neuroimaging markers were extracted by the Global Shape Analysis (GSA).

**Results:** There are some meaningful results in the neuroimaging phenotypes for total 36 subjects, 27 MCI subjects, and 9 AD subjects in terms of the Global Shape Analysis (GSA). In the LSA (Local shape analysis), we looked for regional effects bilaterally in the hippocampus of different phenotypic variables (diagnosis, age, education years, APOE( $\epsilon$ 4), MMSE, Times, and Logical memory (Immediate and Delayed Recall) on the local shape-based registrations across subjects.

**Conclusions:** We observed the significant neuroimaging phenotypes in the 36 EO subjects in terms of neuroimaging. These results may explain some of the differences between EO-AD and EO-MCI

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#### **M. EL HAJ, L. FASOTTI & P. ALLAIN. Directed forgetting of source memory in Alzheimer's Disease.**

**Objective:** The directed forgetting method, in which participants are asked to forget/remember items, is argued to reflect retrieval inhibition. Using this method, we investigated whether Alzheimer's Disease patients were able to inhibit source information.

**Participants and Methods:** Seventeen Alzheimer's Disease patients (11 women and 6 men; M age = 75.61 years, SD = 5.98; M years of formal education = 9.31, SD = 2.17; M Mini-Mental State Examination = 23.02, SD = 1.54), and eighteen older adults (12 women and 6 men; M age = 71.21 years, SD = 6.32; M years of formal education = 10.51, SD = 3.09; M Mini-Mental State Examination = 28.34, SD = 1.11) were presented with two sets of 6 items each: Set1 and Set2. Each item was presented by one of two sources: an experimenter black- or white-gloved hand. After presentation of the Set1 items, participants were asked either to forget or to continue remembering the source of the items. Afterward, all participants were presented with the Set2 items, and were asked to remember their source. Finally, subjects were exposed to the Set1 and Set2 items, and were asked to recall, for each item, its original source presentation (i.e., the experimenter black- or white-gloved hand).

**Results:** Older adults and Alzheimer's Disease participants showed no differences in remembering the source of the Set1 and Set2 items. In other words, they failed to inhibit the source information.

**Conclusions:** These outcomes are interpreted as reflecting retrieval inhibition deficits and changes in adaptive nature of memory in Alzheimer's Disease.

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#### **Dementia (Subcortical, Specific Disorders, MCI, etc.)**

#### **M. EL HAJ, M. CAILLAUD, C. VERNY & P. ALLAIN. Destination recall in Huntington's Disease.**

**Objective:** Destination recall, a component of episodic memory, refers to the ability to remember the destination of produced events (e.g., 'where did I put the keys'?). We investigated this ability in Huntington's Disease patients

**Participants and Methods:** Fourteen Huntington's Disease patients (7 women and 7 men; M age = 47.71, SD = 9.57; M schooling years = 12.41, SD = 1.41; M Cytosine-Adenine-Guanine repeats = 44.6, SD = 2.8; M illness duration = 5.4 years, SD = 3.2) and sixteen age, gender, and education matched participants (8 women and 8 men, M age = 49.32, SD = 12.44; M schooling years = 13.72, SD = 2.87) voluntarily took part in this study. In order to assess their destination recall, participants were asked to deposit 6 items in a 20 x 20 cm black square box and another 6 items in a 20 x 20 white square box. During a 15-min delayed recognition task, participants were exposed to the 12 items and were subsequently required to remember the destination to which each item was originally designated (i.e., the black or the white square box).

**Results:** Huntington's Disease patients showed poorer destination recall than control participants. The memory deterioration seen in Huntington's Disease patients was found to be significantly correlated with their episodic performance, as assessed with the Hopkins Verbal Learning Test.

**Conclusions:** These findings highlight new tools for evaluating episodic deterioration in Huntington's Disease patients.

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#### **O. BEZDICEK, D.J. LIBON, M. LAMAR, J. EPPIG, J. MICHALEC, T. NIKOLAI & E. RUZICKA. Alterations in Working Memory in Parkinson's Disease Mild Cognitive Impairment.**

**Objective:** Mild cognitive impairment in Parkinson disease (PD-MCI) is considered a transitional stage between normal aging and dementia. The diagnostic criteria of PD-MCI were proposed by the Movement Disorders Society (MDS; Litvan et al., 2012). However, the diagnostic utility of Digit Span paradigms, included in Level II (for a comprehensive diagnosis of MCI working memory deficit) has to be accurately ascertained.

**Participants and Methods:** 26 patients with PD-MCI [9 F, 17 M; mean age 62±5; mean education 14±3; PD duration 12±6 years; HY-stage 2±0.6] and 15 age and education-paired controls [10 F, 5 M; mean age 67±7; mean education 16±2] were assessed. All participants performed the Backward Digit Test (BDT) a paradigm providing separate indices measuring storage/rehearsal (ANY-ORDER); mental manipulation/temporal re-ordering (SERIAL-ORDER) recall; and perseverations in conjunction with the PD-MCI, Level II neuropsychological battery.

**Results:** Because of non-normal distributions Mann-Whitney U tests were used and revealed equal MMSE test performance (PD-MCI, Md=28, NC, Md=29, p=0.114 (2-tailed)); however there were significant BDT differences with PD-MCI presenting with worse performance than NCs for total correct trials (p=0.007), ANY-ORDER (p=0.002), SERIAL-ORDER (p=0.005) recall, total errors (p=0.006), and total within/ and capture perseverations (p=0.052).

**Conclusions:** Results suggest significant impairment in a number of indices related to verbal working memory (WM) in PD-MCI including storage/rehearsal, mental manipulation/temporal re-ordering and errors including perseverations. The BDT may be a robust tool for disentangling WM-deficits in PD-MCI and appears to be clinically useful.

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#### **D.M. CAMMISULI, E. CASTRO, D. MENICAGLI, M. BARONCINI & M. TIMPANO SPORTIELLO. Neuropsychological Profile of Patients Suffering From Mild Cognitive Impairment-Parkinson's Disease (MCI-PD).**

**Objective:** To date, there is controversy regarding the definition and characteristics of Mild Cognitive Impairment in Parkinson's disease (MCI-PD). In particular, a significant heterogeneity has been found within MCI-PD in relation to the cognitive domains involved and to the severity of neuropsychological deficits reported by patients. The present study aims at defining with greater precision the neuropsychological profile of a group of MCI-PD outpatients.

**Participants and Methods:** 25 patients (M:F=45:55%; age 72±5; education 5±3 yrs) with a diagnosis of Parkinson's Disease were assessed by: Brief Neuropsychological Exam or Milan Overall Dementia Assessment (global cognitive screening); ADL and IADL; Digit Span, Corsi Span, Pairs Associates Learning, Story Recall, Corsi Learning Suvraspan, Appointment and Hidden Personal Belonging subtests of Rivermead Behavioural Memory Test, Attentive Matrices, Stroop Test, Boston Naming Test, Category Fluency Test, Street's Completion Test, Constructive Apraxia Test, Frontal Assessment Battery, Tower of London, and Brixton Test. The raw scores were transformed into the equivalent scores to compare performances on cognitive tests.

**Results:** Patients showed poor performances on prospective memory subtests, as expected. They also presented a slight impairment of visual-space long term memory and constructive apraxia. The majority of pa-

tients had an executive functioning impairment primarily characterized by planning and mental flexibility deficits, both for set-shifting and capacity to produce words following an unusual procedure. They were more damaged than selective attention, sensitivity to interference and inhibitory control.

**Conclusions:** Following the recent indication of Movement Disorder Society Task Force on MCI-PD, our research confirms that Nonamnesic single domain impairment predominates in PD-MCI, with executive functioning as the most frequent cognitive domain affected.

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**Y.L. CHANG, T. CHEN, M. CHIU & S. YAN. Evaluation of the Utility of the Mandarin Phrase Fluency Test in Identifying Individuals at Risk for Alzheimer's Disease.**

**Objective:** Verbal fluency tests are employed regularly during neuropsychological assessments of older adults, and deficits are a common finding in patients with Alzheimer's disease (AD). The fundamental differences between Mandarin (logographic systems) and English (alphabetic systems) make it difficult to directly apply the Western-based phonemic verbal fluency to non-English speaker. Thus, the present study aimed to evaluate the utility of a newly developed test—the Mandarin Phrase Fluency test—which may be used as a parallel test of phonemic verbal fluency for Mandarin-speaking populations in identifying individuals who are at risk of developing AD.

**Participants and Methods:** Thirty-eight nondemented participants were enrolled into the study (Mild cognitive impairment:  $n = 19$ ; healthy control:  $n = 19$ ). The two groups were matched on age, education, sex distribution, scores on the Geriatric Depression Scale and the vocabulary subtest of WAIS-III.

**Results:** The results revealed that the individuals with amnesic mild cognitive impairment (aMCI) generated significantly fewer phrases relative to cognitively intact older adults, indicating retrieval difficulty. Moreover, the Mandarin Phrase Fluency test was found to be significantly associated with several measures of executive function ( $r = .48$  to  $r = -.46$ ), suggesting that the task was involved in executive control to some degree.

**Conclusions:** The preliminary findings suggest that the Mandarin Phrase Fluency test can potentially serve as a useful tool for identifying individuals who may be at risk for developing AD given its discriminative validity between individuals of aMCI and cognitively intact older adults.

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**C. DECARLO, S.W. MACDONALD & R.A. DIXON. Genetic Influences and Vascular Health Moderate MCI Status and Stability: Evidence from the VLS.**

**Objective:** Sporadic Alzheimer's disease (AD) is an incurable neurodegenerative disease. Mild cognitive impairment (MCI) is considered a high-risk condition for progression to AD. In the absence of a cure, early identification of at-risk populations and implementation of early interventions represents the best strategy for addressing AD. Vascular health has been implicated as a key mechanism underlying age-related neurodegeneration, but surprisingly, the interaction of vascular markers with known genetic risk factors for predicting cognitive impairment is unknown. We have previously identified that the APOE  $\epsilon 4$  allele and the COMT G/G genotype are independently associated with stability of mild cognitive impairment (MCI) and decline from normal (NIC) to impaired status at baseline.

**Participants and Methods:** Using older adults ( $n = 237$  at baseline; age range = 64-91; 62% women) and cross-sectional and two-wave longitudinal data from the Victoria Longitudinal Study (VLS), we examined whether indicators of vascular health (e.g., self-reported heart disease, BMI, stroke, atherosclerosis), both uniquely and interactively with genetic risk factors APOE ( $rs429358$  and  $rs7412$ ; the presence vs. absence of  $\epsilon 4$ ) and COMT ( $rs4680$  met/met vs. val/val), were associated with (a) cognitive status at baseline (NIC vs MCI), and (b) stabil-

ity of cognitive classification across a 4-year retest interval (stable NIC-NIC or chronic MCI-MCI or unstable NIC-MCI). MCI classification was based on each individual's objective performance relative to their own age and education group means on a standardized set of five cognitive tests.

**Results:** Logistic regression revealed that vascular health markers were linked to greater risk of MCI at baseline and their interaction with genetic risk factors conferred greater risk of MCI stability over time.

**Conclusions:** Independently and interactively select vascular health markers and genetic risk factors increase risk for cognitive impairment.

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**T. FUJITA, M. NOTOYA, N. SUNAHARA, K. NAKATANI & D. KIMURA. Differences in behavioral disorders in patients with Alzheimer's disease and Mild cognitive impairment determined using the at-the-desk instrumental activities of daily living (IADL) test.**

**Objective:** We have previously presented our data regarding differences in the clinical dementia rating (CDR) scale leading to variations in behavioral disorders. This data related to mild and moderate Alzheimer's disease (AD) patients who performed instrumental activities of daily living (IADL) as a desk evaluation. In this study, we assessed behavioral disorders in patients with mild cognitive impairment (MCI) and mild AD by using the At-the-Desk IADL test.

**Participants and Methods:** Twenty-five healthy elderly participants (CDR0), 12 MCI patients (CDR0.5), and 24 mild AD patients (CDR1) participated in this study. The At the-Desk IADL test comprised 8 tasks (4 tasks with 2 patterns) that included 2 object and classification tasks, a parallel task, and a prospective memory task. We told the participants to think of the sequence in which they would carry out the 8 tasks; then, we asked them to carry out the tasks while being provided with a task board that displayed the correct task order. The number of participants who demonstrated incorrect responses was noted. We calculated their score by recording their implementation of the task order and the number of times they consulted the task board (ascertainment behavior).

**Results:** No significant differences were observed between the control and MCI groups in terms of task order and ascertainment behavior scores (Kruskal-Wallis test,  $p < 0.05$ ); however, a significant difference was observed between these groups during the "sorting trash" task of classification tasks; several participants gave incorrect responses. No significant differences were observed between the control and MCI groups for the other 7 tasks (Chi-square test,  $p < 0.05$ ).

**Conclusions:** Based on the task order and ascertainment behavior results, we conclude that the MCI patients demonstrated a capacity to compensate for memory deficits, similar to AD patients, by consulting the task sheet. However, "sorting trash" was a task that could not be accomplished despite the provision of a task board.

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**K. HENDRY, T. QUINN, J.J. EVANS & D.J. STOTT. Informant Single Screening Questions for Delirium and Dementia in Acute Care.**

**Objective:** To determine the concurrent validity of informant-based single screening questions (SSQ) for delirium and dementia in older people in acute hospital care.

**Participants and Methods:** Convenience sample of 161 non-elective admissions (age  $> 65$  years) to medical or geriatric hospital wards. The SSQ for delirium was: How has your relative/friend's memory changed with his/her current illness? And for dementia: How has your relative/friend's memory changed over the past 5 yrs (up to just before their current illness)? Both questions were graded on a 5 point scale ranging from 'Much improved' to 'Much worse'; responses were compared to Mini-Mental State Examination (MMSE) scores. Delirium was diagnosed using the Confusion Assessment Method (CAM); dementia was accepted if Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) score  $> 3.5$ .

**Results:** Patients were mean 79.6 years old; 61.5% were female. Mean MMSE score was 18.9, 16.8% were CAM positive. Patients coded as 'No

change' or 'Improved' on SSQ for delirium had a mean score of 22.9 compared to 15.0 for those patients who were identified as 'bit worse', and 12.0 for those patients identified as 'much worse'. On the SSQ for dementia, patients coded as 'No change' or 'Improved' had a mean score of 23.2, for a 'Bit worse' 18.6 and for 'Much worse' 11.0. The SSQ for delirium had a sensitivity of 76.9% and a specificity of 56.1% compared to the CAM. The SSQ for dementia had a sensitivity of 83.3% and a specificity of 93.1% compared to the IQCODE.

**Conclusions:** The SSQ for dementia appears to have good specificity and sensitivity. The SSQ for delirium appears to perform less well. These findings show promise for use of a single question screening tool as the first step in the detection of dementia in older patients in acute hospital.

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**L. OLABARRIETA LANDA, J. PEÑA LASA, O. RILO CANO, M. GOMEZ-BELDARRAIN, I. GARCÍA-GOROSTIAGA, N. OJEDA DEL POZO & N. IBARRETXE-BILBAO. Cognitive reserve mediates the relation between processing speed and memory in Parkinson's Disease.**

**Objective:** Cognitive dysfunction occurs in Parkinson disease (PD) and functions like processing speed (PS), verbal (VM) and visual (VIM) memory are affected. Studies suggest that higher cognitive reserve (CR) is associated with reduced odds of mild cognitive impairment in patients with PD and it influences pronouncedly in mental flexibility and reasoning, attention, PS and memory. Our goal is to analyze the potential mediation role of CR in the relationship between PS and memory.

**Participants and Methods:** We recruited 32 non-demented PD patients (mean age=68.81, mean of illness duration=6.45). Patients underwent an extensive neuropsychological battery including Salthouse test, as indicative of PS, and Hopkins verbal learning test-Revised (HVLT-R) and Brief visual memory test-Revised (BVM-T-R) total learning score as indicative of VM and VIM respectively. In addition, to measure CR, we created a composite score using TAP, the Spanish version of National Adult Reading test (NART), PROLEC, the Spanish version of Pseudoword Reading Test, and Cognitive Reserve questionnaire's standardized score.

**Results:** We obtained a composite score for CR ( $\alpha=.83$ ). We first tested the CR mediation hypothesis on VM. In the first step, PS significantly predicted VM ( $\beta=.45$ ,  $p=.010$ ). Secondly, CR was regressed on PS ( $\beta=.56$ ,  $p=.001$ ). Thirdly, PS ( $\beta=.16$ ,  $p=.391$ ) and CR ( $\beta=.49$ ,  $p=.014$ ) were introduced simultaneously in the regression analysis. Sobel's equation result was significant at  $p<.04$  for CR ( $z=2.10$ ), suggesting full mediation in Parkinson disease. Second, we tested the CR mediation on VIM. Sobel's equation result was significant at  $p<.01$  for CR ( $z=2.54$ ), suggesting full mediation. The relationship between PS and VIM was reduced from  $\beta=.48$  ( $p=.007$ ) to  $\beta=.11$  ( $p=.537$ ) when CR was entered.

**Conclusions:** These results suggest that CR influences the cognitive dysfunction profile in this disease.

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**F. LUCHELLI, M. FRUSTACI, G. GHIRARDI, E. MARTINI, P. SALETTA & R. VERGA. Short Term Memory in Degenerative Aphasia due to Alzheimer's Disease: beyond verbal impairment?**

**Objective:** Short term memory (STM) deficits are distinctly unusual in the early stages of Alzheimer's disease (AD). On the other hand, verbal STM impairment has been consistently reported in the logopenic variant of primary progressive aphasia (PPA).

**Participants and Methods:** STM was extensively assessed in AC, a 54-year-old, right-handed man and former sculptor, affected by a progressive language disturbance with features suggestive of logopenic aphasia. Lack of reliable history information and evidence of extra-verbal cognitive deficits did not allow a diagnosis of PPA. Imaging studies (brain MRI and F18-FDG PET) and positive CSF markers pointed to AD as the underlying pathology. STM was investigated by an extensive battery of standardized and experimental tasks, using different verbal, spatial and visual stimuli and different response modalities (auditory vs visual; verbal vs pointing). Gestures, both meaningful and meaningless, were also studied.

**Results:** AC was severely impaired in all tasks, failing consistently with sequences of more than three stimuli and in most cases being unable to reproduce more than two stimuli. The results of verbal STM tasks provide hints of the absence of phonological similarity effect in contrast with at least partial sparing of word length effect.

**Conclusions:** These findings suggest that the store component of verbal STM is more impaired than the articulatory rehearsal process, in line with previously reported data in logopenic aphasia (Gorno-Tempini et al., 2008). On the other hand, AC's STM deficit extends well beyond the verbal domain and involve all modalities. While verbal STM deficit could be related to left parietal cortex involvement, the neural substrates of non-verbal STM deficits are more difficult to characterize. A role of right and/or bilateral parietal involvement, as demonstrated by the PET study, could be envisaged.

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**C. MERCK, P. JONIN, M. LAISNEY, H. VICHARD & S. BELLARD. Is semantic dementia a syndrome of semantic knowledge disequilibrium rather than of a distressing loss of concepts? Evidence from a semantic priming paradigm.**

**Objective:** Few studies used semantic priming paradigms to explore the loss of conceptual knowledge in Semantic Dementia (SD). When the integrity of the various features underlying concepts was measured, quite conflicting results were yielded and could be partially explained by the lack of boundary lines between attributes. We made the effort to restrict the exploration of the semantic features to two clear-defined kinds of attributes: Visual/Perceptual (VP) and Contextual/Functional (CF).

**Participants and Methods:** Eight SD patients and 31 matched controls were administered an implicit lexical-decision priming task, where priming effects in these two attributes conditions were contrasted: VP (ostrich-neck) vs. CF (squirrel - hazelnut).

**Results:** We demonstrated a significant Groups (controls vs. SD) X Links (related vs. unrelated pairs) X Attributes (VP vs. CF) interaction (ANOVA,  $F(1, 37) = 32.190$ ;  $p < 0.001$ ). Post hoc analyses yielded a significant priming effect in VP but not in CF conditions in controls, while the SD group showed the reverse pattern of performance.

**Conclusions:** Priming effect observed in SD patients in the absence of any priming in controls could be regarded as a sign of semantic disequilibrium. Since prior studies have demonstrated that perceptual features are a core determinant of similarity-based/taxonomic relationships while complementary-based/thematic processing mainly relies on contextual relationships, our findings were interpreted in terms of differential recruitment of one of the two competing semantic relations systems (taxonomic vs. thematic). Besides, these two distinct and parallel systems were previously reported to coexist in healthy adults. We thus argued that in controls the similarity-based/taxonomic relationships would be preferentially used leading to significant priming effect for VP features without any priming for CF ones. In SD, as perceptual features are impaired, the thematic relationships system could take over from the similarity-based/taxonomic one.

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**A. MIDORIKAWA & M. KAWAMURA. Hyperesthesia and dementia.**

**Objective:** It has been reported that patients with mild head injuries frequently complain of a decreased ability to endure intense light and sound stimuli or hyperesthesia (Bonnet et al., 1992). As the same as mild head injury patients, elderly person with dementia might also have symptoms of mild head injuries. The purpose of the study was to evaluate types and frequency of hyperesthesia in demented patients.

**Participants and Methods:** Based on a semi-structured interview for caregivers, we developed a five-point scale questionnaire. The items are consisting of 18 remarkable behaviors or complain based on hyperesthesia such as "He/She seems like a sensitive to sound" or "He/She seems like a sensitive to feel left out". A total of 31 elderly persons with diagnosed dementia were assessed by their caregivers using the questionnaire.

**Results:** Factor analysis revealed that there are three factors. These factors were named (a) Hypersensitivity to Surroundings, (b) Hypersensi-

tivity to People, and (c) Hypersensitivity to Self. In addition, most frequently reported complain was auditory hyperesthesia. Over 50% of caregiver noticed the symptom. Some caregiver noticed that after introduction of hyperesthesia-considered care, patient's problematic behavior was reduced.

**Conclusions:** Not a small number of demented elderly persons sometimes show hyperesthesia. In order to reduce the problematic behaviors, hyperesthesia-considered care might be effective.

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**E.C. MIOTTO, J.B. BALARDIN, M.C. MORAIS MARTIN, M.C. BATISTUZZO, J. SMID, C.R. SAVAGE, C.S. PORTO, E. AMARO JR & R. NITRINI. Right DLPFC activation differentiates MCIs from controls in the use of verbal learning strategies.**

**Objective:** We used fMRI to investigate whether there were behavioural and neural activation differences in verbal learning training-specific changes in MCI patients and controls.

**Participants and Methods:** Eighteen amnesic MCI patients according to Petersen's criteria and 19 healthy controls were scanned twice, before and after a 30-min session of cognitive training targeted to strategic memory processing. A block-design paradigm was used to assess memory encoding of word lists with variable strategic processing load: semantically unrelated words (UR) and semantically related words (SR) in terms of categories presented in a unstructured order. BOLD images (GRE-EPI) were acquired on a 3T scanner (Philips Achieva), with a 8Ch head coil. Image parameters: TR=3000ms, TE=30ms, 41 3mm isotropic voxels. fMRI data processing was carried out using FSL-FEAT.

**Results:** Both groups improved their memory performance on free recall tasks and had greater strategic clustering indexes after training only in the SR condition. The MCIs exhibited increased activation after training in the right dorsal middle frontal gyrus extending to superior frontal gyrus and frontal pole. In controls, activation in these areas decreased after training.

**Conclusions:** Increased behavioural performance due to cognitive strategic training in normal aging and MCI is associated with different patterns of fMRI activation that might reflect differences in the spontaneous engagement of strategic processing subserved by right DLPFC.

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**N. MONTORO, J. MONTES & M. ARNEDEO. INECO Frontal Screening (IFS): A Test Sensitive to Executive Alterations In Mild Cognitive Multidomain Impairment.**

**Objective:** The aim of this study is to test the sensitivity of the INECO Frontal Screening tool when detecting the alterations of the executive functions in mild cognitive multidomain impairment patients.

**Participants and Methods:** 2 groups were tested with the INECO Frontal Screening tool and with the Rey Auditory Verbal Learning Test: - patients who suffer from mild cognitive multidomain impairment - a group of typical aging population

**Results:** Significant differences amongst both groups have been found as much to the total INECO scoring as to its different subtests. Moreover significant correlations with different long and short-term verbal memory measures have been found.

**Conclusions:** The INECO Frontal Screening is an efficient tool for the detection of executive dysfunctions in patients with mild cognitive multidomain impairment.

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**T. NIKOLAI, M. VYHNALEK, E. LITERAKOVA, Z. NEDELSKA, H. MARKOVA, J. LACZO & J. HORT. Figural and spatial components of nonverbal memory in Rey-Osterrieth Complex Figure are associated with hippocampal atrophy in non-demented elderly.**

**Objective:** Rey-Osterrieth Complex Figure Test (ROCFT) is one of the most widely used nonverbal tests, where the delayed recall condition is considered to reflect nonverbal memory. The figural and spatial com-

ponents of ROCFT are developed scoring methods believed to reflect function of the left (L) and right (R) hippocampus (HIP), respectively. The purpose was to examine the association between figural and spatial components of the ROCFT and L- and R-HIP volumes in non-demented elderly.

**Participants and Methods:** Twenty six right handed subjects with amnesic mild cognitive impairment (aMCI, diagnosis was based on verbal memory scores) and 22 age-matched cognitively normal controls underwent complex neuropsychological testing including ROCFT - Recall condition. The results of ROCFT were not used to define patients with aMCI. We used Meyers standard scoring method and J.I. Breier and colleagues' figural/spatial scoring method to evaluate the results of delayed recall. All participants received 1.5T MRI scan with subsequent automatic measurement of TBV and L- and R-HIP and volumes, using FreeSurfer (v4.5.0) algorithm. HIP volumes were corrected for total brain volume (TBV). Spearman correlation was used to correct for abnormal score distribution.

**Results:** There were significant differences in spatial and figural memory scores, total nonverbal memory score of ROCFT and both HIP volumes between aMCI and controls ( $p < 0.001$ ) but not in TBV. We found moderate correlations of HIP volumes with ROCFT reproduction figural ( $rR = .39$ ,  $rL = .46$ ,  $p < .001$ ), ROCF reproduction spatial ( $rR = .48$ ,  $rL = .51$ ,  $p < 0.001$ ) and ROCFT reproduction total ( $rR = .46$ ,  $rL = .50$ ,  $p < .001$ ). No correlation in any score of nonverbal memory was achieved with TBV.

**Conclusions:** ROCFT delayed memory was able to discriminate between MCI and controls in all used scoring methods. Total score of ROCFT delayed recall and both figural and spatial scores equally reflect hippocampal atrophy in non-demented elderly.

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**R.M. OLIVEIRA, H. CHARCHAT-FICHMAN, C.S. FERNANDES & D.C. MOGRABI. Disexecutive Mild Cognitive Impairment Predominance in Elderly Assisted at a Geriatric Clinic in a Public Hospital in Rio de Janeiro.**

**Objective:** Mild cognitive impairment (MCI) is a nosological entity with a high prevalence in the elderly population that shows a possible transition between the cognitive decline expected in the aging process and dementia. The objective of this study was to map the neuropsychological profile and identify mild cognitive impairment in a sample of elderly outpatients from a geriatrics clinic of a public hospital in Rio de Janeiro, using a brief neuropsychological battery.

**Participants and Methods:** The sample included 88 patients who did not fulfill DSMIV criteria for dementia or other neurological or psychiatric disease. We used the following instruments: Mini Mental State Examination, Figures Memory Test, Semantic Verbal Fluency (animal), Clock Drawing, Lawton and Katz Daily Living Activities Scales. We describe the frequencies and proportions of decline for each of the assessed cognitive functions. Groups of mild cognitive impairment were compared using Student's t and Chi-Square tests.

**Results:** Most of the subjects (61.4%) were classified as non-amnesic disexecutive MCI. It was identified a group with decline and another without functional decline, but there was no difference between these groups in terms of clinical diagnoses of multiple domains, amnesic and disexecutive MCI. The results indicate, in our sample, the prevalence of executive dysfunction, with a subset of subjects having memory deficits. Many of the participants (31.2%) with cognitive decline (executive functions, memory), already show some functional decline.

**Conclusions:** This data set brings theoretical and clinical contributions in relation to the understanding of pathological aging and functional decline. In particular, it is discussed the possible contribution of demographic variables to variations in MCI types predominance and the consequences in terms of interventions.

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**M. RODRÍGUEZ, T. GARCÍA-MORÁN, N. MONTORO-MEMBILA, M. ARNEO & M.J. FUNES. What is common and what is different in everyday functioning between Dementia and Mild Cognitive Impairment.**

**Objective:** One of the most relevant criteria to differentiate dementia from MCI is the presence of functional impairment in everyday basic actions in dementia but not in MCI. However less is known about how patients with MCI and Dementia differ when performing instrumental everyday actions.

The aim on this study was to develop a performance-based task that helps to characterize specific error patterns in instrumental everyday actions in Dementia and Mild Cognitive Impairment (MCI).

**Participants and Methods:** A group of dementia and a group of MCI patients were asked to complete a cooking task under conditions where the target items were intermixed with highly “eliciting” items (distracters). Critically, the distracters altogether constituted the object set necessary to complete an additional semantically related but not required “tangential task”.

**Results:** We found that under these conditions, the MCI and the Dementia group made more total errors than the healthy control group, thus replicating recent studies showing that instrumental activities are already impaired in MCI patients. More interesting, the analysis of specific pattern of errors within the context of this task, allowed us to delimitate a pattern of commonalities and differences in the functional deficits of both groups. On the one side Dementia patients made more errors related with deficits in the knowledge of the task schema (e.g. omissions and sequence) compared to MCI or healthy control participants. On the other side, both patient groups made more errors than controls in error categories related with response inhibition, such as toying, repetitions or tangential actions

**Conclusions:** This pattern of results might help to dissociate the type of cognitive and functional processes which are commonly altered in Dementia and MCI from those that are altered in Dementia but not in MCI. The present task might serve as a diagnostic tool to differentiate between these two forms of illness.

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**R. RUSINA, E. BOLCEKOVA, R. MATEJ, K. STOREY, J. KELLER & M. BUNCOVA. FTLD-TDP and Progressive Supranuclear Palsy in Comorbidity: Study of a Rare Case.**

**Objective:** Frontotemporal lobar degenerations (FTLD) encompass several clinically and pathologically heterogeneous disorders. Histopathological analysis of brain tissue recognizes FTLD-tau (with tau-positive inclusions), FTLD-TDP (with protein TDP-43 positive inclusions) and FTLD-UPS (with ubiquitin positive inclusions). Progressive supranuclear palsy (PSP) is a pure tauopathy. We present a case of a 60-year old male with concurrent FTLD-TDP and progressive supranuclear palsy.

**Participants and Methods:** The patient was referred with a slowly developing cognitive deterioration since two years. He underwent repeated neurological and neuropsychological assessments, MRI and SPECT examinations. He was followed up regularly for three years and a detailed neuropathological investigation was realized on autopsy.

**Results:** The initial clinical presentation was characterized by marked episodic memory impairment, visuospatial deficits, apraxia and a pronounced dysexecutive syndrome with perseverations. MRI found marked frontal and temporal cortical atrophy, SPECT revealed hypoperfusion in the right occipital-parietal and frontal regions bilaterally. The patient was diagnosed with Alzheimer’s disease, and successively treated with rivastigmine, donepezil and memantine. However, the clinical presentation worsened with increasing frontal lobe dementia, development of extrapyramidal features with frequent falls, dysautonomy and oculomotor abnormalities. Neuropathological examination revealed an extremely rare combination of FTLD-TDP and tau pathology fulfilling diagnostic criteria for PSP.

**Conclusions:** Our presentation of simultaneous affliction with two different neurodegenerations – FTLD-TDP and PSP showed an atypical clinical course from the initial presentation evoking Alzheimer’s disease up to a picture compatible with progressive supranuclear palsy. Close clinical and neuropathological correlations are thus very useful in atypical cases of neurodegenerative dementias.

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**E.J. SITEK, E. NAROZANSKA, S. KONIECZNA, M. GUGALA, M. HARCIAREK, A. BARCZAK, M. CHODAKOWSKA-ZEBROWSKA, M. BERDYNski, C. ZEKANOWSKI, M. BARCIKOWSKA & J. SLAWEK. Changes in Creative Output in an Artist Painter with Frontotemporal Dementia with MAPT P301L Mutation.**

**Objective:** Behavioral variant of frontotemporal dementia (bvFTD) is characterized by progressive changes in behaviour, speech and cognition. Its impact on the artistic expression remains controversial. Several case reports suggest that it may trigger artistic activity. However, case reports of professional artists with FTD also document the impoverishment of artistic activity in the FTD course. We present a 54-year-old patient, an artist painter with P301L MAPT mutation, fulfilling the criteria of a behavioral variant of frontotemporal dementia (bvFTD) in whom behavioral dysfunction, aphasia and dysexecutive syndrome are the most prominent features.

The study aimed at analysing the patient’s artistic expression at the early stages of FTD and close to the disease onset. Furthermore, it was hypothesized that the changes in the artistic output would be consistent with the neuropsychological profile (dysexecutive syndrome with a marked perseverative tendency).

**Participants and Methods:** The patient was neuropsychologically examined at the age of 50, 52 and 53. In the course of the second and third neuropsychological examinations the patient was asked to draw and copy several items (e.g. an elephant, a guitar). Moreover, the analysis of selected paintings from 4 periods was performed: far from onset (1995-1997), close to onset (1998-2001), early in the disease course (2002-2005) and at the moderate stage of the disease (2006-2009).

**Results:** The results of the comparative analysis of the patient drawings performed at the moderate stage of the disease at the age of 52 and 53 are consistent with the predominance of dysexecutive symptoms. The prospective analysis of paintings also suggests the negative impact of FTD on the patient’s creativity: repetition of themes, simplification of structure and frequent inclusion of text into the painting.

**Conclusions:** In bvFTD artistic expression may impoverished early in the disease course and severely compromised at the moderate stage of the disease.

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**J. STOKHOLM, T.W. TEASDALE & A. GADE. Neuropsychological Changes in Nine Asymptomatic FTD-3 CHMP2B Mutation Carriers over an Eight-year Period.**

**Objective:** The objective of this study was to characterize the changes in individual neuropsychological profiles in the preclinical phase of FTD-3.

**Participants and Methods:** Nine non-demented CHMP2B mutation carriers between the age 40 and 70 were neuropsychologically tested in 2002, 2005 and 2010.

**Results:** Individual test scores on six cognitive domains (psychomotor speed, episodic memory, working memory, verbal fluency, executive functions and visuospatial abilities) from 2002, 2005 and 2010 show great variability in rate and profile of cognitive decline: Two individuals remained unaffected and stable over the eight-year period. Neither showed clinical signs of bv-FTD. Two individuals showed mild gradual and global cognitive decline over the years. One developed massive behavioral changes leading to the FTD-3 diagnosis shortly after the last testing, while the other remains undiagnosed. Four individuals showed a marked cognitive decline over the years with dominant impairment in working memory and executive functions over the eight years. Two of these were formally diagnosed with FTD-3 shortly after the last testing. Finally, one individual, who was severely dyslectic, performed poorly on tests already in 2002 and showed marked deterioration only in visuospatial functions and psychomotor speed from 2002 to 2010. He was diagnosed with FTD-3 in 2011.

**Conclusions:** In most CHMP2B mutation carriers cognitive changes can be detected 5-8 years before the clinical diagnosis of dementia is established. Some show a typical FTD-profile, while others seem to be more globally cognitive affected at the preclinical stage.

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**M. LEE, J. CHIN, K. OH, S. SEO & D. NA. The Mediation Effects of Self-absorption on the Relationship between Depression and Memory Complaints in Older Adults.**

**Objective:** Subjective memory impairment (SMI) refers to conditions where people complain about memory decline without cognitive impairment. The association between depression and SMI has been established well. However, few researches were conducted on personality trait such as self-absorption on the relationship between depression and SMI. This study was designed to examine the relationship among depression, self-absorption, and memory complaints in older adults. We hypothesized that depressive symptoms influence memory complaint with the mediation of self-absorption.

**Participants and Methods:** A total of 107 patients with SMI completed several questionnaires, including Maladaptive Self-focused Attention Scale– Self Absorption, a short version of the Geriatric Depression Scale, and Multifactorial Memory Questionnaire – Ability. In order to examine the relation among significant variables, correlation and hierarchical regression analyses were conducted. The mediation analysis was conducted as Baron and Kenny (1986) suggested and significance test of the mediation effect was done through Sobel test.

**Results:** On the hierarchical regression analysis, depression significantly predicted scores of self absorption and memory complaints respectively in the step 1 and 2. In step 3, when both depression and self absorption were entered into the model, self-absorption significantly predicted memory complaint whereas prediction value of depression was restricted. Mediation effect of self-absorption was also significant on the Sobel test.

**Conclusions:** These results revealed that the relationship between depression and memory complaint is mediated by self-focused attention, suggesting that personality trait like self-absorption could play an important role on subjective memory complaints. Not only depressive symptoms, but also maladaptive self-focused attention should be treated on the psychological intervention for older adults with SMI.

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**T. ZANDI. Identifying vascular dementia risk factors.**

**Objective:** The main objectives of this projects were:

- 1) To identify the the role of vascular risk factors as well as medical compliance in development of primary symptoms of vascular dementia.
- 2) To identify the co morbid psychological disorders and determine their contributing role in presentations of dementia symptom

**Participants and Methods:** 350 individual age 55 and older participated in this study. the subjects were the clients of a local large primary care practice. They sign off to participate in the study without any prior screening for dementia. The participants medical file was evaluated in order to obtain information as to their vascular risk factors. The risk factors were mainly based on the present diagnosis of HTN, high cholesterol and diabetes. We also pulled out information in regard to the duration of their risk factors, as well as their medications and their compliance with their medication. Further more we obtained several cognitive screening data form the patients. The group were divided into 2 subgroups of “with, partial and without” vascular risk factors. then they were further broken down into those with cognitive impairment and those without.

**Results:** the most prevalent risk factors that were identified in this group of participants were Hypertension, and then high cholesterol and finally diabetes. Age was highly correlated with these risk factors as well. the group that at the highest risk with the three risk indicators of hypertension, high cholesterol and diabetes showed the highest number of cognitive related problems as well. the group with long term hypertension (more then 10 years) also showed a great deal of cognitive impairment.

**Conclusions:** Preventing the vascular risk factors is essential for either delaying or preventing symptoms of dementia. In the U.S. we need to manage the underlying causes of the risk factors in order to be able to prevent dementia disorders.

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**HIV/AIDS/Infectious Disease**

**A. AU, K. NAN, A. AU, I. CHAN & P. LI. Dimensions of Impulsivity and Their Relationships to Memory Functioning in Persons Living with HIV in Hong Kong.**

**Objective:** The understanding of the complex and possibly reciprocal relationships between risk factors and neurocognitive impairment is essential to minimize the transmission and progression of HIV. As a first step to understanding these relationships, the present study has two main objectives. First, we aim to identify some core components of impulsivity. Second, we explore the relationships of these various impulsivity components with dimensions of memory functioning.

**Participants and Methods:** Ninety HIV-positive persons aged between 20 to 4and sixty-five HIV-negative demographically-matched control participants were recruited. Neuropsychological assessment with the captioned impulsivity tests and the Hong Kong List Learning Test was carried out. HIV-positive participants scored systematically lower than normal controls on all the impulsivity and memory measures. Investigating the dimensions of impulsivity, exploratory factor analysis was first carried on the results of the controls and confirmatory analysis was conducted on the HIV-positive participants. .

**Results:** HIV-positive participants scored systematically lower than normal controls on all the impulsivity and memory measures. Investigating the dimensions of impulsivity, exploratory factor analysis was first carried on the results of the controls and confirmatory analysis on the HIV-positive participants. Results yielded distinct factors of impulsivity which could be understood as dimensions of inhibition, reflexivity, set-shifting and risky decision making. Finally, these measures were found to be significantly correlated with measures of delayed recall, subjective organization and semantic clustering.

**Conclusions:** Results were discussed with reference to the need to take into account of the role of learning and memory in the various possible cognitive correlates of impulsive behavior.

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**J. CATTIE, E. MORGAN, A. KNIGHT, S.P. WOODS & I. GRANT. Poorer Theory of Mind and Risky Decision-Making in HIV.**

**Objective:** As frontostriatal regions are specifically vulnerable to HIV infection, HIV+ individuals commonly evidence executive dysfunction. The aim of this study was to examine the effects of HIV on Theory of Mind (ToM), or the ability to attribute mental states (e.g., intentions, beliefs, knowledge, and emotions) to others. ToM is an important aspect of social cognition, as well as a key input for decision-making, which is subserved by frontostriatal circuits.

**Participants and Methods:** In this investigation, 42 individuals with HIV and 29 seronegative participants with comparable substance use histories completed two tasks of ToM (the Mind in the Eyes task and Combined Stories task) as part of a comprehensive neurocognitive, psychiatric, and medical research evaluation.

**Results:** The HIV+ group performed significantly more poorly than seronegative participants on verbal (Combined Stories,  $p < .01$ ) and nonverbal (Eyes task,  $p < .05$ ) measures of ToM, despite comparable performance on non-social control items ( $ps > .10$ ). Poorer performance on the Eyes task was associated with riskier decision-making on the Iowa Gambling Task ( $p < .05$ ).

**Conclusions:** These findings support the hypothesis that individuals with HIV may be at risk for social cognitive deficits, which may be relevant to risky decision-making. Future studies may explicate the relationship between these ToM measures, other aspects of neurocognition, and real-world risk behaviors that are relevant to HIV transmission.

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**U.S. CLARK, L.H. SWEET, C. JASPER, A.M. FOLKERS, S. ROSS, M.J. PINA, N.S. PHILIP, L.L. CARPENTER, K.T. TASHIMA & R.A. COHEN. Effects of Early-Life Stress on Amygdala Function in HIV Positive Patients: A Pilot Study.**

**Objective:** Recent data suggest HIV positive patients exposed to high early-life stress (ELS) demonstrate increased amygdala volumes. Yet it is not known whether these individuals exhibit changes in amygdala function, and whether such functional changes contribute to the increased rates of psychopathology commonly noted in HIV+ cohorts.

**Participants and Methods:** This pilot fMRI study included 14 HIV positive (HIV+; 9 male) and 13 age-matched HIV negative healthy control (HC; 6 male) adults (mean=46 years). ELS status was defined using the Early Life Stress Questionnaire (HIV+ High-ELS=7; HC High-ELS=4). A battery of psychological screening measures was administered. During fMRI scans, participants viewed facial images of negative emotion (anger, fear), which are known to elicit a robust blood oxygen level dependent (BOLD) response in the amygdala relative to resting baseline. Mean BOLD responses were extracted from the bilateral amygdala to examine the combined effects of HIV and high ELS on amygdala function.

**Results:** Compared to HC, HIV+ patients reported higher rates of apathy ( $p=.04$ ), depression ( $p<.10$ ), alexithymia ( $p<.10$ ), and social isolation ( $p=.03$ ). A 2x2 ANOVA (HIV x ELS) controlling for Hepatitis C status revealed a main effect of ELS ( $p=.03$ ). Planned pair-wise comparisons in the HIV+ group indicated marginal differences between HIV+ High-ELS and HIV+ Low-ELS ( $p=.13$ ;  $r=.43$ ), where ELS status accounted for 18% of the variance in amygdala activation, with HIV+ High-ELS demonstrating lower activations than HIV+ Low-ELS. Among HIV+, lower amygdala response was significantly correlated with higher levels of depression ( $r=-.56$ ,  $p=.02$ ), alexithymia ( $r=-.69$ ,  $p<.01$ ), and social isolation ( $r=.64$ ,  $p=.01$ ).

**Conclusions:** These data indicate that for HIV+ individuals, high ELS exposure contributes to reduced amygdala responsivity, which is associated with higher levels of psychological impairment. This suggests that ELS-related changes in amygdala activity may contribute to increased rates of psychopathology in HIV+ cohorts.

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## THURSDAY AFTERNOON, JULY 11, 2013

### Invited Address:

#### Frontotemporal Dementias: Behaviour, Cognition, Phenotypes and Genotypes

Presenter: Julie Snowden

12:00–1:00 p.m.

**J. SNOWDEN. Frontotemporal Dementias: Behaviour, Cognition, Phenotypes and Genotypes.**

The frontotemporal dementias are clinically and pathologically heterogeneous. The predominant symptoms may be of problems in behavior, executive skills, language or conceptual knowledge. A proportion of patients show physical signs of amyotrophic lateral sclerosis. It is well recognized that patients' behavioural/cognitive profile reflects the anatomical distribution of degenerative change within the anterior hemispheres. There is, however, growing evidence that it is also influenced by the type of underlying pathology and by genetic mutations associated with frontotemporal dementia. The talk considers the neuropsychological variation within the frontotemporal dementias and examines its relationship to pathology and genetics. Systematic associations are demonstrated, which suggest that behavioural/cognitive profiles, taken together with other clinical features, are predictors of pathology and genetic status.

The talk shows the importance of neuropsychology in delineating the diversity of clinical phenotypes in frontotemporal dementia. It is argued that neuropsychology has a crucial role not only in clinical diagnosis and management of patients with frontotemporal dementia, but also in the theoretical understanding of disease mechanisms.

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### Symposium 5:

#### Mechanisms of Dysregulation of Thought and Emotion Within the Broad Autism Spectrum

Chair: Sophie van Rijn

Discussant: Hanna Swaab

12:00–1:30 p.m.

**H. SWAAB, H. SWAAB, S. VAN RIJN, P. BARNEVELD, M. BIERMAN & L. VAN EYLEN. Mechanisms of Dysregulation of Thought and Emotion Within the Broad Autism Spectrum.**

**Symposium Description:** Self-regulation is crucial for adaptation to the dynamic social environment humans live in. The aim of this sym-

posium is illustrating the importance of understanding mechanisms of self-regulation and self-regulation deficiencies in relation to risk for psychopathology. Self-regulation, i.e. the ability to select and initiate complex behaviors in response to the specific conditions of the social environment, depends critically on the regulation of thought and emotions, involving a variety of neurocognitive functions with a prominent role for executive functions. This symposium is focused on the dysregulation of thought and affect and the consequences on mental health. The presentation of Petra Barneveld will focus on executive dysfunctioning in the prediction of risk for severe mental health problems, i.e. psychosis, in individuals with autism spectrum disorder. Marit Bierman will discuss the role of executive functioning and language in predicting dysregulation of thought, i.e. thought disorder, in individuals at risk for autism because of a genetic disorder (Klinefelter syndrome). Sophie van Rijn will also focus on Klinefelter syndrome, and argue that this high risk population is not only characterized by dysregulation of thought, but also dysregulation of emotion. She will present data on emotion regulation deficiencies, as expressed in autonomic arousal and eyetracking of social scenes, in relation to autism symptoms. Lien van Eyleen will present on profiles of executive dysfunctioning in autism and another genetic condition associated with high risk for autism, i.e. Neurofibromatosis, illustrating that different cognitive profiles of self-regulation impairments may exist within the broad autism spectrum. This set of four presentations will stress the importance of a neurocognitive approach in understanding the regulation of thought and emotion and the impact of dysfunctional self-regulation on mental health in terms of autistic and psychotic symptoms.

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**S. VAN RIJN, M. BARENDSE, S. VAN GOOZEN & H. SWAAB. Social Attention, Arousal and Empathy in Men With XXY: Evidence From Eyetracking and Skin Conductance.**

**Objective:** Individuals with an extra X chromosome (Klinefelter syndrome) are at risk for problems in social functioning and have an increased vulnerability for autism traits. In the search for underlying mechanisms driving this increased risk, this study focused on social cognition and emotion regulation.

**Participants and Methods:** Seventeen adults with XXY and 20 non-clinical controls participated in this study. Eyetracking was used to investigate social attention, as expressed in visual scanning patterns in response to the viewing of empathy evoking video clips. Skin conductance levels, reflecting affective arousal, were recorded continuously during the clips as well. Participants' understanding of own and others' emotions in response to the clips was also assessed.

**Results:** Results showed reduced empathic understanding, decreased visual fixation to the eye region, but increased affective arousal in individuals with Klinefelter syndrome.



**Conclusions:** We conclude that individuals with XXY tend to avoid the eye region. However, this attentional deployment strategy may not be sufficient to successfully downregulate affective hyper-responsivity. As increased affective arousal was related to reduced empathic ability, we hypothesize that deficient emotion regulation plays an important role in difficulties in understanding the feelings and intentions of others. This knowledge may help in the identification of risk factors for psychopathology and targets for treatment.

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**P. BARNEVELD, L. DE SONNEVILLE, S. VAN RIJN, B. LAHUIS, H. VAN ENGELAND & H. SWAAB. Deficits in Executive Functioning in Adolescents With Autism Spectrum Disorder: Markers of Vulnerability to Develop Schizotypal Symptomatology?**

**Objective:** Some individuals with autism spectrum disorders (ASD) are at risk for schizophrenia spectrum disorders (SSD). Studies focusing on this risk, suggest that specific developmental abnormalities in childhood, such as dysregulation of affective state and primitive anxieties, may precede meeting the criteria for SSD later in life. Studies comparing symptoms of ASD and SSD as well as diagnostic criteria (DSM-IV) suggest resemblances in the clinical phenotype. It is considered crucial to identify developmental markers of vulnerability to SSD in adolescents with ASD to understand developmental mechanisms that might lead to severe psychopathology, to be able to identify highly vulnerable individuals early in life. This study examined whether or not specific deficits in EF correspond to dimensions of ASD and schizotypal symptoms and thus may serve as vulnerability markers for the development of SSD in adolescents with ASD diagnosed in childhood.

**Participants and Methods:** Symptoms of ASD and the risk for SSD symptoms were assessed in 29 high-functioning adolescents (10-13 years) with ASD, and compared with 40 typically developing adolescents. Cognitive control (response inhibition, mental flexibility, visuo-motor control, interference control, and perseveration) was evaluated for specific association with SSD symptoms.

**Results:** EF problems and substantial levels of SSD traits were found within the ASD population. The overlap of ASD and schizotypal symptoms was not limited to negative symptoms, but extended to disorganized and positive symptoms as well. Out of the EF domain, impaired response inhibition appeared to be exclusively associated with schizotypal traits, specifically with positive and disorganized symptoms.

**Conclusions:** Our findings suggest that impaired response inhibition is a vulnerability marker of risk for the development of SSD pathology in ASD already during adolescence.

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**L. VAN EYLEN, E. PLASSCHAERT, M. DESCHEEMAER, M. BORCHGRAEF, D. WILLEKENS, E. LEGIUS, I. NOENS & J. STEYAERT. Neurocognitive Profiling of Children With Neurofibromatosis Type 1 With and Without Co-occurring Autism Spectrum Disorder.**

**Objective:** Neurofibromatosis type 1 (NF1) is among the most common inherited human diseases. Besides physical manifestations, neurocognitive deficits are frequently reported in children with NF1. In general, an average IQ of about 90 and additional impairments in visuospatial skills, attention, and executive functioning (EF) are described. However, there is no consensus on the neurocognitive profile. In addition, recent studies found a high prevalence of autism spectrum disorder (ASD) in children with NF1. In this research project we assessed the neurocognitive abilities of children with NF1 with and without co-occurring ASD, children with ASD (without NF1), and typically developing (TD) children.

**Participants and Methods:** A task battery was developed measuring EF (inhibition, cognitive flexibility, planning, working memory, and generativity) as well as local and global visual processing. This battery was administered from 20 children with NF1 without ASD (NF1-ASD), 19 children with NF1 and ASD (NF1+ASD), 62 children with ASD, and 63 TD children, aged between 8 and 18 years.

**Results:** Preliminary analyses show that children with NF1+ASD have problems with inhibition, working memory, local and global visual processing, compared to TD children. Children with ASD perform worse

than TD children on tasks measuring cognitive flexibility, inhibition, and working memory, and they appear to have a more locally oriented processing style. However, children with ASD are better in inhibition and global processing compared to the NF1+ASD group. The data of the NF1-ASD group have not been analyzed yet.

**Conclusions:** Children with NF1+ASD, children with ASD, and TD children all have a different neurocognitive profile. This could be informative to clinical practice and provides directions for differential treatment of these disorders. However, the heterogenic manifestations of both NF1 and ASD have to be taken into account as well. The data of the NF1-ASD group will also be presented at the conference.

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**M. BIERMAN, S. VAN RIJN, E. DE BRUIN & S. HANNA. The Role of Language and Executive Functions in Dysregulation of Thought in Children and Adolescents With an Extra X Chromosome.**

**Objective:** Language and executive functions are considered to play a crucial role in the organization of thought, as illustrated by studies on psychotic disorders. Because deficits in language and executive functioning are typically seen in individuals with an extra X chromosome, this may drive an increased risk for thought disorder and related psychopathology. It is important to address this, as it may indicate risk for psychopathology in addition to risk for autism symptoms in individuals with an extra X chromosome. This study was aimed at assessing risk for thought disorder in children and adolescents with an extra X chromosome, and assessing the contribution of deficits in language and executive functions.

**Participants and Methods:** A group of 58 children and adolescents with an extra X chromosome participated (26 girls and 32 boys) and a group of 101 typically developing individuals (57 girls and 44 boys). Regulation of thought was measured using the Kiddie Formal Thought Disorder Story Game, based on speech samples. Language and executive functioning was measured using neurocognitive tests.

**Results:** The results showed more deficits in regulation of thought, as indicated by more perseverations/associations and a higher level of incoherence of speech in boys and girls with an extra X-chromosome. Furthermore, a relationship was found between thoughts disorder and language as well as between thought disorder and executive functioning specifically in the domains of inhibition, attention, and working memory.

**Conclusions:** Although speculative, deficits in language and executive functions may indicate a risk for thought disorder in individuals with an extra X chromosome. Unraveling the underlying cognitive mechanism might help to identify (cognitive) targets for clinical, possibly preventive, treatment especially in groups known to be at risk for severe psychopathology.

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**Symposium 6:  
Validation of the NIH Toolbox in Individuals with  
Neurological Impairments and Disabilities.**

**Chair: David S. Tulsky**

**Discussant: Erin Bigler**

**12:00–1:30 p.m.**

**D.S. TULSKY, E. BIGLER, R. GERSHON, S. MCCLINTOCK, D.S. TULSKY & A. HEINEMANN. Validation of the NIH Toolbox in Individuals with neurological impairments and disabilities.**

**Symposium Description:** The NIH Toolbox for Neurological and Behavioral Functioning provides rapid testing of cognition, emotion, motor, and sensory function. The Cognitive Domain contains tests of episodic memory, working memory, vocabulary, executive functioning, processing speed, and reading. The Toolbox includes a large normative sample representative of the US population from age 3–85. This symposium presents testing and validation in clinical populations.

The Toolbox was tested in a group of 119 individuals with Parkinson's disease along with criterion neuropsychological tests (Rey Auditory Verbal Learning Test; WAIS-IV Letter Number Sequencing, WAIS-III Processing Speed Index).

The Toolbox has been tested in people who have had traumatic injury. A sample of 52 individuals with medically confirmed traumatic brain injury (TBI) completed the working memory and processing speed tests from NIH Toolbox along with criterion measures. The Toolbox tests had high correlations coefficients with the tests measuring similar constructs (e.g., convergent validity) and correlations of a much lower magnitude with tests of verbal functioning (e.g., discriminant validity). When compared with a control sample of 52 participants that were matched on key demographic characteristics (age, race, gender), the individuals with TBI had significantly lower scores than matched controls. A multisite study is underway to validate the NIH Toolbox in individuals who have sustained a TBI (N=200), spinal cord injury (200), or stroke (200). In interim analyses, 213 individuals completed the Toolbox and neuropsychological tests. Data support the Toolbox's convergent and discriminant validity.

These participants completed measures of functioning in real life including participation, impact of environmental factors, and motor, sensory, and emotion from the NIH Toolbox. The final presentation will discuss the relevance of the Toolbox cognition findings in relation to measures of functioning in the larger context.

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#### **R. GERSHON, M.V. WAGSTER, D. CELLA, C.J. NOWINSKI & S. WEINTRAUB. Development and Norming of the NIH Toolbox for Neurological and Behavioral Functioning.**

**Objective:** As part of the NIH Blueprint for Neuroscience Research, a large initiative was funded to develop the NIH Toolbox for Assessment of Neurological and Behavioral Function. The NIH Toolbox provides short (30 minute) assessments of cognition, sensory, motor, and emotional functioning. The NIH Toolbox was developed with English and Spanish language versions and has been fully normed for use in individuals ages 3 – 85. Over 250 scientists and staff from more than 100 institutions participated in the development and testing phases. To determine the measurement characteristics and to select the instruments to be used or developed, a rigorous process was undertaken: several surveys and requests for information were obtained through the field; 1,391 potential instruments were identified through a literature review; 9 domain teams were formed with leading scientists to select and/or develop tests; a scientific advisory board was appointed to guide the process. Sixty-one measures were selected/developed across the domains and validated against 54 criteria measures. Over 20,000 participants provided data (in various pilot, validation, and norming samples). Of these, 468 individuals, identified by marketing research firms drawn from the general population, made up the validation sample for the cognition tests. Similarly, 4,705 subjects (both English and Spanish speaking, ages 3-85, made up the normative sample. The sample methodology for norming employed a stratified random sampling at 10 geographically diverse market research firms with sampling of individuals from the general population. Examiners were trained and certified to administer the proposed NIH Toolbox test batteries. The final Toolbox yielded 30 core standardized tests with normative data corrected for age, education level, ethnicity/race, and gender as well as 34 standardized supplemental instruments. Future research should focus on validation of the NIH Toolbox in patient populations.

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#### **S.M. MCCLINTOCK, M. CULLUM, I. BERNSTEIN, E. ARSLANGIC, L. LACRITZ, R. DEWEY & M.M. HUSAIN. The Feasibility of the NIH Toolbox Cognitive Battery in Patients with Parkinson's Disease.**

**Objective:** Parkinson's disease (PD) is a common neurodegenerative disorder that can adversely affect neurocognitive function. Thus, there is a critical need for precise measurement (i.e., measurement based care) of cognitive abilities in order to assess for stability or change across time.

The National Institutes of Health (NIH) recently developed the Toolbox, a new behavioral and neurological battery of tests that assess cognitive, sensory, motor, and emotion functions. The purpose of this study was to assess the feasibility of the NIH Toolbox cognitive measures in patients with PD.

**Participants and Methods:** We enrolled 124 participants who were diagnosed with PD based on standard neurologic criteria from an academic medical center. At two testing time points separated by 3-months, participants completed the NIH Toolbox cognitive battery, which includes computerized neurocognitive tests of processing speed, attention, language, memory, and executive function. Also, they completed a standard neuropsychological battery. Pearson correlation coefficients and paired t-tests were used to examine psychometric properties of the NIH Toolbox cognitive measures.

**Results:** The sample had a mean age of 65.0 (SD=9.8) and estimated IQ of 106.6 (SD=9.4), 72% were male and 90% were Caucasian. The mean UPDRS score was 15.1 (SD=8.7). The test-retest reliability coefficients were moderate ( $r=.65$ ) for the List Sorting test, and high for the Vocabulary ( $r=.76$ ), Pattern Comparison ( $r=.81$ ) and Flanker ( $r=.77$ ) tests. While there was modest improvement on the measures, there were no significant practice effects (p-value range: 0.65-0.81) from baseline to the 3-month testing time point.

**Conclusions:** The NIH Toolbox cognitive measures were feasible to administer to participants with PD. Overall, the cognitive measures demonstrated temporal stability across two testing time points, and practice effects were negligible. This suggests that performance may not be artificially inflated at follow-up testing sessions.

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#### **D.S. TULSKY, N. CARLOZZI, C. BAUM, S.L. JERSEK & A.W. HEINEMANN. Validation of the NIH Toolbox for Neurological and Behavioral Functioning in Individuals with Traumatic Injury.**

**Objective:** Report validation evidence for the NIH Toolbox cognition tests in individuals with traumatic injury.

**Participants and Methods:** Study 1, 52 individuals with traumatic brain injury (TBI) completed the List Sorting Working Memory Task and the Pattern Comparison Processing Speed Task from NIH Toolbox (NIHTB), along with the Letter Number Sequencing (LNS), Paced Auditory Serial Addition Test (PASAT), WAIS-IV Processing Speed Index (PSI), and the WAIS-IV Verbal Comprehension Index. An age, race and gender matched control of 52 participants were obtained from the Toolbox cognitive validation sample.

Study 2, the NIHTB was administered to individuals TBI (N=200), spinal cord injury (N=200), and stroke (N=200). In an interim analyses, 213 individuals completed the NIH Toolbox WAIS-IV Processing Speed Index (PSI), Letter Number Sequence (LNS) and the Peabody Picture Vocabulary Test (PPVT).

**Results:** Study 1, the NIHTB tasks demonstrated strong correlations with tests measuring similar constructs (convergent validity) and correlations of a much lower magnitude with tests of verbal functioning (discriminant validity). Independent samples t tests indicated that individuals with TBI had significantly lower scores than matched controls for both the Pattern Comparison,  $t(102)=-9.79$ ,  $p<.0001$ , and List Sorting Task,  $t(101.95)=-2.08$ ,  $p=.04$ .

Study 2, Moderate correlations existed between List Sorting and LNS ( $r=.54$ ) and lower correlations between List Sorting and PPVT ( $r=.37$ ). Similarly, there were moderate correlations between Pattern Comparison and PSI ( $r=.54$ ) and much lower correlations between Pattern Comparison and PPVT ( $r=.25$ ).

**Conclusions:** These studies demonstrate the convergent and discriminant validity of the NIHTB in individuals with disabilities. Funding was provided by National Institute on Disability and Rehabilitation Research through the Rehabilitation Research and Training Center on Improving Measurement of Medical Rehabilitation Outcomes (H133B090024) and a Field Initiated Grant (H133C070138).

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**A.W. HEINEMANN, D.S. TULSKY, N.E. CARLOZZI & S. JEROSEK. Relationships between the NIH Toolbox and Participation in Persons Living with Stroke, Traumatic Brain Injury and Spinal Cord Injury in the Community.**

**Objective:** Describe relationships between the NIH Toolbox cognitive and emotional domain measures and subjective cognitive functioning with indicators of community participation in a sample with neurologic impairments.

**Participants and Methods:** We administered the NIH Toolbox to 213 community-resident individuals with traumatic brain injury, spinal cord injury, and stroke. Tests included the Dimensional Change Card Sorting (DCCS), Flanker, List Sorting, and Pattern Comprehension test from the Toolbox Cognition domain; the Rey Auditory Verbal Learning Test (RAVLT); and Life Satisfaction, Positive Affect, Social Support, Social Distress, and Companionship measures from the Toolbox Emotional domain. Subjects also completed the Executive Functioning, General Concerns, and Ability to Participate measures from the Neuro-QOL instruments, and Control of Participation and Involvement in Life Situations from the Community Participation Indicators (CPI).

**Results:** DCCS, Flanker, List Sort, Pattern Comprehension and RAVLT correlated positively with the Neuro-QOL measure of Ability to Participate. Flanker and RAVLT correlated positively with Neuro-QOL measures of Executive Function and General Concerns, and with the measures of Control of Participation, Involvement in Life Situations, and the Neuro-QOL Ability to Participate measure. Neuro-QOL Executive Function correlated positively with the CPI Control, Involvement, and Neuro-QOL Ability to Participate measures.

**Conclusions:** The NIH Toolbox variables are related positively to measures of everyday cognitive functioning and participation in community activities as perceived by individuals with neurologic impairments. In particular, the NIH Toolbox cognition measures demonstrate ecological validity and cognitive limitations are an important influence on participation.

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**Paper Session 3:  
Dementia**

**2:00–4:00 p.m.**

**B. SCHMAND, A. RIENSTRA, H. TAMMINGA, E. RICHARD, W.A. VAN GOOL, M.W. CAAN & C.B. MAJOIE. Responsiveness of Magnetic Resonance Imaging and Neuropsychological Assessment in Memory Clinic Patients.**

**Objective:** Scales of global cognition and behavior, gold standards and endpoints for intervention trials in mild cognitive impairment (MCI) and Alzheimer's disease (AD), are insufficiently responsive (i.e. rather insensitive to change). Many patients are needed to detect beneficial drug effects. Therefore, MRI measures of cerebral atrophy have been proposed as surrogate endpoints. We examined how proper neuropsychological assessment (NPA) compares to MRI in this respect.

**Participants and Methods:** We measured hippocampal atrophy and performance on five neuropsychological tests in 64 memory clinic patients at baseline and after two years. 3-Tesla MRI scans were made and analyzed automatically with Freesurfer. Rey's Auditory Verbal Learning Test, Rivermead Behavioural Memory Test subtest prose recall, phonemic fluency, Trailmaking, and Stroop color-word test were administered. Neurologists who were blind to MRI and NPA results rated the patients at follow-up as cognitively normal (n=29) or as declining (n=35).

**Results:** A composite NPA score deteriorated 0.8 SD in the declining group, and was unchanged in the normal group. Atrophy rates were 1.4% and 3.0% per year in the normal and declining group, respectively, which corresponds to 0.2 and 0.6 SD. Sample size estimates for a hypothetical two-arm medication trial were about six times larger for hippocampal atrophy than for NPA.

**Conclusions:** Neuropsychological assessment is more responsive than hippocampal atrophy for detecting disease progression in MCI and AD, and for detecting beneficial intervention effects in trials.

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**S. SAVAGE, O. PIGUET & J.R. HODGES. Word Retraining in Semantic Dementia: Can Trained Words Generalise to Other Contexts?**

**Objective:** Recent studies have shown that patients with Semantic Dementia (SD) can improve their naming skills through training, although it remains unclear how well this extends beyond picture naming to other uses of these words.

**Participants and Methods:** Five SD patients, ranging from mild to severe, were assessed on the production and comprehension of target words prior to, and immediately following, a 2-month word training program. Training involved a daily repetitive practice of word-picture pairs of household items, completed at the patient's home using an online computer program. Assessment tasks included picture naming, category fluency, spoken word-picture-matching, video description and responses to verbal requests. Both trained and untrained items were tested.

**Results:** All participants showed clear gains in naming the pictures which had been trained ( $p < .001$ ). Importantly, post-training improvements were also observed on other measures, with four out of the five patients showing significant increases for target items on the video description task. Severe SD patients also improved when matching trained words to pictures; milder patients demonstrated improved verbal comprehension of words even when tested without any picture cues. Improvements were not found, however, in generating words under time pressure (category fluency), most likely due to the additional cognitive demands required. Over the same period, no significant changes occurred for untrained items on any of the measures.

**Conclusions:** A simple naming intervention was successful in improving both the production and comprehension of trained words in SD patients. Patients with milder disease showed greater ability to transfer therapy gains into other contexts. For SD patients with severe impairments, application of word knowledge to other tasks still occurred, but was reduced.

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**E. RICHARD, B. SCHMAND, P. EIKELBOOM & W.A. VAN GOOL. MRI and Cerebrospinal Fluid Biomarkers Do Not Improve Accuracy of Diagnosis of Alzheimer Disease Following a Brief Memory Test.**

**Objective:** From a pragmatic clinical perspective it is important to complete diagnostic evaluations in an optimally informative order. We assessed whether MRI and CSF analysis have incremental value for diagnosing Alzheimer's disease (AD) after Rey's Auditory Verbal Learning Test (RAVLT) has been administered.

**Participants and Methods:** We analyzed data of participants of the Alzheimer's Disease Neuroimaging Initiative who had neuropsychological assessment, MRI, and CSF analysis: 92 patients with AD, 181 with mild cognitive impairment (MCI), and 106 healthy controls. Mean follow-up of MCI patients was 33 months (range 5.5-55) and of controls 38 months (range 6.0-52.5). Diagnostic accuracies of RAVLT (immediate recall), MRI (entorhinal cortex volume), and CSF (p-tau / amyloid beta ratio) were calculated, and incremental value of MRI and CSF after administration of RAVLT was expressed as the Net Reclassification Improvement (NRI). This is the change in percentage of individuals correctly diagnosed as Alzheimer or non-Alzheimer case.

**Results:** Tested in isolation RAVLT, MRI and CSF all substantially contributed to the correct classification of AD patients and controls, and to the differentiation of MCI patients who remained stable during follow-up from those who progressed to dementia.

RAVLT, MRI and CSF improved diagnostic classifications by 33% (95% CI: 28-37), 30% (95% CI: 26-35), and 25% (95% CI: 21-29), respectively. After administration of the memory test however, NRI of MRI was -2% (95% CI: -5 to -1), and NRI of CSF was -7% (95% CI: -10 to -5). Similar results were found for the distinction between stable MCI and converters.

**Conclusions:** MRI or CSF do not substantially improve diagnostic accuracy for Alzheimer's disease after administration of a less invasive and less expensive test of memory.

Net Reclassification Improvement is an intuitive and easy to interpret measure for evaluation of the potential added value of new diagnostic instruments in daily clinical practice.

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**M. BROEDERS, B. SCHMAND, R.M. DE BIE, D.C. VELSEBOER, J.D. SPEELMAN, D. MUSLIMOVIC & G. GEURTSEN. The Evolution Of Mild Cognitive Impairment In Parkinson Disease.**

**Objective:** Mild cognitive impairment (MCI) was originally used to describe prodromal Alzheimer's disease, but it is now also a key issue in studies on Parkinson's disease (PD). Recently, an MDS taskforce proposed consensus criteria for MCI in PD (PD-MCI). We examined the development of PD-MCI defined by these criteria, and we assessed the inter-rater and intra-rater reliability of the criteria.

**Participants and Methods:** We followed a hospital-based cohort of newly-diagnosed PD patients over five years. The patients underwent extensive neuropsychological testing at baseline (N=123), three-year follow-up (N=93), and five-year follow-up (N=59). Clinical status was examined yearly. The PD-MCI diagnosis was based on neuropsychological testing according to the new consensus criteria, while the PDD diagnosis could be made solely based on clinical data.

**Results:** At baseline, 35% of the patients had PD-MCI. Three years later, 51% of the 93 patients that participated in the neuropsychological follow-up had PD-MCI and 5% of patients fulfilled criteria for PD dementia (PDD) 2. After five years, 48% of the 59 patients who participated in the neuropsychological follow-up had PD-MCI and 5% had PDD. Of 122 patients who participated in at least one clinical follow-up, 16% became demented within 5 years after diagnosis. With few exceptions, all PDD patients had PD-MCI at a previous assessment. The inter-rater reliability ( $\kappa$ ) was 0.91 and the intra-rater reliability coefficients were 0.85 and 0.96.

**Conclusions:** At baseline, a third of newly-diagnosed PD patients fulfilled the PD-MCI criteria, while three and five years later, the proportion increased to approximately 50%. The new consensus criteria prove to be easily applicable with good to excellent reliability. Due to selection bias, the true proportion of patients with PD-MCI may actually be higher.

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**J. M. J. VONK, R. JONKERS & L.K. OBLER. Semantic Decline in Alzheimer's Disease: The Effects of Semantic Sub-categories, Word Class, and Abstractness.**

**Objective:** The progressive decline in communicative success in Alzheimer's Disease (AD) arises primarily at the semantic level, however the specific lexical factors that contribute to this decline have not been specified. One set of inconsistent results focuses on nouns and verbs; ignoring the semantic subcategories of these word classes may have led to the contradictory results.

**Participants and Methods:** We have studied the influence of semantic features and imageability in word processing by testing 12 categories of concrete and abstract nouns and verbs in patients with AD. With the Embodied Cognition Framework (ECF) as a model for our hypotheses, we predicted that semantic subcategories linked to brain regions known to be vulnerable to AD would be more affected than subcategories with semantic features represented outside of affected regions. We tested thirteen native Dutch speakers clinically diagnosed with mild AD and sixteen healthy controls on accuracy and reaction times via a semantic similarity judgment task.

**Results:** The AD group responded slower on animals than furniture ( $p = .014$ ), consistent with previous studies that propose that the networks subserving the category animals crucially include the posterior superior temporal sulcus. Also, the AD group is less accurate on hitting verbs than cutting verbs ( $p = .031$ ), in accordance with the proposal that the posterolateral temporal cortex and intraparietal sulcus/inferior parietal lobule are involved in the processing of hitting verbs. The role of imageability is shown: for all participants the more imageable abstract words are, the more accurately and more quickly they are processed ( $p < .001$ ).

**Conclusions:** The results support the ECF in that there is an anatomical-behavioral correlation between language deficits in AD and the regions most vulnerable to the disease. These findings map out the language problems in dementia more precisely and should guide the development of diagnostic and therapeutic materials for individuals with AD and their caregivers.

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**ÖZGÜL. UYSAL-BOZKIR, M. GOUDSMIT, J. PARLEVLIE, J. VAN CAMPEN, S. DE ROOIJ & B. SCHMAND. The Cross-cultural Dementia Screening (CCD): A New Dementia Screening Battery for Non-Western Migrant Elders.**

**Objective:** Almost one out of 17 European citizens are born outside an EU country. In the next decades, this migrant population will grow older and the incidence of dementia will increase. Diagnosis of dementia in elderly migrants can be challenging because of a language barrier. Also, their education is limited and illiteracy is not uncommon, which makes cognitive testing hard. When conventional instruments are used without alterations, results are hard to interpret. Even specially designed cross-cultural instruments rely on the use of an interpreter to administer the test.

We developed a new neuropsychological dementia screening test, the Cross-cultural dementia screening test (CCD), to overcome these barriers. The CCD is a dementia screening battery and consists of 4 newly designed subtests measuring concentration, memory, mental speed and executive functioning. The test is appropriate for illiterates, with culturally fair items. The most important feature is that the test can be administered in the language of the patient by using a set of computerized standard instructions in different languages.

**Participants and Methods:** Normative data of the CCD are presented based on 1500 healthy participants (55 years and older) from Turkish, Moroccan, Surinam and Dutch cultural backgrounds. They were recruited via General Practices in the 4 big cities in the Netherlands in the SYMBOL-study. Validation data are based on this group plus 50 demented patients recruited via Memory Clinics. Dementia diagnosis was made according to the international criteria by a specialist.

**Results:** Sensitivity and specificity (ROC) analysis per subtest and regarding the CCD as a whole were completed. The CCD was useful in discriminating cognitively healthy and demented subjects in this sample. Also, the CCD is applicable across cultures/ languages (MANCOVA analysis).

**Conclusions:** The CCD is a useful new dementia screening battery for low educated, illiterate migrant elders.

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**M. EL HAJ, C. MORONI, S. SAMSON, L. FASOTTI & P. ALLAIN. Prospective and retrospective time perception in Alzheimer's disease.**

**Objective:** Prospective and retrospective time perception are concerned with contrasting elements of time. The former concerns forthcoming time whereas the latter addresses elapsed time. An abundant literature suggests that prospective time perception is deteriorated in Alzheimer's Disease. However, little is known about retrospective time perception in these patients. The current work is aimed at filling this gap in the literature.

**Participants and Methods:** Seventeen Alzheimer's Disease patients (10 women and 5 men; M age = 73.33 years, SD = 6.80; M years of formal education = 8.11, SD = 2.87; M Mini-Mental State Examination = 22.82, SD = 1.55), and twenty older adults (10 women and 6 men; M age = 70.01 years, SD = 6.91; M years of formal education = 9.74, SD = 2.88; M Mini-Mental State Examination = 28.09, SD = 0.87) voluntarily participated in the study. In a retrospective time perception experiment, in which participants were not aware of the real purpose of the task, a text about mushroom picking was read aloud by participants over the course of 2 minutes. Subsequently, participants were asked "How many seconds did the task last?". In a prospective time perception task, they read a series of numbers aloud, once again over the course of 2 minutes and were explicitly instructed that they would be required to estimate the duration of reading.

**Results:** Analyses revealed that retrospective timing is generally underestimated relative to prospective timing in Alzheimer patients, and that both timings are underestimated when compared with the actual interval time. Alzheimer's Disease patients showed a greater underestimation of time than older adults but both populations showed the same reduction in retrospective time evaluation.

**Conclusions:** Alzheimer's Disease patients seem to perceive time as passing more quickly than older adults.

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#### Paper Session 4: Traumatic Brain Injury

2:00–4:00 p.m.

**A. HILES, H. WILLIAMS, J. COSGROVE, A. LAVRIC, N. LAWRENCE, D. SHARP, J. FULFORD, A. ZEMAN, A. HARRIS & A. REUBEN. Investigating the Neurocognitive and Neuroimaging Correlates of Multiple Mild Traumatic Brain Injuries in Professional Athletes: a Magnetic Resonance Imaging Study.**

**Objective:** Repeated sports mTBI has been linked to dementia. It is likely that mTBI leads to changes in sub-cortical structures. We aimed to examine the relationship between history of mTBI, neuropsychological performance and the volume of sub-cortical brain systems.

**Participants and Methods:** Magnetic Resonance Imaging (MRI) was used to obtain subcortical brain volumes. Also, a range of computerised and pencil-and-paper cognitive measures were administered to assess functioning in eighteen professional rugby players.

**Results:** Those with four or more mTBI's (4+) scored worse on the Sport Concussion Assessment Tool 2 (SCAT2) and delayed recall. Significant associations were found between neuropsychological performance and subcortical volumes. SCAT2 total scores being significantly correlated with amygdala and pallidum volumes; processing speed with amygdala and putamen volumes; and attention and working memory with amygdala, hippocampus, putamen and caudate volumes.

**Conclusions:** Variation in neuro-cognitive performance may be linked to differences in sub-cortical brain structures. Although clear associations to changes in structures due to mTBI were not apparent, ongoing monitoring of concussed players with cortical volume imaging may be important for player safety.

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**S. MCDONALD, M. DETHIER, S. BLAIRY & H. ROSENBERG. Does traumatic brain injury selectively impair the production of emotional expressions?**

**Objective:** It is well known that many people with traumatic brain injury (TBI) have difficulties recognizing emotions in others and that, for many, this is most difficult when recognizing negative emotions. This raises the question as to whether there is a systemic difficulty with emotions that may extend to the expression of emotions. In this study we aimed to determine whether people with severe TBI have difficulty with either spontaneously or deliberately displaying emotions.

**Participants and Methods:** 23 adults (18 males: mean age = 46.3 years, SD = 13.1) with severe TBI (mean post-traumatic amnesia = 81.3 days, SD = 55; mean time since trauma = 12.7 years, SD = 8.5) and 27 matched control participants (16 males: mean age = 42.2 years, SD = 14.1) were asked to describe three personal events of a sad, happy and angry nature respectively. They were also asked to pose happy, sad and angry expressions in response to a photo and a word. Judges blinded to the group or the objectives of the study rated the intensity of their expressions from a video recording.

**Results:** Participants with a TBI had less intense sad spontaneous expressions than controls when recounting a sad story. They were also less able to pose a sad expression. Their performance when posing an angry expression was marginally poorer than controls. Performance on happy expressions (spontaneous and posed) did not differ between groups.

**Conclusions:** These findings suggest that there are a number of levels of impairment in emotion processing following TBI and that this extends to the expression of negative, especially sad emotions.

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**T. HART, A. KOZLOWSKI, J. WHYTE, A. NORDENBO, I. POULSEN, K. KRISTENSEN & A. HEINEMANN. Trajectory of Acute Recovery in Traumatic Brain Injury: Relationship to Patient Characteristics, Injury Severity, and Inpatient Rehabilitation.**

**Objective:** As part of a quasi-experimental study comparing traumatic brain injury (TBI) outcomes in specialized programs in the US and Denmark (DK) which differ in inpatient rehabilitation length of stay (LOS), we examined the relationship of patient characteristics, injury severity, and amount of treatment received to the trajectory of recovery during inpatient rehabilitation.

**Participants and Methods:** 202 patients with moderate/ severe TBI were enrolled on admission to inpatient rehabilitation in the 2 sites an average of 3 wk post injury. US patients spent a median 29 days in treatment, DK patients a median of 73 days. Demographics, premorbid characteristics, and injury severity (= length of coma, LOC) were measured during acute care and inpatient rehabilitation. Treatment was measured daily in 15-minute units administered to the patient (P) and family (F). Dependent measures used in Individual Growth Curve (IGC) analyses were Motor and Cognitive FIM scores on admission and discharge, and every 2 wk during rehabilitation.

**Results:** The best fitting IGC models were curvilinear with linear, quadratic and cubic parameters. Random effects were allowed on the intercept and first rate parameter, but only fixed effects were allowed on quadratic and cubic parameters. Motor and Cognitive FIM trajectories showed slightly different covariate effects. Overall, rate of recovery was negatively affected by age, LOC, and interruptions to treatment. Total amount of P and F treatment was inversely related to recovery, suggesting that more severely impaired patients received more treatment and had slower recovery.

**Conclusions:** Acute TBI recovery trajectory is negatively affected by age, severity of injury, and complications that interrupt rehabilitation. Analysis of treatment effects on recovery is confounded by the provision of more patient and family treatment to those with more severe injuries and/ or less favorable recoveries.

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**J. DENBOER & E. ROSARIO. Utilizing Serial Neuropsychological Assessment to Evaluate Recovery from Traumatic Brain Injury: Acute to 2 Years Post-Injury.**

**Objective:** The purpose of this study was to evaluate the effectiveness of utilizing serial neuropsychological evaluations to help assess and inform patient's recovery from TBI.

It was hypothesized that the inclusion of neuropsychological evaluation at important time points in the patient's recovery (i.e., 10 days post-injury, 1 month, 3 months, 6 months, 1 year, and 2 years post-injury) would greatly aid clinical-decision making (particularly in the area of prognosis).

**Participants and Methods:** Participants were 264 patients with diagnosed TBI.

Patients were administered a fixed battery of standard neuropsychological test measures at the following uniform time points: 10 days post-injury, 1 month, 3 months, 6 months, 1 year, and 2 years post-injury. Recovery from TBI was measured using reliable change index (RCI) analysis.

Neuropsychological evaluation results were combined with neuroimaging results at multiple time points, whenever available.

**Results:** Researchers found that the use of neuropsychological assessment measures at important time points in TBI recovery greatly aided diagnostic decision making. Neuropsychological evaluation was a significant and positive factor in guiding treatment interventions (e.g., speech therapy). Although a positive neuropsychological trajectory was found throughout the 2 year period for the majority of patients, the most significant clinical change was found to be between 10 days and 1 month and 1 month and 3 months.

**Conclusions:** The results of this study provide the first comprehensive depiction of assessment of longitudinal TBI recovery utilizing serial neuropsychological evaluation. Results underscore the utility of neuropsychological assessment during TBI recovery and emphasize the need for earlier neuropsychological intervention during recovery from TBI.

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**D.E. TUCK & C.E. SKILBECK. Prognostic Evidence for Serum S100B as a Biomarker for Neuropsychological Outcomes after TBI.**

**Objective:** Empirically, depth of coma and duration of post traumatic amnesia offer insufficient prognostic accuracy for neuropsychological outcomes following TBI. Recently, serum S100B has been proposed in the associated literature as a potential prognostic biomarker for outcome following TBI. Unfortunately, most of the studies investigating this blood test have utilised crude outcome measures or mortality as the dependent variable in research design. This study aimed to investigate the relationship between S100B levels and existing TBI diagnostic measures and to quantify its ability to predict future cognitive impairment, post-concussion syndrome symptomatology, and quality of life.

**Participants and Methods:** 142 participants who presented to the Royal Hobart Hospital following a TBI were recruited for this study. On presentation, blood serum samples were collected, freeze-stored, and then batch analysed for acute S100B levels. Participants completed a neuropsychological cognitive battery two months post injury, and then completed the British Columbia Post-Concussion Inventory and the Quality of Life Inventory six months post injury.

**Results:** S100B levels were significantly correlated with participants' depth of coma and duration of post traumatic amnesia, and regression analyses showed that duration of post traumatic amnesia can be predicted accurately by using S100B and depth of coma alone. S100B levels accounted for a significant proportion of variance in symptoms of post-concussion syndrome and poorer quality of life. However, S100B was not shown to account for a significantly unique proportion of variance in cognitive impairment.

**Conclusions:** Impressively, serum S100B levels can predict duration of post traumatic amnesia, and offer the best accuracy for predicting the severity of a number of symptoms of post-concussion syndrome. Unfortunately however, the ability to accurately predict patients' future cognitive impairment based on a simple blood test while in an acute setting remains elusive - if not illusive.

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**T. SILBERG, O. BAR, S. GEORGE, J. LANDA & A. BREZNER. "Pure PTA": Differentiating disorientation from amnesia during the sub-acute phase of recovery from pediatric TBI.**

**Objective:** Post Traumatic Amnesia (PTA) is the period following brain injury in which patients are disoriented and impaired in their ability to acquire new information. PTA is an indicator for the severity of injury, predicting behavioral and cognitive outcomes. The two processes, disorientation (post traumatic confusion, PTC) and the ability to acquire new information (PTA), do not always resolve at the same time. The difference between the two might represent a more sensitive measure of learning and memory impairments and is suggested here to be a measure of "Pure PTA". The current study aimed to address the possible significance of "Pure PTA" among children with severe TBI in relation to their cognitive profile during the sub-acute phase of recovery.

**Participants and Methods:** Sixty children, age 5-18 y (M= 11.8y; SD=0.45), admitted for rehabilitation following severe TBI (LOC > 6 Hrs; PTA > 7 days) between the years 2004-2012.

The Child's Orientation and Amnesia Test (COAT) was used for the evaluation of PTC. PTA duration was assessed using the "Three words test". Cognitive functions were evaluated using: (1) the "Test of Everyday Attention for children (TEA-Ch)"; (2) the "Behavioral Assessment of the Dysexecutive syndrome for Children (BADS-C)", and (3) the "Rivermead Behavioral Memory Test (RBMT)".

**Results:** Children's performance was significantly lower than that of the general population, on all cognitive tasks. In about 35% of the children PTC and PTA did not resolve in a parallel time frame and the interval between PTC and PTA was 5-17 days. These children had significant lower profiles on all cognitive abilities examined.

**Conclusions:** Our results support Stuss et al (1999) suggestion regarding two different recovery pathways in PTA, one for PTC and the other for the acquisition of new information. Furthermore, the time interval between the recovery of PTC and PTA ("Pure PTA") is suggested to be a more sensitive marker for the severity of injury in pediatric TBI, with implications for intervention and prognosis.

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**M. SCHÖNBERGER, M. HERRBERG & J. PONSFORD. Fatigue as a cause, not a consequence of depression and daytime sleepiness: A cross-lagged analysis.**

**Objective:** Fatigue is a frequent and disabling consequence of traumatic brain injury (TBI). However, it is unclear whether fatigue is a primary consequence of the organic brain injury, or a secondary consequence of injury-related sequelae, such as depression and daytime sleepiness. The current study aimed at examining the temporal relationship between fatigue, depression and daytime sleepiness after traumatic brain injury.

**Participants and Methods:** Eighty-eight adults with complicated mild-severe TBI (69 % male) were examined with the Fatigue Severity Scale, the depression subscale of the Hospital Anxiety and Depression Scale, and the Epworth Sleepiness scale at baseline and six months follow-up.

**Results:** A cross-lagged path analysis computed within a structural equation modeling framework revealed that fatigue was predictive of depression ( $b=.20, p<.05$ ) and sleepiness ( $b=.25, p<.05$ ). However, depression and sleepiness did not predict fatigue ( $p>.05$ ).

**Conclusions:** The results support the view of fatigue after TBI as "primary fatigue" - that is, a consequence of the organic brain injury, rather than "secondary fatigue" - that is, fatigue caused by depression or daytime sleepiness. Important therapeutic implications are discussed in the paper.

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**Paper Session 5:  
Miscellaneous**

**2:00–4:00 p.m.**

**S. BAKER, H. WILLIAMS, A. GARDNER, D. SHARP, A. ZEMAN, A. HARRIS, J. FULFORD, A. REUBEN & W. MUKONOWESHURO. Mild traumatic brain injuries associated with and diffusion tensor imaging findings in rugby players.**

**Objective:** Diffusion tensor imaging (DTI) has been utilised as a method for identifying white matter structural abnormalities caused by mild traumatic brain injury (mTBI). DTI abnormalities have been correlated with cognitive impairments. In this study we collected data from detailed injury records in elite contact sportsmen, and undertook neurocognitive testing and DTI. We aimed to identify changes in brain systems and cognition linked to concussion history.

**Participants and Methods:** Nineteen elite rugby players were tested pre-season on a neurocognitive battery and computerised assessment of attention, memory, problem solving and executive control. Data was collected on history of mTBI (<3 or >4) and severity (loss of consciousness). Participants underwent DTI scanning, collecting functional anisotropy (FA) measures of structural integrity.

**Results:** There was a significant relationship between severity of mTBI history, and DTI FA in the right inferior longitudinal fasciculus (ILF) and right cingulum hippocampus (H). Analysis found the ILF and H only weakly correlated with one cognitive measure in the neuropsychological battery and none in the computerised assessment.

**Conclusions:** A link between DTI FA and mTBI history in the ILF and H may support the notion that mTBI has a role in impacting on inhibition networks. Future research would benefit from longitudinal analysis and inclusion of more subtle neuropsychological assessments. Use of DTI as a means of monitoring change in cumulative mTBI is supported.

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**M. OLAITHE, P.R. EASTWOOD, T.C. SKINNER, D. HILLMAN & R.S. BUCKS. Cognitive Dysfunction in Obstructive Sleep Apnoea; Mechanisms of Harm.**

**Objective:** Obstructive Sleep Apnoea (OSA) is a common sleep disorder diagnosed in ≈28% of the population, with increasing risk in older adults and for males. OSA is characterized by repeated upper airway collapse, resulting in chronic, intermittent hypoxia and sleep fragmentation. Meta-analysis reveals that OSA causes cognitive difficulties in attention, memory and executive function (EF). Beebe and Gozal (2002) have proposed that sleep fragmentation and hypoxia combine to lead to cognitive dysfunction. This study tested this hypothesis.

**Participants and Methods:** Participants (N = 157) were recruited from the general public and from Sir Charles Gairdner Hospital, Perth. All participants underwent a full, diagnostic, polysomnography and completed cognitive assessment of attention, short-term & long-term memory and EF. One factor congeneric models were built to examine individual latent constructs of hypoxia, sleep fragmentation, executive function, attention, short term and long term memory. Finally a theoretically driven model was constructed to examine the relationships between hypoxia and sleep fragmentation, and cognitive function

**Results:** Final model fit was good,  $\chi^2(104) = 113.9$ , CFI = .84. After controlling for both IQ and daytime sleepiness, significant relationships were found between oxygen desaturation and sleep fragmentation to attention ( $p = .04$ ,  $p = .02$ , respectively) and executive function ( $p = .05$ ,  $p = .02$  respectively). No significant predictors of memory function were found.

**Conclusions:** These results confirm that more severe OSA is significantly associated with poorer attention and executive function. However, this paper provides only partial support for Beebe and Gozal's model. Whilst attention and executive deficits were related to fragmentation and hypoxia, LT and ST memory deficits were not. Memory dysfunction in OSA may be a product of low mood and/or daytime sleepiness.

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**M. HUIJTS, A. DUIJS, R.J. VAN OOSTENBRUGGE, A.A. KROON, P.W. DE LEEUW & J. STAALS. The Total Burden Of Brain MRI Markers Of Small Vessel Disease Is Associated With Cognitive Function In Patients With Cerebral Small Vessel Disease.**

**Objective:** White matter lesions (WMLs), asymptomatic lacunar infarcts, brain microbleeds (BMBs) and enlarged perivascular spaces (EPVS) have been identified as silent lesions due to cerebral small vessel disease (cSVD). All these markers have been individually linked to cognitive functioning, but are also strongly correlated with each other. The combined effect of these markers on cognitive function has never been studied and would possibly provide more useful information on the effect on cognitive function. The aim of this study therefore was to investigate whether a higher total burden of cSVD was associated with a decreased performance in cognitive function.

**Participants and Methods:** We included 189 patients with a high prevalence of cSVD (112 hypertensive patients and 77 first-ever lacunar stroke patients). Patients underwent brain MRI and extensive neuropsychological assessment. We rated the presence of any asymptomatic lacunar infarct, extensive WMLs, any deep BMB, and moderate to extensive EPVS in the basal ganglia. One point was awarded for the presence of each of these markers, with a minimum score of 0 and a maximum of 4. Associations with domains of cognitive function were analyzed with correlation analyses.

**Results:** Correlation analyses revealed significant associations between cSVD category and all cognitive domains (all  $p \leq .001$ ). Results remained significant for information processing speed ( $r = .181$ ,  $p = .013$ ) and overall cognition ( $r = .178$ ,  $p = .017$ ), after correction for age and sex. Testing of trend using linear regression analyses revealed the same results.

**Conclusions:** We demonstrated that after adjustments for age and sex, a higher total burden of cSVD is associated with decreased performance on tests of information processing speed and overall cognition. Longitudinal studies following increase of MRI markers and cognitive decline over time are needed in order to confirm a causal relationship between total burden of cSVD and cognitive function.

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**E. NYGAARD, K. SLINNING, V. MOE & K.B. WALHOVD. Cognitive Abilities of Children Prenatally Exposed to Opiates and Polysubstances: A Longitudinal Study.**

**Objective:** Previous studies have found young children exposed to maternal opioid and polysubstance use in utero are at increased risk for neuropsychological difficulties. The study investigated whether these waned, persisted, or increased over time, and to what extent such perinatal vulnerability could be compensated by being raised in optimized conditions.

**Participants and Methods:** In the present study, 60 children with substance exposure and 48 control children without known prenatal risk were followed longitudinally. The most common main drug of choice among the pregnant mothers was opiates ( $n = 31$ ). The children's general cognitive abilities were assessed at 1, 2 and 3 yrs of age using the Bayley-II Mental Development Index, at 4 ½ yrs using the McCarthy General Cognitive Index, and at 8 ½ yrs using the WISC-R Total IQ.

**Results:** Children with prenatal drug exposure had significantly ( $p < .05$ ) lower cognitive abilities than children in the control group at all time points ( $M = 96.1$ ,  $SD = 17.0$  and  $M = 116.1$ ,  $SD = 14.2$ , respectively, at 8 ½ yrs,  $p < .001$ ). Mixed effects models showed that the group difference was stable from 1 to 3 yrs of age but increased between 3 and 8 ½ yrs. The group difference at 8 ½ yrs was significant even after controlling for earlier cognitive abilities in regression analyses. The group differences remained when assessing only exposed children who moved to stable adoptive/foster homes before 1 yr of age ( $n = 50$ ). The study could not isolate effects of prenatal substance exposure.

**Conclusions:** However, the results indicate that children exposed to opioid and polysubstance abuse in utero do not cognitively "catch-up" over time. Instead, risk effects appear to increase with age, even in adoptive/foster children with minimal postnatal risk. As the complexity of the learning environment and social relationships increases over time, there may be transactional processes in which neurobiological vulnerabilities become increasingly important with respect to various aspects of children's functioning.

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**A. MCILROY, M. NICHOLLS, V. ANDERSON, M. SPENCER-SMITH, R. LEVENTER & A. WOOD. Atypical Bilateral Frontal Lobe Activation During a Language fMRI Task in Young People with Agenesis of the Corpus Callosum (ACC).**

**Objective:** Individuals with ACC have difficulties across a number of areas of language function, including expression and comprehension. There is currently limited and conflicting research regarding the lateralisation of language in ACC and no functional magnetic resonance imaging (fMRI) studies have been conducted to investigate language activation in children and adolescents with ACC.

**Participants and Methods:** The current study used an expressive language fMRI task (a visually presented noun-verb generation paradigm) to investigate language lateralisation in seventeen (9 male) young people aged 8-22 years ( $M = 12.41$ ,  $SD = 3.65$ ; 53% right-handed) with partial or complete ACC and fourteen (8 male) age matched typically developing controls ( $M = 12.55$ ,  $SD = 3.86$ ; 71% right-handed). Participants were scanned on a 3T Siemens Trio at the Royal Children's Hospital, Melbourne. Laterality indices were calculated using a threshold independent bootstrapping method (Wilke & Schmithorst, 2006), with the frontal lobe as the region of interest.

**Results:** An analysis of covariance (ANCOVA) showed that there was a statistically significant difference between the laterality indices in the ACC group ( $M=0.049$ ,  $SD=0.42$ , i.e. bilateral activation) and the control group ( $LI=0.39$ ,  $SD=0.33$ , i.e. left lateralisation) after controlling for the effect of handedness ( $F(1,28)=5.14$ ,  $p=0.031$ ).

**Conclusions:** These findings indicate that language is atypically lateralised in ACC and this cannot be attributed to the higher proportion of left and mixed handed individuals in this group. Findings from this study further our understanding of language organisation in the malformed ACC brain and it is possible that atypical organisation together with disrupted connectivity may contribute to the language difficulties experienced in ACC.

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#### L.W. BRAGA. Does Literacy Improve Brain Function?

**Objective:** Literacy is a fairly recent invention in the history of humankind. It is important to understand the influence of culture and education on the brain's architecture. We explored the following hypothesis: Does literacy change the neuronal networks when acquired in childhood, and do these same changes occur when literacy is only acquired in adulthood?

**Participants and Methods:** We studied 31 healthy adult Brazilian subjects: 10 illiterates; 10 who became literate as adults; 11 literate since childhood. They all had the same socioeconomic backgrounds. We used a 3-Tesla functional MRI to measure brain responses to spoken and written language, visual faces, houses, tools and checkers in these adults of variable literacy.

**Results:** The fMRI study was conducted using the SPM5 software within whole-brain ANOVA analyses (threshold  $p<0.001$ ). Reading performance was the covariate of interest in the main ANOVA. A massive effect was seen in the left ventral occipito-temporal cortex, at classical VWFA (visual word form area) coordinates in the 2 groups of readers: the literates since childhood and those who became literate only in adulthood. Literacy enhanced the left fusiform activation evoked by writing, but also broadly enhanced visual responses in fusiform and occipital cortex, extending to area V1. Literacy also boosted phonological activation to speech in the planum temporale, and caused a top-down activation of orthography from spoken inputs. The illiterates did not show any significant activation in these areas when exposed to written sentences.

**Conclusions:** Literacy elicits massive changes in the neuronal networks, regardless if acquired in childhood or later, in adulthood, underscoring that both childhood and adult education can profoundly refine cortical organization.

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#### N. BROOMFIELD, A. SCOLAR, P. WELSH, M. WALTERS & J. EVANS. Post Stroke Anxiety is prevalent at the population level, especially amongst socially deprived and younger age community stroke survivors.

**Objective:** Most studies of post stroke anxiety (PSA) prevalence are hospital based, so knowledge of anxiety in community stroke survivors is limited. Few studies address the association between PSA and patient age. No study has explored the relationship between PSA prevalence and social deprivation. Our aim was therefore to describe population level prevalence data of PSA and to examine the association of PSA prevalence with patient age, gender and social deprivation.

**Participants and Methods:** We conducted an observational study of 3,831 community stroke survivors attending general practice reviews between April 01 2009 to March 31 2010 in Greater Glasgow, UK. All participants completed the Hospital Anxiety and Depression Scale (HADS). Univariate and multivariate analyses investigated the association between PSA prevalence (HADS: anxiety sub-scale [HADS-A]), age, gender and social deprivation variables.

**Results:** 618 (16.1%) of 3831 community dwelling stroke survivors had definite abnormal mood on HADS-A ( $\geq 11$ ), with 952 (31.5%) scoring  $\geq 8$ . 65 (35.5%) of stroke survivors aged under 50 years had definite abnormal mood on HADS-A compared to 59 (7.2%) of over 80

year olds. 340 (19.8%) of women had definite abnormal mood on HADS-A compared to 278 (13.1%) of men. 372 (22.6%) of most deprived stroke survivors had definite abnormal mood on HADS-A compared with 49 (7.6%) of least deprived. Age, gender and social deprivation all contributed significantly to HADS-A score variance.

**Conclusions:** Using a conservative HADS-A cut-off, a high prevalence of definite abnormal anxiety in community stroke survivors is observed. This prevalence increases markedly in younger and more socially deprived stroke survivors and is more common in women. Implications for service provision to stroke survivors is discussed.

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### Poster Session 3: Assessment / Intervention / Multiple Sclerosis

3:15–4:45 p.m.

#### Assessment/Psychometrics/Methods (Child)

##### J. AHONNISKA-ASSA, T. SILBERG, A. BREZNER & M. LEVAV. Short Neuropsychological Assessment Protocol for Children with Cerebral Palsy (CP).

**Objective:** As far as we know there is no "gold standard" to guide the assessment of children with complicated motor and communication disabilities. Neuropsychologists are commonly left on their own while trying to decide which tools would enable valid and reliable "prediction of the assessed individual's ability to function in everyday life, in work or school" Vakil, 2011. Therefore, most studies which evaluate cognitive functions of children with CP, choose to assess a limited, relatively homogeneous subgroup of children only. We suggest a short neuropsychological assessment protocol for children with spastic CP in all levels of motor impairment (GMFCS level 1-5), including those with severe motor and communication difficulties.

**Participants and Methods:** Twenty six children with spastic CP (18 males), age range 6:4 - 16:1 years ( $M = 10.1$ ;  $SD = 2.9$ ), GMFCS levels 1-5, were assessed with the short protocol which included IQ (Raven Coloured Matrices), verbal abilities (Vocabulary from Wechsler Intelligence Scales, Peabody Picture Vocabulary Test), verbal memory (Digit Span – Forward), executive functions (EF) (Children's Category Test), and visual perception (Test of Visual Perceptual Skills). The association of birth weight, gestational age and GMFCS levels on the neuropsychological profile was analysed.

**Results:** IQ, EF and visual perception significantly correlated with GMFCS levels. However, there was no correlation between verbal abilities and verbal memory with the GMFCS levels. None of the test results correlated with birth weight or gestational age.

**Conclusions:** We present an assessment protocol which requires little manual dexterity or fluent speech and therefore enables the neuropsychological evaluation of children with CP in all motor disability levels. In addition, this battery is parsimonious and covers most areas of function allowing the planning of educational interventions.

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##### E. CANCELLIERE & A. CANCELLIERE. Boston Naming Test Norms for Ages 14 and 15: A plateau in developmental growth?

**Objective:** The Boston Naming Test (BNT) is a very popular test of visual naming ability with norms for children and adults. However, there is a gap in the norms between age 14 and 17 (Strauss, Sherman and Spreen, 2006). The current study addressed the lower half of this gap in a sample of high school students providing normative data for 14 and



15-year-olds. This study also examined the progression of naming ability within this age range. A review of data collected by Yeates (1994) revealed a slowing of age-related gains in BNT (naming) performance from age 12 to age 13. The current, new data was examined within this context.

**Participants and Methods:** The BNT was administered to 40 students (ages 14 or 15) from a suburban high school in Toronto, Canada. Students were taking core, mandatory classes (English and Canadian History) at the time of testing.

**Results:** The total mean ( $n=40$ ) BNT score was 49.83 (S.D. 3.63). There was no significant difference between the 14 and 15-year-old means ( $T=0.35$ ,  $P=0.728$ ). Furthermore, the mean for the 14-year-old group (49.59) did not differ from the 13-year-old norms (49.55) provided by Yeates (1994). Inspection of those data revealed a slowing of gains in BNT performance from almost 4 points from age 9-10 to gains of almost 2 points while aging from 10-11 and also from 11-12 and just one point change from age 12-13.

**Conclusions:** The current data provide a preliminary normative base for interpreting BNT scores at ages 14 and 15. The lack of increases with age across this age group was unexpected and contrasted with the conclusion of Yates (1994) that, "means demonstrate a linear increase with age." The current data suggest a plateau at age 14 and 15 (and at age 13 if one considers Yeates' data). Data collected for older adolescents (Cancelliere and Cancelliere, 2012) and young adults (Schmidter-Edgecombe et al., 2000) has indicated that growth and naming ability resumes at later ages, after this plateau.

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#### L. CHAPIESKI, K. EVANKOVICH, P. KLAAS, P. TAYLOR & M. HISCOCK. Validity of Subjective Reports of Everyday Memory in a Pediatric Population.

**Objective:** Tests of memory are used with the assumption that performance mimics memory during everyday activities. This study examined the relationship between verbal memory test performance and newly developed measures of child and parent report of everyday verbal memory. In addition, reports of everyday memory and performance on objective tests of memory were compared as predictors of academic performance.

**Participants and Methods:** Participants were 417 patients between the ages of 8 and 18 years who were referred for neuropsychological evaluation because of neurological, developmental or mood disturbance. Patients with a Verbal IQ of  $<80$  were excluded. The patient and one parent completed a questionnaire assessing Everyday Verbal Memory and the patient was administered Verbal Learning and Story Memory subtests from the WRAML-2 and reading and math subtests from the KTEA-II. Patients' parents and teachers also completed questionnaires concerning academic performance.

**Results:** Confirmatory factor analysis confirmed two previously identified factors—for both the child and parent versions of the memory questionnaire—a Prospective Memory Scale (PMS) and a Learning/Retrieval Scale (LRS). The expected correlations between the parent and child scales were found. Both the child and parent LRS scales were correlated with performance on the memory tests ( $p<.01$ ). In contrast, the PMS scores were not correlated with the objective memory tests. Multiple regression analyses revealed that both parent and child reports of everyday memory, particularly LRS scores, were consistent predictors of reading and math skills, as well as parent and teacher reports of academic performance.

**Conclusions:** A subjective measure of memory administered to both children and their parents can differentiate two types of memory processes—prospective memory and learning/retrieval. These categories are differentially related to performance on memory tests and both are better predictors of academic performance.

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#### M.A. COENEN, C.C. AARNOUDSE, R.B. HUITEMA, O.B. BRAAMS & W.S. VEENSTRA. Development of Facial Emotion Recognition in Childhood: Age-related Differences in a Shortened Version of the Facial Expression of Emotions - Stimuli and Tests.

**Objective:** Facial emotion recognition is essential for social interaction. The development of emotion recognition abilities is not yet entirely

understood (Tonks et al. 2007). Facial emotion recognition emerges gradually, with happiness recognized earliest (Herba & Phillips, 2004). The recognition of anger, fear and disgust, relying on brain regions that continue to develop during childhood and adolescence (Thomas et al., 2007), may develop latest. The aim of the present study is to investigate the normal development of facial emotion recognition and to develop a useful test for detecting emotion recognition difficulties in children with acquired brain injury.

**Participants and Methods:** 100 normally developed children (49 boys, 51 girls) between 3.6-12.9 years of age participated ( $M=7.79$ ,  $SD=2.75$ ) in this cross-sectional study. The FEEST-36 is a Dutch shortened version of the computer based Facial Expression of Emotions - Stimuli and Tests by Young et al. (2002). It consists of 36 black and white pictures of men and women expressing the six basic emotions: Anger, disgust, fear, happiness, sadness and surprise. The relationship between total scores, IQ and age was investigated.

**Results:** Emotion recognition is significantly influenced by age. Especially, the recognition of fear, disgust and surprise improves with age. The results show that pre-school children younger than 5 years are significantly less accurate than children aged 5 to 10 years or children of 10 years and older in their recognition of emotions. There is no relationship with intelligence or sex.

**Conclusions:** Facial emotion recognition develops during childhood; especially the identification of fear, disgust and surprise is influenced by age. The FEEST-36 is hoped to be useful in detecting specific emotion recognition abnormalities in children and adolescents with acquired brain injury. The results are discussed in the light of the implications of the Dutch FEEST-36 in pediatric neuropsychological assessment of emotion recognition following acquired brain injury.

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#### K.D. EVANKOVICH, P. KLAAS & M.L. CHAPIESKI. Contributions of Attention and Mood to Everyday Memory in Children.

**Objective:** Patient reports of everyday memory have been associated with mood disturbances and inattention. The question remains whether mood disturbances and inattention interfere with everyday memory or distort patients' perceptions of their memory. We addressed this question in a pediatric population using self-report measures and measures obtained from parents and teachers.

**Participants and Methods:** Participants were 322 patients ages 8 to 18 years referred for neuropsychological evaluations for neurological, developmental and mood disturbances. Patients with Verbal IQ scores  $<80$  were excluded. Patients and one parent completed an Everyday Verbal Memory questionnaire assessing Prospective Memory (PMS) and Learning/Retrieval (LRS). Patients received memory tests (WRAML-2) and completed anxiety (RCMAS) and depression (CDI) questionnaires. The parent completed the Achenbach CBC and teachers completed the Student Behavior Survey, both assessing anxiety, depression, and ADHD behaviors.

**Results:** The impact of emotional distress and attention on memory test performance and reports of everyday memory were assessed with simple correlations or multiple regression. Memory test performance was not associated with reports of emotional distress or inattention. Parent PMS scores were negatively related to both parent ( $p<.001$ ) and teacher reports ( $p<.001$ ) of inattention, parent reports of anxiety and depression ( $p<.001$ ) and child reports of anxiety ( $p<.001$ ). Child PMS scores were negatively related to parent ( $p<.001$ ) and teacher ( $p<.01$ ) reports of inattention, child reports of anxiety and depression ( $p<.001$ ). Parent LRS scores were negatively related to parental report of inattention ( $p<.001$ ) and child report of anxiety ( $p<.01$ ). Child LRS scores were only negatively impacted by child reports of anxiety ( $p<.001$ ).

**Conclusions:** Our findings suggest that memory in everyday activities is negatively impacted by inattention and emotional distress. Conversely, memory test performance was unrelated to mood disturbance and inattention.

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**L. BELL, M. HOLCOMB & A. MAERLENDER. Increased Intrasubtest Scatter on WISC-IV Verbal Subtests in Language Disorder and ADHD Clinical Groups.**

**Objective:** This study examined intrasubtest scatter on the Wechsler Intelligence Scale for Children– Fourth Edition (WISC-IV) Verbal Comprehension subtests to determine whether increased scatter relative to overall performance is related to specific disorders such as attention-deficit/hyperactivity disorder (ADHD) or language disorders.

**Participants and Methods:** Data was drawn from the WISC-IV normative sample, which includes a national standardization sample of 2,200 children representing children ages 6:0-16:11. Children were included in the ADHD clinical sample group if they met diagnostic criteria for ADHD or had been diagnosed by a physician. The language disorder clinical sample consisted of children whose deficit was not solely the result of a deficit in speech fluency and who met diagnostic criteria for a language disorder, or whose test scores on a language assessment were impaired. Scatter was calculated as the number of scatter points (e.g., a score of 2 on an item followed by a score of 1 on the next item = 1 scatter point) divided by the total raw score in order to control for overall performance on each subtest. ANOVAs were applied using age as a covariate in order to examine group differences.

**Results:** The results indicated that children with ADHD demonstrated significantly greater scatter than the normal sample on the Vocabulary subtest  $F(1, 722) = 3.81, p = .05$ . Children with language disorders demonstrated significantly greater scatter relative to their overall performance on each of the three core verbal subtests, Similarities  $F(1, 748) = 6.28, p = .01$ , Vocabulary  $F(1, 749) = 10.64, p = .00$ , and Comprehension  $F(1, 746) = 35.40, p = .00$ .

**Conclusions:** The results of this study suggest that examining children's levels of intrasubtest scatter on verbal subtests of intellectual functioning may provide useful clinical information as children with ADHD and language disorders demonstrate more variable performance on these subtests compared to peers. We thank Pearson for the use of WISC-IV normative data.

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**Y. OKAMURA, M. EHARA, Y. NAKAJIMA, E. OTSUKA, M. AKAIISHI & K. YOSHINAGA. Comparison of the Behavior Rating Inventory of Executive Function in English and Japanese.**

**Objective:** Executive dysfunction (ED) frequently occurs in children with traumatic brain injury, but it is difficult to make a diagnosis of ED in its early stages or in childhood. The Behavior Rating Inventory of Executive Function (BRIEF) published in the USA (Gioia et al., 2000) is a widely used measure of executive dysfunction in children. In Japan, there are few tools for the comprehensive assessment of child ED and the Japanese translation of BRIEF may be helpful in this regard. However, very limited data on use of the Japanese translation are available. In this study, BRIEF data obtained for a Japanese translation sample were compared those of the normative sample.

**Participants and Methods:** The Parent Form sample in Japanese was completed by 329 parents for 136 boys and 193 girls aged 6–18 years. The Teacher Form sample was completed by 323 teachers for 128 boys and 195 girls. Independent t-tests were used to compare the findings for the Japanese sample with the normative sample (Gioia et al., 2000) for each of the scales.

**Results:** A series of t-tests revealed that the Japanese sample had a significantly lower score than the normative sample on the scale of Global Executive Composite (GEC), except for the Parent Form male sample rating for 6–7 year olds ( $t=0.02, n.s.$ ), the Teacher Form male sample for 6–7 year olds ( $t=0.01, n.s.$ ), and the Teacher Form female sample for 6–7 year olds ( $t=0.19, n.s.$ ).

**Conclusions:** We found significant differences in BRIEF scores between the original sample and a Japanese sample. There could be several reasons for the differences, including the cultural aspect that the Japanese tend to assess negatively. Our findings suggest that BRIEF has to be standardized in a Japanese sample, and we hope to prepare a standardized Japanese version of BRIEF.

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**S. THOMAS, D.A. WALKER, E.J. TALBOT, E.J. BENNETT & A. STARZA-SMITH. Paediatric Cerebellar Mutism Syndrome: Challenges to Cognitive Assessment.**

**Objective:** Cerebellar Mutism Syndrome (CMS) is a disorder associated with surgical resection of cerebellar tumours. It can evolve in the first three days post operatively characterised by reduction in speech, and development of ataxia and hypotonia. It is often associated with emotional lability, dysregulation of mouth movements, additional long tract signs and cranial nerve palsies suggesting localised cerebellar and brain stem injury. The patho-physiology of the condition or mechanism of delayed-onset injury is not clear; however, we present current hypothesis and research.

**Participants and Methods:** We present two case studies including serial assessment each with strikingly diverse cognitive findings but with common features. We discuss the challenges to neurocognitive assessment and research data collection where levels of disability prohibit standardised assessment.

**Results:** Our first case was initially assessed one year post surgical resection, demonstrating high premorbid IQ, and aspects of well-preserved cognition (VIQ=126; 95th percentile) despite motor and communication limitations. Only processing speed was below age-matched expectations (PS=74; 4th percentile). Our second case was first assessed in the acute stages of recovery. Standardised cognitive assessment techniques were restricted due to impaired communication and motor function, thus we present an adapted assessment protocol. At follow-up assessment low average abilities were identified (VIQ=87; 19th percentile, PRI=84; 14th percentile) with again significant processing speed impairments (Symbol Search scaled score=1), which were undoubtedly but not exclusively related to motor disability.

**Conclusions:** Research elucidating the causes of CMS remains in its infancy; however the communication, motor and cognitive sequelae can be debilitating. We present the associated challenges to cognitive assessment and standardised data collection.

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**S.A. THOMAS, A. GASKILL, E.J. TALBOT, E.J. BENNETT, C. TORRANCE, K.M. DYER & A. STARZA-SMITH. Parental Perceptions of a Support and Information Group for Parents of Children with Hydrocephalus.**

**Objective:** Hydrocephalus is a condition associated with abnormal accumulation of cerebrospinal fluid in the ventricles of the brain. It has varied aetiologies and can occur congenitally or secondary to intracranial haemorrhage, infection or tumours (Kandasamy et al., 2011). It is a lifelong and life threatening condition and is consequently associated with high levels of parental concern (Kulkarni et al., 2007). We present the findings of our evaluation of a pilot support group for parents of children with hydrocephalus.

**Participants and Methods:** We describe the group programme which comprised six fortnightly sessions hosted by qualified psychologists at a regional neurosciences centre, each attended by up to 24 participants. Pre and post group evaluation measures included a Hydrocephalus Concerns Questionnaire for Parents (HCQ-P) (Kulkarni, 2006); alongside Knowledge of Hydrocephalus, Hopes and Fears and Parental Satisfaction questionnaires.

**Results:** A Wilcoxon Signed Rank Test revealed a statistically significant increase in both parental understanding of paediatric hydrocephalus ( $z = -3.41, p < .01, r = .62$ ) and also parental concern ( $z = -2.43, p < .05, r = .57$ ). A large majority indicated that the group met all previously identified hopes and that they would recommend the group to others. Meeting other parents, sharing experiences and asking questions were highlighted as particularly helpful. Additional time for discussion between parents and sharing their views was requested.

**Conclusions:** We present positive parental perceptions. Parental understanding of hydrocephalus was increased as was parental concern,

the potential reasons for which are discussed. Levels of satisfaction were high. Parents reported valuing the opportunity for discussion with other parents and professionals. We present considerations for further parent groups which are applicable to groups for parents of children with acquired brain injury and a wide range of neurological conditions.

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**L. VAN ITERSÓN & P.B. AUGUSTIJN. Rates of Reliable Cognitive Change (RC) after a change of WISC test version in children with refractory epilepsy: adjustment for Flynn effects.**

**Objective:** Epilepsy in children is a condition that emerges at different ages and may continue with remissions and relapses for a prolonged period. When concerns about cognitive development remain and retesting is required with the Wechsler Intelligence Scale for Children (WISC), a change of test version is likely to have occurred in the interval.

The objective was to establish rates of Reliable Cognitive Change (RC) in children with epilepsy after adjusting cut-off scores for test changes: from WISC-R to WISC-III.

**Participants and Methods:** N = 26 Dutch children (46% boys) from tertiary epilepsy settings had completed the WISC-R at first (T1) and the WISC-III at second testing (T2) with a T1–T2 interval of 1.6–14.3 years (mean = 8.9;). At T1, mean age = 8.9 years. FS-IQ at T1 = 82.9 (61–108), at T2 = 74.2 (45–100). Mean AOE = 5.0 years; AEDs = 1.9 (0–5). Seizure type: 65.4% focal; 26.9% generalized; 7.7% uncertain/unknown. Active epilepsy at T2: 73%.

Analyses: Asymmetrical 90% RC cut-off scores were applied, adjusted for change in test version (Flynn effects) based on data from Schittekatte (2005) and Van Itersón et al. (2012): gain/loss: VIQ 10/19 points; PIQ 18/18 points; FS-IQ 11/17; with chi-square to test rates of children presenting RC. Paired-samples t test for comparison of means.

**Results:** On the VIQ, RC was seen as gains / losses in 0.0%/15.4%; on the PIQ, 3.8%/19.2%; on the FS-IQ, 0.0%/23.1%; for all:  $p < .02$ , meaning elevated rates of losses. Mean declines of 9.4, 5.6 and 8.7 IQ-points were seen for VIQ, PIQ and FS-IQ, all significant with medium to large effect sizes.

**Conclusions:** After adjusting for Flynn effects, in long-lasting child epilepsy reliable cognitive decline was seen in elevated rates: 23.1% of the children showed RC-loss on FS-IQ.

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### Assessment/Psychometrics/Methods (Adult)

**A.R. AMBROZIAK & E. LOJEK. Narrative Medicine: Implications for Neuropsychological Assessment.**

**Objective:** Narrative discourse is a powerful ecological tool in assessing patient's ailments, perceived cognitive function, self-experience and world view allowing for more relevant references to be made both in diagnosis and in treatment. Yet, its utility seems underestimated in clinical practice. The current study is in accordance with a new line of research in narrative medicine and aims at a better account of narratives' use in neuropsychological assessment.

**Participants and Methods:** A total of 36 participants, 9 left- (LHD) and 16 right-hemisphere-damaged (RHD) stroke patients, as well as 11 bone fracture controls (C) performed on standardized neuropsychological tests of memory, thinking, attention, activity rate, expressive, executive and emotional functions, and completed an experimental method of an interview.

**Results:** Analysis of narratives' thematic content revealed main topics to be alike across all groups, with statistically significant differences in the elaboration on cognitive and interpersonal illness aspects, as well as circumstances of illness onset. Using Frank's (1995) typology, distinct attitudes toward own illness were found between the groups, especially in terms of emotional battering and pessimism at recovery. Comparison of self-reports to tests' results showed that patients reported their cognitive deficits in minority (14%) of cases. Instead, patients showed a tendency to report stereotypical deficits (19% of cases).

**Conclusions:** Together, these results indicate that stroke patients' stories convey essential information, i.e., subjective problems and attitude toward own illness, preoccupation or even trauma, which should be addressed in the therapeutic process. Thus, narrative discourse seems a valuable and indispensable component of the diagnostic process. In addition, patients' stereotypical answers call for attention and further investigation. The study was supported by grants of the Faculty of Psychology, University of Warsaw (BST 15-4502/2010, BST 161500/51/2011).

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**G. ARCARA, S. MONDINI, F. BURGIO, M. MAZZOLDI, S. GHEZZER, S. PEDRONI, A. ZANGROSSI, C. TOMASI, F. PIRROTTA & D. MAPELLLI. Normative Data for the Italian Version of the Montreal Cognitive Assessment (MoCA): the Impact of Sociocultural Variables on Cut-offs.**

**Objective:** The goal of the present study is to establish the psychometric and diagnostic properties of the Italian version of the Montreal Cognitive Assessment (MoCA, Nasreddine et al., 2005). Data have been collected on control participants of different age and clinical populations (MCI and Alzheimer patients). The wide age range of normative data allows us to have cut-offs for the whole Italian population.

**Participants and Methods:** The Italian version of MoCA and the MMSE (Folstein, Folstein and McHugh, 1975) were administered to 426 control participants (mean age = 45.46, SD = 21.78, range = 15–93; mean education = 11.59, SD = 4.82 range = 1–26), 60 patients with MCI (mean age = 79.60, SD = 5.90, range = 62–88; mean education = 8.06, SD = 5.66 range = 3–17), and 57 patients with Dementia of Alzheimer type (mean age = 79.93, SD = 6.19, range = 62–88; mean education = 7.38, SD = 3.08 range = 3–13). Cut-offs in the control sample were calculated as fifth percentile of scores, with participants stratified in four age groups and two levels of education. The cut-offs to discriminate between Alzheimer, MCI and Controls were obtained through ROC analysis.

**Results:** The Italian version of MoCA resulted very efficient in discriminating between elderly control participants and Alzheimer patients (93% sensitivity, 89% specificity) whereas its ability in discriminating elderly controls and MCI (57% sensitivity, 82% specificity) was moderate. The cut-off score to discriminate Alzheimer from Controls was 15.5, which is considerably lower than the score of the Canadian version (Nasreddine et al., 2005).

**Conclusions:** The results of the present study suggest that cultural differences may have an important influence in determining the performance in MoCA, and underline the importance of country-specific cut-offs (as shown by Rossetti et al., 2011). Remarkably, cut-offs obtained as fifth percentile on the control normative sample and those obtained with the ROC analysis were virtually identical.

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**M. BERTHOLD, S. ASCHENBRENNER, R. DEBELAK, J. EGLE, K. RODEWALD, D. ROESCH-ELY, M. SOMMER, M. VETTER & M. WEISBROD. When Asking Does Matter: A Comparison of Subjective and Objective Measures in the Cognitive Basic Assessment (COGBAT) Test Battery in Healthy Subjects and Patients with Schizophrenia.**

**Objective:** Previous empirical findings suggest a weak association between subjective and objective measures of cognitive performance with focus on executive functions, for both healthy subjects and patients with schizophrenia. The goal of the present study was the examination of the relationship between subjective and objective measures of executive functions, attention and memory in both these groups, and in a norm sample which is representative for the Austrian adult population.

**Participants and Methods:** As a first step, we investigated two subsamples of 46 healthy controls and 46 schizophrenic patients, matching in age, gender and educational level. As a second step, a representative sample of N=283 respondents, which underwent examination with the Cognitive Basic Assessment (COGBAT), was used for further statistical analysis.

**Results:** In accordance with previous findings, small and mostly insignificant correlations between subjective and objective measures were observed. However, results of three hierarchical logistic regression analyses, separately conducted for the three dimensions, reveal that the administration of subjective measures provides incremental validity over the neuropsychological tests.

**Conclusions:** Our results suggest that subjective judgement and objective measurements can be regarded as independent sources of diagnostic information. A consequence for clinical practice could be to raise the awareness of differences in subjective perception and actual objective test results in order to improve their adherence in the rehabilitation process.

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**D.H. BIECHOWSKA, D. DZIEGIELEWSKI & K. SLAWINSKA. Semantic verbal fluency of animals: a normative and predictive study in a Polish population.**

**Objective:** Semantic verbal fluency is very sensible but rather unspecific tool for detection of neuropsychological deficits. This test is highly influenced by socio-cultural factors. Normative and predictive data for semantic verbal fluency of animals in Polish population are presented.

**Participants and Methods:** A sample of 414 subject was chosen (43% male, 57% female), presenting different degrees of schooling (mean = 12.97 years; SD = 3.31) and with an age comprised between 26 and 79 years (mean = 56.05; SD = 10.62).

**Results:** Statistical analysis reconfirmed a significant negative correlation (-0.353) for age, and a significant positive correlation (0.406) for years of formal education. A predictive function for the production of names of animals during 1 minute was established based on the subject's age and level of education:  $F(52.46) + \text{age}(-0.140) + \text{education}(0.541)$ .

**Conclusions:** The neuropsychological value and limitations of normative data and the predictive equation are discussed.

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**L. BOXLEY, N. GABEL, W. TSANG & L. BIELIAUSKAS. Normative Addenbrooke's Cognitive Examination (ACE-R) performance among older inpatient veterans.**

**Objective:** While the Mini Mental Status Exam (MMSE) is a mainstay in cognitive screening, Addenbrooke's Cognitive Examination (ACE-R) has proven to be a useful extended screen in the assessment of older adults. As the normative data was developed using an outpatient geriatric population (Mioshi et al., 2006), normative data for other populations such as inpatients and Veterans may provide needed comparative data for a broader variety of patient populations. The purpose of this study was to provide preliminary normative ACE-R data for older inpatient adults in a VA setting.

**Participants and Methods:** The ACE-R was administered to 96 inpatient Veterans [age 65.13 (10.49); education 12.44 (2.29)] as part of a larger neuropsychological test battery used to screen for overall cognitive functioning. The Peabody Picture Vocabulary Test (PPVT-IV) was included as an estimate of premorbid intelligence.

**Results:** Estimated premorbid intelligence among inpatient Veterans was average [98.99(13.82)]. Average total ACE-R scores in our sample [76.65(12.62)] appeared much lower than in Mioshi's original control sample [93.7 (4.3)] or MCI sample [84.2 (7.3)]. Mean inpatient Veteran performance was, however, higher than Mioshi's dementia sample [65.4 (15.9)]. Similar patterns of general underperformance were also observed across ACE-R subtests, even among individuals who did not have a diagnosis of dementia.

**Conclusions:** Further investigation is needed to provide insight into inpatient geriatric cognitive screening performance in a Veteran setting. Comparisons to other published norms among related patient subgroups suggest some performance variability due to medical status (Ferreira, Simones, & Maroco, 2012; Lischka et al., 2012; Morris, Hackert & Lincoln, 2012). Reasons for relative underperformance in this sample may include acute illness, polypharmacy, and frequency of comorbid psychiatric distress.

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**R. KANSER, L. BOXLEY, N. GABEL & L. BIELIAUSKAS. Modification of the ACE-R for use among American Veterans.**

**Objective:** Developed in the UK, the ACE-R presents unique cultural challenges when used in an older American Veteran population. To address some of these challenges, new items on the Retrograde Memory sub-test were piloted. While questions regarding the current US President and "the President who was assassinated in the 1960's" were retained, "the current Prime Minister" and "the woman who was Prime Minister" were substituted with "the current Vice President of the US" and "the first man on the moon." The purpose of this study was to compare these items with other clinical data to determine their potential utility.

**Participants and Methods:** A neuropsychological battery was administered to 87 veterans [age 64.3 (10.03)] in an inpatient VA rehabilitation unit. Tests given included the ACE-R, Mini Mental Status Exam (MMSE), Memorial Delirium Assessment Scale (MDAS), and Peabody Picture Vocabulary Test (PPVT-IV). Individuals who screened positive for delirium (MDAS score >7) were excluded from the analysis (n=13). Point biserial correlation coefficients were calculated between individual Retrograde Memory questions and total MMSE scores, years of education, and PPVT-IV standard scores.

**Results:** The frequency of correct responses to the name of the current President, Vice President, first man on the moon, and President assassinated in the 1960s were 96.6%, 46%, 46%, and 89.7% respectively. Higher MMSE scores and estimated intelligence were significantly associated with correct identification of the US President ( $r=.45, p<.01$ ;  $r=.26, p<.05$ ), Vice President ( $r=.34, p<.01$ ;  $r=.37, p<.01$ ), and the President who was assassinated in the 1960's ( $r=.36, p<.01$ ;  $r=.36, p<.01$ ). Patient ability to identify the first man on the moon was not associated with MMSE score, estimated IQ, or education.

**Conclusions:** Further investigation is needed to evaluate the utility of the ACE-R among an older American Veteran population, as well as the potential benefit of using culturally adjusted items.

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**Z. BOUMAN, H. HOEIJMAKERS, M.P. HENDRIKS, A.P. ALDENKAMP & R.P. KESSELS. Validation of the WMS-IV Brief Cognitive Status Exam (BCSE) in Elderly with MCI and Dementia: Comparison with the MMSE.**

**Objective:** The Brief Cognitive Status Exam (BCSE) is a new optional subtest of the Wechsler Memory Scale-IV (WMS-IV) developed to quickly detect cognitive deficits. We examined the validation of the Dutch version of the BCSE in elderly with Mild Cognitive Impairment (MCI) or dementia, comparing it with the Mini-Mental State Examination (MMSE).

**Participants and Methods:** The BCSE consists of 7 content areas: Orientation, Time Estimation, Mental control, Organisation - Planning, Incidental Recall, Inhibitory Control and Verbal Production. BCSE and MMSE were administered to 19 elderly with MCI, 37 with dementia and 34 matched healthy controls. Sensitivity, specificity, positive- (PVV) and negative predictive values (NPV) of the BCSE and MMSE were determined.

**Results:** Results indicate a group difference on BCSE total score ( $F(2,89) = 46.6; p<.001$ ). Post-hoc analyses revealed significant differences between all three groups: controls ( $M=50.7, sd=7.9$ ) and MCI ( $M=37.5, sd=7.8$ ),  $p<.001$ ; controls and dementia ( $M=30.9, sd=10.4$ ),  $p<.001$ ; and MCI and dementia,  $p<.03$ . The detection of dementia as compared to controls was similar for the BCSE and the MMSE. A BCSE cut-off score  $\leq 38$  revealed sensitivity of 78%, specificity of 91%, PVV of 87% and NPV of 90%, whereas a MMSE cut-off score of  $\leq 24$  showed a sensitivity of 79%, specificity of 91% PVV of 91 and NPV of 92%. Sensitivity, specificity and PVV and NPV to detect MCI compared to controls was respectively 79%, 82%, 79% and 79% on the BCSE with a cut-off score of  $\leq 45$ , and respectively 84%, 82%, 69% and 79% on the MMSE with a cut-off score of  $\leq 27$ .

**Conclusions:** The BCSE is sufficiently capable of distinguishing elderly with dementia from healthy controls, but for distinguishing elderly with MCI from healthy controls both the BCSE and MMSE have limitations. The BCSE is not designed to be diagnostic for a specific population, hence the value and applicability in different patient groups needs to be examined more specific.

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**C.J. BRUIJNEN, A.J. WESTER, W. MARKUS, C. DE JONG & R.P. KESSELS. Screening of Cognitive Disorders in Substance Abuse Patients Using the Montreal Cognitive Assessment - Dutch Version (MoCA-D).**

**Objective:** Long-term excessive use of substances may lead to cognitive disorders. It is estimated that these deficits are present in half of all treatment seeking addicts. Success of treatment, the ability to find a job and general everyday functioning after care are all affected by cognitive disorders. However, extensive neuropsychological assessment is often not feasible in settings specialized in addiction care. Short cognitive screeners, e.g. the Montreal Cognitive Assessment (MoCA), may help to identify individuals at risk for cognitive disorders in an early stage of addiction care.

**Participants and Methods:** Data were collected in 49 treatment seeking addicted patients from IrisZorg. None of the patients were referred because of cognitive complaints. All participants completed the Measurements in the Addictions for Triage and Evaluation (MATE 2.1), to determine primary addiction substance. Additionally the MoCA-D version 7.1 was administered, using a cut-off score of 26 indicative for cognitive impairment.

**Results:** With a large majority of males (79.6 %) and an average age of 41.49 (SD = 14.08), over half of all participants (57.14 %) scored below the clinical cut-off (mean total score of 24.59; SD = 3.32). More specifically, 62.5 % of alcohol (N = 24), 75.0 % of opiate (N = 8) and only 25.0 % of cannabis (N = 8) users performed below the cut-off. Other substances were not taken into account due to small groups.

**Conclusions:** Our findings show that cognitive impairments are frequently found in patients with substance abuse, even in the absence of cognitive complaints. These findings should be taken into account in adjusting the treatment program for cognitively impaired individuals.

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**B. DANDACHI-FITZGERALD & R. PONDS. Incredible Symptom Reports of Patients Referred for Neuropsychological Assessment in a General Hospital.**

**Objective:** In the current study, we looked at two issues: the prevalence of incredible symptoms during neuropsychological assessment in a general hospital setting and how good clinicians are in detecting poor credibility.

**Participants and Methods:** All patients (N = 93) were routinely referred for neuropsychological assessment. Patients with obvious severe cognitive impairment (e.g., dementia, acute psychosis) were excluded. Neuropsychological assessment included two symptom validity tests (SVTs): the Amsterdam Short Term Memory test (ASTM) measuring underperformance on cognitive tests and the Structured Inventory of Malingered Symptomatology (SIMS) tapping into over-reporting of symptoms.

Because former studies made plain that clinicians are poor at detecting incredible symptom reports, we asked clinicians, by means of a checklist, to estimate the validity of the assessment *after* their interview with the patient, but *before* testing.

**Results:** Using the recommended cut-offs, prevalence's of SVT failure were as follows: 45% of the patients passed both tests, 30% failed either the ASTM or the SIMS, and 25% failed both tests. Thus, following the two-test failure rule, 25% of the patients exhibited incredible symptoms. Prior to testing clinicians believed that the subsequent testing would be valid in 71% of the cases. A Chi Square test revealed a significant association between clinicians' judgments and SVT failure [ $\chi^2(1) = 4.1, p < .05, \phi = .24$ ].

**Conclusions:** Our results indicate that in a general hospital setting, incredible symptom reports occur in a substantial minority of neu-

ropsychological evaluations. Further, our findings suggest that clinicians are nowadays better able to detect incredible symptom report. However, the agreement between clinicians' impressions and SVTs was far from perfect, and so it seems wise to systematically administer symptom validity tests to screen for incredible symptom reports.

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**J. DAVISON, E. KHENG WEI LONG & S. COLLINSON. Supplementing the RBANS with the MoCA for detecting dementia.**

**Objective:** The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is a short, easily administered cognitive screening battery that is well validated in both clinical and community populations. While the RBANS is able to reliably detect Alzheimer's disease (AD), the lack of executive function measures however limits its clinical applicability in the detection of other diseases with hallmark executive dysfunction, as well as in differential diagnosis. The aim of this study was to examine the potential value of an executive function composite index derived from the Montreal Cognitive Assessment (MoCA) in order to address the absent executive measure in the RBANS.

**Participants and Methods:** Thirty Mild Cognitive Impairment (MCI), 30 mild AD, and 30 healthy No Cognitive Impairment (NCI) participants were recruited. Receiver Operator Characteristics (ROC) curve analysis was used to assess the discriminant validity of the MoCA Executive Function Composite (MoCA-EFC) in detecting MCI or mild AD, compared with the Color Trails Test (CTT), and when supplemented with the RBANS.

**Results:** Receiver Operator Characteristics (ROC) curve analysis revealed that the MoCA Executive Function Composite (MoCA-EFC) is a good measure of executive functioning, and is comparable to a commonly used measure – the Color Trails Test (CTT). Supplementing the RBANS with the MoCA-EFC however did not significantly improve its discriminant validity in detecting MCI or mild AD.

**Conclusions:** The MoCA Executive Function Composite (MoCA-EFC) provides a good measure of executive functioning. In this pilot study however, supplementing the RBANS with the MoCA-EFC did not significantly improve its discriminant validity in detecting MCI or mild AD, although it provided additional clinically valuable information.

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**M. ENNOK & L. LEMSALU. New Scoring Method and Preliminary Estonian Normative Data for the Coetsier Story Recall Test.**

**Objective:** We describe a new scoring method for the Coetsier Story Recall Test – a narrative memory test used in Belgium, and provide preliminary normative data for Estonian population.

**Participants and Methods:** Sample includes 135 healthy persons (75 men, 60 women) with mean age of 39.7 years (range 19-92 years) and mean education of 14.7 school years (range 8-25 years). A short story of 158 words was read aloud to the subjects and they were asked to provide written transcript immediately after reading, and 30 minutes later.

The story was divided into 51 scoring units based on the content and transcripts were scored based on the reproductions of these units. We also developed a qualitative scoring system to account for the mistakes made in remembering. Incorrect recall moments were categorized as additions, content confusions, content changes and repetitions.

**Results:** Subjects were able to reproduce in general 60.3 content units (SD=15.6) in immediate recall and 58.7 content units (SD=15.2) in delayed recall. Demographic variables had significant influence on the results in both immediate ( $R^2=.27$ ) and delayed recall conditions ( $R^2=.23$ ). Age explained most of the variance, education and sex had smaller additional explanatory power. About 12-13% of content units in recall were erroneously remembered. Most typical errors were content confusions, followed by additions. Content changes and repetitions were very rare.

**Conclusions:** Coetsier test is a useful method for the assessment of narrative memory. The results are influenced by demographic variables,

these should be considered in development of test norms. While most of the information is correctly recalled healthy normal persons also make mistakes in remembering, mostly from confusing the information units in the story. The proportion and nature of mistakes in clinical samples deserves further study.

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**M. ENNOK & L. VAHTER. Examining the Errors on the Stroop Test.**

**Objective:** The Stroop test (ST) is a widely used assessment method of attentional processes in different clinical conditions. The evaluation is usually concentrated on the performance speed, however the performance in ST can as well be inaccurate and subjects make mistakes in naming the targets. The aim of this study is to assess and establish base rates of different errors in ST in normative sample.

**Participants and Methods:** The sample consists of 206 healthy subjects (102 women, 104 men) with mean age of 48.4 years (range 19-92) and mean education of 13.7 school years (range 4-24.5). An Estonian version of ST was administered. The test includes 3 parts (100 items in each arranged to 5 x 20 columns) and the subject is either asked to read color names or name the color of X-s or colored words printed in nonmatching colored ink. The errors were classified as lapses (incomplete immediately self-corrected errors), self-corrected errors and true errors that were not self-corrected.

**Results:** In simple reading condition very few errors were made. These were mostly lapses (22.3% of subjects), self-corrected (3.4%) and true errors (8.3%) were infrequent. In color naming condition the lapses were very frequent, 70.9% of subjects made this type of errors. Most subjects made only 1-2 lapses. Self-corrected errors were observed in 20% and true errors in 22.3% of subjects. In the nonmatching interference condition lapses were also very frequent (58.3% of subjects) but mostly no more than 3 lapses were made. Subjects also made self-corrected errors (42.7% of subjects) but true errors were more infrequent (27.7%). Most subjects made only 1-2 of these errors.

**Conclusions:** The pattern of errors in different ST parts varies. Immediately corrected lapses were most frequent. In color naming and nonmatching interference condition it is more difficult to self-correct as more errors were completed before correction and more errors were left uncorrected.

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**Y. LAI, H. CHEN, C. YANG & M. HUA. The Clinical Utility of the Family Pictures Subtest on Content- and Context-Related Memory Assessment.**

**Objective:** Both content and context memory play important roles in daily life, but most of the conventional measures often overlook the latter. The Family Pictures (FP) subtest of the WMS-III is an essential tool for measuring three major types of ecological-related memory information, character, location and activities, respectively reflecting content- and context-related memory. However, the current test merely provides a single summed score, restricting its utility to evaluate these two memory features. Thus, specific objectives of this study were to explore issues of the dissociability of the three types of memory attributes in terms of the concept of content and context memory, their psychometric properties and impacts of demographic variables on each sub-score. **Participants and Methods:** Two hundred and thirty two healthy adult participants in Taiwan were recruited by stratified sampling according to their demographic backgrounds and received the FP and a battery of neuropsychological tests.

**Results:** The results revealed that the three types of memory sub-scores were dissociable, and demographic variables including age, gender, and education did have marked impacts on each of the sub-scores. Meanwhile, the three-aspect measures seemed competent to respectively reflect content- and context-related features, and also demonstrated sound test-retest and split-half reliability and proper criterion-related and construct validity.

**Conclusions:** Based on the preliminary results, it appears that the FP subtest can impart an extensive and ecological-related panorama of memory function and closely link to the ensuing neurorehabilitation. Clinically, an inclusion of it in the routine neuropsychological assessment and research is thus suggested.

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**A. JAVURKOVA, J. RAUDENSKA, P. MARUSIC, L. FISEROVA & J. AMLEROVA. Can we Identify Malingered Neuropsychological Deficits in Temporal Lobe Epilepsy Patients?**

**Objective:** Memory functions connected to temporal lobes are routinely assessed pre and postsurgically in temporal lobe epilepsy (TLE) patients. The aim was to find subtests of neuropsychological battery that may be associated with malingering of memory functions. There is clear evidence of focal memory deficit in TLE patients. That is why we can expect some false positive malingering conclusions of neuropsychological test.

**Participants and Methods:** We included 19 left TLE patients (TLE sin), mean age 38.3 years, FIQ 98.1, and 22 right-sided TLE patients (TLE dx), mean age 39.1 years, FIQ 88.3. Patients were examined with standard neuropsychological battery, expanded with WAIS-III, executive functions (verbal and design fluency), memory functions (ROFT, RAVLT), personality (BDI, EPQ/R). We also used test for memory malingering (Rey 15-item memory test). All scores we correlated in both groups of epilepsy patients.

**Results:** We observed positive correlation between decreased scores of 15-items memory test and low intelligence. Ipsilateral nonverbal recall (delay and immediate) in TLE dx patients was altered. We observed positive correlation between temporal epilepsy and other subtest for malingering: Digit span in both groups and result of Vocabulary minus Digit span in group of TLE sin (i. e. ipsilateral memory deficit), nevertheless specificity and sensitivity of this procedure is very high (79% and 63%).

**Conclusions:** We found poorer cognitive test performance and ipsilateral memory functions deficit in patients with TLE. Results were associated with poorer malingering score.

Tests of malingering in neuropsychological assessment is certainly valid point, but this problem is more likely to impact false negative identification (i.e. miss true malingerers) than false positive identifications like in our group of TLE patients.

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**C. LAFOSSE, I. DE SMET, L. DEREYMAEKER, M. MOEREMANS, E. VAN MOER & E. KERCKHOFS. The Development of a Virtual Interactive Task-Dependent Assessment Combining Physical Responses With Sensory and Cognitive Tasks Demands.**

**Objective:** We designed an interactive virtual task-dependent platform that provides assessments in personal, peri-personal and extra-personal space combining a physical (postural or motor) response with perceptual and cognitive task-dependent challenges in a virtual environment.

**Participants and Methods:** 20 patients (age between 30-79 years) with a Vascular Cognitive Impairment (VCI) and with (N=10) and without (n=10) hemispatial neglect participated in this study. In extra-personal space the task is presented on a HD flatscreen 5m in front of the patient. We utilize a time-of-flight (TOF) camera (www.Silverfit.nl) that can track the full body movement of a patient in three dimensions. For registering responses in peri-personal space, we use a 22 inch digital tablet (DIN A3) where the patient performs visual scanning and search task by a visuo-motor response through computerized assisted testing (www.diagnoseis.nl).

**Results:** In personal, peri-personal and extra-personal space, independent sample t-tests and Chi-squared tests discriminated between the neglect and no-neglect VCI patients.

**Conclusions:** Our virtual interactive task-dependent assessment platform provides a reliable and valid assessment for the neglect patients in personal, peri-personal and extra-personal space combining a physical (postural or motor) response with perceptual and cognitive task-dependent challenges in a virtual environment.

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#### **S.C. LANTING & G.L. IVERSON. Reliability and Validity of the Ruff Neurobehavioral Inventory Cognitive Scale in Older Adults.**

**Objective:** There are very few well validated self-report cognitive screening tests. The purpose of this study was to examine the reliability and validity of the Ruff Neurobehavioral Inventory (RNBI) Cognitive Scale in older adults.

**Participants and Methods:** Participants were 60 older adults who were seen for a screening or comprehensive neuropsychological evaluation (age=63.2, SD=6.3; Range= 55-83; 45% were women). They completed the RNBI Cognitive Scale, Patient Health Questionnaire (PHQ-9), and an abbreviated anxiety questionnaire from the Psychiatric Diagnostic Screening Questionnaire (PDSQ-Anx). The RNBI Cognitive Scale consists of 24 items and it is comprised of four subscales with six items each. The subscales are Attention & Concentration, Speech & Language, Learning & Memory, and Executive Functioning.

**Results:** Cronbach's internal consistency reliability for the RNBI Cognitive scale was  $r=.93$ . The internal consistency reliabilities of the subscales were as follows: Attention & Concentration=.86, Speech & Language=.79, Learning & Memory=.79, and Executive Functioning=.71. In comparison, the internal consistency reliabilities of the PHQ-9 and PDSQ-Anx were .82 and .90, respectively. The Spearman correlations between the PHQ-9 and the RNBI were as follows: Cognitive Scale=.51, Attention & Concentration=.58, Speech & Language=.28, Learning & Memory=.30, and Executive Functioning=.61. The Spearman correlations between the PDSQ-Anx and other measures were as follows: Cognitive Scale=.52, Attention & Concentration=.50, Speech & Language=.28, Learning & Memory=.43, Executive Functioning=.53, and PHQ-9=.61. The intercorrelations among the RNBI subscales ranged from .44 to .77.

**Conclusions:** The RNBI Cognitive Scale had excellent internal consistency reliability and the subscales had acceptable to good internal consistency. The RNBI scales had small to medium correlations with measures of depression and anxiety.

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#### **A.M. POREH, I. KOROBKOVA & P. DINES. The Rey Auditory Verbal Learning Test Forced Choice Task for the Screening of Malingering.**

**Objective:** The purpose of the study was to examine the base-rate of a 15 item forced-choice task among patients with dementia.

**Participants and Methods:** 586 subjects were administered the Saint Louis Mental Status Exam and the Rey Auditory Verbal Learning Test as part of a battery aimed at differentiating between normal aging, Alzheimer's and Vascular dementia. All of the subjects also underwent either a CT or MRI study.

**Results:** The study showed that the forced choice (FC) performance correlated with the level of dementia with subjects scoring in the severe range (SLUMS=1 to 10; FC, Mean= 10.36 SD= 2.9) scoring lower than those with moderate (SLUMS=11 to 20; FC, Mean =13.35 SD=1.8) or mild dementia (SLUMS=21 to 26, Mean=14.07 SD=1.5). Subjects who scored in the normal range on the SLUMS also made few errors on the forced choice task (SLUMS=26 to 30, Mean=14.63, SD=1.244).

**Conclusions:** The current study provides data regarding the base rate of patients with dementia on various malingering indexes of the RAVLT. The study suggests that subjects with mild head trauma who obtain a mild to normal score on a mental status exam yet obtain less than 80% correct on the 15 item forced choice task are likely to be feigning cognitive symptoms.

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#### **M. URBANOVÁ, M. VYHNÁLEK, T. NIKOLAI, E. LITERÁKOVÁ, J. LACZÓ, J. HORT, K. SHEARDOVÁ & J. MICHALEC. Free and Cued Selective Reminding Test in Differential Diagnosis of Alzheimer's Disease and Frontotemporal Lobar Degeneration.**

**Objective:** Alzheimer's Dementia (AD) and Frontotemporal Lobar Degeneration (FTLD) are the two most common causes of degener-

ative dementia in elderly. Free and Cued Selective Reminding Test (FCSRT) is widely used memory test. The main purpose of the study is the validation of sensitivity and psychometric properties of FCSRT in the assessment of memory impairment in patients with AD and FTLD.

**Participants and Methods:** Forty-six patient with probable mild AD according to NINCDS ADRDA criteria, 17 with probable mild FTLD according to Neary's criteria and 45 normal controls underwent complex neuropsychological battery and 16 items picture version of FCSRT. "Cueing effect index" was count as (Cued recall / (16 - Free recall)) \*100. Groups were paired according to age.

**Results:** Both patient groups differed from controls in free and total recall ( $p<0.001$ ). AD patients differed from FTLD patients most significantly in total recall, AD patients scored significantly lower than patients with FTLD, proving that FTLD patients benefit more from cueing. Cut-off score for discriminating between AD and FTLD for Total recall was set on 9 with .92 sensitivity and .85 specificity, area under the curve (AUC) for this score was .911. Cut-off score for "Cueing effect" was set on 57% with .92 sensitivity and .85 specificity, AUC was .908.

**Conclusions:** Benefit from cueing is specific for FTLD patients compared to AD. Total recall and Cueing effect index is useful in clinical settings for differential diagnosis between AD and FTLD.

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#### **M. YOKOGAWA, D. TAMURA & K. INOUE. Advantage of Time-Reduced Psychomotor Vigilance Task.**

**Objective:** The psychomotor vigilance task (PVT) is a tool for assessing sustained attention of individuals. Normally, PVT requires 10 minutes to complete, but a shorter PVT time may be advantageous to participants. The purpose of this study was to examine the credibility of a 5-minute PVT.

**Participants and Methods:** The participants consisted of 9 healthy men and 7 women, each of whom carried out PVT for one 10-minute period and one 5-minute period. During PVT the participant's reaction time (RT) to the targeted stimulation was measured. Three shapes were used: circle, triangle and square, and the target was arbitrarily selected for each individual participant. The participant was instructed to press a button immediately the target appeared on the computer screen. The probability of occurrence of the target was 25%. The targets were randomly presented at varying intervals of  $2\pm 0.5$  seconds. The performance measures employed were mean RT, mean fastest 10% RT, mean slowest 10% RT and median RT. The participant's RT was measured during the following 4 task conditions: 10-minute PVT (A), 5-minute PVT (B), the first half of a 10-minute PVT (C) and the latter half of a 10-minute PVT (D). Using a linear regression analysis the relationship was analysed between A and B, C and D, A and C and B and C, respectively.

**Results:** RT, fastest 10% RT and median RT yielded a linear regression for all of the conditions. However, slowest 10% RT showed no significant linear regression for any of the conditions.

**Conclusions:** The results suggest that a 5-minute PVT can be used, but we should be aware of the interpretations of the finding for slowest 10% RT.

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#### **E. RÓDENAS, M. ARNEDO & M. TRIVIÑO. Neuropsychological Profile of Confabulators. Towards a sensitive assessment.**

**Objective:** Confabulations have been frequently associated with deficits in memory and executive functions, although the results are not consistent in the literature. This study aimed to define the profile of neuropsychological impairment in a group of confabulators, as well as to explore how a cognitive treatment can selectively improve it.

**Participants and Methods:** Eight patients took part in this study, receiving a neuropsychological treatment that reduced their confabulations effectively. A comprehensive neuropsychological evaluation were administered both pre and post-treatment. The functions assessed were: number of confabulations on Dalla Barba's Provoked Confabulation Interview (Dalla Barba, 1999), sustained and selective attention, verbal and visual memory, and executive functions.

**Results:** The neuropsychological profile in the pre-treatment evaluation was mainly characterized by a deficit in selective attention, auditory memory (learning, recall and recognition), presence of confabulations in the recall of a visual complex figure and planning. A T-Student analysis was performed comparing the results in the pre and post-treatment assessment, which showed a significant improvement specifically in selective attention ( $p=0.002$ ) and false positives in recognition of auditory material ( $p=0.004$ ). An improvement was also observed in the intrusions in free and cued recall of auditory material, confabulations in recall of visual material and planning (all  $ps<0.03$ ). Finally, a correlation analysis showed a significant positive correlation between false positives and number of confabulations ( $r=0.80$ ), and a negative one between false positives and selective attention ( $r=-0.72$ ).

**Conclusions:** This study provides new evidence about the neuropsychological indicators which seems to be related to confabulations, highlighting selective attention and discriminability memory processes. This profile could provide a sensitive assessment allowing an early detection of confabulators, as well as the design of more effective interventions. Correspondence: *Monica Triviño, Psychology; Neuropsychology; San Rafael Hospital, c/ Francisco Palau y Quer, nº8, portal 1, 30B, Granada 18006, Spain. E-mail: mtrivino@ugr.es*

### Cognitive Intervention/Rehabilitation

#### E. RÓDENAS, C. NOGUEROL, M. ARNEDO & M. TRIVIÑO. Effectiveness of a Treatment for Confabulations after Brain Injury.

**Objective:** Confabulations are considered an impairment in early filtering processes on memory recall, or in the later monitoring processes. Despite the amount of the hypotheses proposed, there is not known treatment. The main aim of this study was to design a treatment based on the current hypotheses in order to test its effectiveness.

**Participants and Methods:** Eight patients were included in the study. Inclusion criteria were to show spontaneous confabulations after acquired brain injury. A design A-B-A was administered, where A were the baselines and B the treatment. Treatment consisted of 9 sessions spread over 3 weeks, in which a brief material (12 stimuli per session) was presented to the patients. They were asked for a free and cued recall at both immediate and delayed moments. Finally they attributed the source to each recollection. After both recalls, a feedback was provided informing the patients about their errors and hits. Feedback was not provided in baselines.

**Results:** A T-Student analysis was performed comparing the baselines pre and post treatment. Confabulations showed a significant reduction,  $p=0.0002$ , as well as there were a significant increasing of the correct responses,  $p=0.001$ . However, the non-responses did not change,  $p=0.155$ . The correct source attribution responses increased significantly,  $p=0.004$ , while the errors in source attribution decreased in a very significant way,  $p=0.0003$ . Finally, a long term baseline was administered to five patients, results remaining the same.

**Conclusions:** This study shows, for the first time, the effectiveness of a treatment for confabulations. The improvement occurs in only three weeks producing a decrease of confabulations and an improvement in the quality of memory (more correct answers and better source attribution). Moreover, the changes are maintained long-term and generalize to daily life. These outcomes are very interesting not only from a clinical, but also from a theoretical point of view.

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#### L. ABEN, M.H. HEIJENBROK-KAL & G.M. RIBBERS. Patient Satisfaction after Memory Self-efficacy Training for Stroke Patients.

**Objective:** Memory Self-efficacy (MSE) training for patients in the chronic stage after stroke proved to be effective in increasing MSE scores and psychological quality of life in patients under 65, in comparison to a peer support control group. However, the found effect size is small to average (Cohen's  $d$  of 0.37), which suggests further improvements may be necessary. Also, older patients did not benefit from the MSE training. The current study aims to evaluate patient satisfaction after training in order to improve the training for (elderly) stroke patients.

**Participants and Methods:** In a Randomized Controlled Trial, 153 patients were allocated to either a MSE training program or a peer support group. After training, all participants were asked to evaluate the training, using an adapted patient satisfaction form. We used qualitative measures to determine patient satisfaction and further improve the training program.

**Results:** The response rate in the experimental group was 71% (55 out of 77 patients) and 70% in the control group (53 out of 76 patients). Overall, all patients participating in the experimental group were more satisfied after training, assigning an average rate of 8.0 on a ten-point scale. Main points for improvement were duration of the groups and the addition of practice to the theoretical content. The effects of fatigue were frequently mentioned.

**Conclusions:** These findings suggest that although in general patients were satisfied, there are several options to further improve the MSE training program. Longer and more sessions, additional practice and extra breaks to decrease fatigue may increase the effectiveness of the MSE training and make it more useful for older patients and in an earlier stage of rehabilitation.

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#### T. AKAMATSU & T. KAWAMATA. Effect of health tourism on motor and non-motor functions of people with Parkinson's disease in Kyoto.

**Objective:** The growing knowledge of Parkinson's disease (PD) has shown that people with PD also exhibit non-motor symptoms, such as depression and executive dysfunction affecting their quality of life (QOL), in addition to motor symptoms including tremor, rigidity, bradykinesia, and postural instability even in the early stages of the disease. It has been hypothesized that these deficits may result from dysfunction of processes normally controlled by basal ganglia-frontal lobe circuitry. In persons with PD and depression, motor symptoms and cognitive dysfunction progress quickly. The persons with PD require rehabilitation to prevent decline in cognitive function and emotional stability, and to maintain good QOL status.

The purpose of this study was to examine the impact of health tourism in Kyoto on the emotional and cognitive functions of people with PD.

**Participants and Methods:** Seventeen people with PD (age:  $63.7 \pm 7.6$  years; Hoehn and Yahr stage:  $2.7 \pm 0.6$ ) were recruited from PD support groups in local communities. All people were informed about the study, and they provided written informed consent. Neuropsychological status and motor imagery task performance were examined in all subjects. Each of PD people chose which historical sites of Kyoto to visit with an occupational therapist. The evaluation was performed 1 week before and after the visits to the places of interest.

**Results:** The PD people' mood and depression scores were significantly lower after visiting the historic sites of Kyoto than before the visits ( $p < 0.05$ ). The time taken to perform a virtual-reality walking task was also significantly reduced ( $p < 0.05$ ).

**Conclusions:** Visits to places of natural beauty and historical interest in Kyoto may have an impact on the depressive mood and motor imagery function of people with PD, leading to positive effects on brain activity.

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#### E. RUDOLPH, C. MOORE & C. ANDERSON-HANLEY. Exercising for Cognitive Health: Virtual versus Outdoor Cycling.

**Objective:** Research has demonstrated benefits of exercise on cognition, but it remains unclear whether adjusting certain variables can maximize the benefit. A recent study revealed that older adults who pedaled on a stationary bike with an interactive virtual landscape improved more than those who rode a traditional stationary bike (Anderson-Hanley et al., 2012). This study examined whether the cognitive benefit of a virtual cycling tour would be similar to that of a naturalistically occurring outdoor ride. We hypothesized that cognitive functioning would be relatively similar following a single bout of cycling in a virtual versus outdoor landscape.



**Participants and Methods:** Thirty-one adult participants were randomly assigned to one of two exercise conditions: (1) exergaming (stationary bike with an interactive virtual world), or (2) bicycling outdoors. Measures of executive function (Digit Span Backwards, Color Trails 2-1, Stroop C-B) were obtained following a 20-minute warm-up (baseline), and after the 20-minute cycling session (post-test).

**Results:** Repeated measures ANOVA revealed that virtual cyclists experienced improvement on one of three tests of executive function (Color Trails 2-1), while outdoor cyclists were unchanged ( $p = .02$ ).

**Conclusions:** There may be some cognitive advantage to a single bout of cycling through a virtual landscape versus naturalistic cycling. The results are intriguing and somewhat counter-intuitive since the more enriched experience of riding outdoors could arguably be expected to require more cognitive processing and thus have a greater impact on neuronal interconnections. However, it may be that the more focused processing required in the virtual tour yields a particular benefit in executive functioning at the intersection of the visuospatial realm (as in Color Trails). Results warrant further research to clarify the possible moderating role of heart rate or other physiological or psychological variables.

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**J. CHROMECC, T. OLIVARES, P. HUMPOLÍCEK, M. BETANCORT & M. GONZÁLEZ. The Efficiency of Self-Generated Cues in Face-Name Recall in Relapsing-Remitting Multiple Sclerosis.**

**Objective:** Several studies have been conducted to verify the generation effect in multiple sclerosis (MS) population. However, the benefit of self-generated learning for activities of daily living remains controversial. Objective: to assess the efficiency of a specific generation protocol with phonemic cues to enhance the face-name recall compared with didactically presented material in MS patients with mild cognitive impairment.

**Participants and Methods:** Method: 17 patients with clinically definite MS of relapsing-remitting type were studied (5 men, 12 women). Expanded Disability Status Scale did not exceed 3.5. The patients averaged 7.9 (SD=5.3) years from symptom onset. Firstly, the Hospital Anxiety and Depression Scale (HADS), the Multiple Sclerosis Neuropsychological Screening Questionnaire (MSNQ), the Fatigue Severity Scale (FSS), the Brief Repeatable Battery of Neuropsychological Tests (BRB) and first part of the generation protocol (presentation of the stimuli including faces, names and cues) were administered. Subsequently, the immediate recall measure was taken. During the delay period, the MS Quality of Life Questionnaire (MSQOL-54) was administered. Testing was completed with the delayed recall and recognition measure.

**Results:** Results: A repeated measures design to study the effects of condition (generated x didactic), recalled material (cues x names), strategies (contextual x facial feature x synonyms) and the delay (immediate x long-term recall) was conducted. A statistically significant effect of self-generated condition during long-term recall was found ( $F=6.189$ ;  $p<0.05$ ). Furthermore, significantly more names were recalled during long-term recall when aided by generated rather than didactic phonemic cues ( $F=4.558$ ;  $p<0.05$ ).

**Conclusions:** Conclusions: these preliminary results suggest that self-generation of information associated with the name via phonemic similarity can positively influence face-name recall in MS patients.

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**P.J. ESLINGER, N.H. BALLENTINE, M. ROYER, K. HOUSER, R. MISTRICK, R. BONNEAU, A. WILKERSON & D. WAGNER. Cognitive and Mood Effects of Therapeutic Optical Radiation in Long-term Care Residents.**

**Objective:** Optical radiation therapy, i.e., light therapy, has been described as a non-pharmacological intervention for mood, cognitive, and sleep disorders. The potential for its regular use with neurological patients is not yet clear. Since it has been estimated that long-term care patients receive only 10.5 minutes of high lux light exposure daily, we developed a double-blind, placebo-controlled trial to investigate the effect of optical radiation on standardized measures of cognition and mood in a sample of long-term care residents (mean age 85.3 years).

**Participants and Methods:** Fifteen participants were exposed to a treatment of approximately 400 lux of short-wavelength (blue) optical radiation while 13 were exposed to a placebo of approximately 75 lux of long-wavelength (red) optical radiation. Treatment and placebo conditions were administered for 30 minutes per day, Monday through Friday morning, for 4 weeks. Approximately one-half of each sample had a dementia diagnosis and two-thirds had a depression diagnosis.

**Results:** Outcome measures revealed that 3 of the 4 composite scores from the MicroCog test battery (i.e., general cognitive functioning, general cognitive proficiency, and information processing accuracy) as well as the Tension/Anxiety score from the Profile of Mood States inventory showed a significant treatment versus placebo effect. The light therapy protocol was then discontinued for 3 months and participants retested. Results indicated that the beneficial cognitive and mood effects had worn off and treatment sample scores returned to baseline.

**Conclusions:** Short-wavelength optical radiation treatment has the potential to lead to relatively quick and measurable cognitive improvements in nursing home elderly with and without dementia and may be a promising environmental intervention to reduce cognitive symptoms in long-term care residents. Further studies are needed regarding stability of effects with and without continued treatment.

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**J.A. FIELDS, A.M. LUNDE, S.M. HANNA, M.C. GREENAWAY, D.E. LOCKE & G.E. SMITH. A Multicomponent Intervention for Mild Cognitive Impairment Improves Mood and Cognition in Patients and Caregivers.**

**Objective:** This study sought to examine the impact of a multicomponent intervention program on mood, cognition and behavior in patients with MCI and their caregivers.

**Participants and Methods:** Newly diagnosed MCI patients referred to HABIT (Healthy Action to Benefit Independence and Thinking) attended a 10-day program that included memory compensation training, mind-body movement, brain fitness training, group therapy, and wellness education. One hundred forty-nine participant/ caregiver dyads completed mood, quality of life (QOL), functional ability, patient self-efficacy, and caregiver burden surveys at baseline and 3 months post program. These surveys were also collected at baseline and 3 months later from 66 control dyads, i.e., individuals with MCI and their partners who did not go through HABIT.

**Results:** Mixed-model analyses of variance showed that HABIT MCI participants showed significant improvements in depression ( $p=.002$ ), anxiety ( $p<.01$ ), and QOL ( $p<.0001$ ) and experienced fewer and less severe neuropsychiatric symptoms ( $p<.01$  and  $p=.04$ , respectively) 3 months post intervention. MCI controls showed no change on any of these variables except for a trend towards improvement in depression ( $p=.06$ ). HABIT MCI caregivers showed significant reductions in depression ( $p<.01$ ), anxiety ( $p<.0001$ ), and distress ( $p<.02$ ) and a trend towards improved QOL ( $p=.07$ ). Caregivers of MCI controls showed no change. Furthermore, higher memory compensation learning scores for MCI participants who completed the HABIT program were significantly associated ( $p<.001$ ) with higher scores on a measure of instrumental ADLs that assesses memory, language, visuospatial abilities, and executive functioning.

**Conclusions:** Multicomponent behavioral interventions such as HABIT can help individuals with MCI and their caregivers adjust to the disease and its consequences on cognition and well-being, potentially leading to reduced healthcare costs and extended time to nursing home placement.

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**K. HASHIMOTO, M. NOTOYA, H. HARADA, N. SUNAHARA, T. FUJITA, K. NAKATANI, M. ITO & T. YOSHIZAKI. Relationship between verbal IQ (VIQ) scores in hearing-impaired children and reading tests.**

**Objective:** A large number of studies have been conducted on a delay in language acquisition among people with hearing impairment. However, our previous studies have reported that most hearing-im-

paired children undergoing the Kanazawa Method training, a multi-sensory-based language training method implemented in our institution, have acquired the same level of language skills as hearing children. At a mid-year meeting of the INS Conference 2012, we conducted a survey of VIQ, involving eighteen hearing-impaired children aged nine years or older whose performance IQ (PIQ) was within the normal range. The results were as follows: The VIQ score was between 60 and 124, and the median was 92. Fourteen of the eighteen children received the VIQ score within the normal range, and sixteen answered the questions orally in the test. In the present study, a reading test was conducted, involving hearing-impaired children with the PIQ score within the normal range, as the subjects of the previous study, to examine the relationship between VIQ/PIQ and reading ability.

**Participants and Methods:** Subjects were fifteen of the eighteen subjects of the previous study who underwent a one-on-one reading test: Kyoken (Education and Research Association)-style Reading Test.

**Results:** There was no correlation between the PIQ and VIQ scores received by the fifteen children, whereas a significant correlation was noted between the Kyoken-style Reading Test and VIQ scores. Whereas children with a hearing level of 80 dB or higher received a mean deviation score of 48.1 for Kyoken-style reading ability, those with less than 80 dB earned a mean deviation score of 57.8. There was no marked difference between the two groups.

**Conclusions:** It was suggested that there was a marked correlation between the VIQ scores received by hearing-impaired children and the PIQ score within the normal range and their reading test scores. This means that a high PIQ is not necessarily required to acquire reading ability.

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#### **M. HOLLEMAN, S. SMEETS & M. VINK. Effects of a Comprehensive Neuropsychological Rehabilitation Programme (Intensive NeuroRehabilitation, INR): Results of a Waiting-List Controlled Study.**

**Objective:** The Intensive NeuroRehabilitation (INR) programme is a comprehensive, neuropsychological outpatient rehabilitation service focusing on problems following from cognitive, emotional, and behavioural changes persisting in the chronic phase after acquired brain injury (ABI). It consists of two times seven weeks of therapy (four days a week), with a two-week 'home practice break' in between. We expected patients to experience benefits in the domains of emotional well-being, coping, and quality of life. Performance on neuropsychological tests is not expected to improve.

**Participants and Methods:** 59 patients (37 male, 22 female) with ABI (e.g., traumatic brain injury, stroke, extirpated tumour) were included in the control or experimental group based on time of referral. The waiting-list control group (N=21) underwent two assessments, 14 weeks apart, before treatment, while the experimental group (N=38) underwent a pre- and post-treatment assessment. Differences between the pre- and post-treatment assessment (experimental group) were compared to differences between baseline and pre-treatment assessment (control group).

Assessment consisted of questionnaires (psychopathology, coping, quality of life) and neuropsychological tests (attention, memory, executive functioning).

**Results:** In a pilot study, a multivariate analysis of variance (N = 37) rendered a significant effect of group (Wilks'  $\lambda = 0.771$ , F3, 33 = 3.000,  $p = 0.033$ ) regarding depression, anxiety, and quality of life. Using t-tests with pooled z-scores, no changes were seen in neuropsychological test results. The current study includes new data from more recently included patients, as well as analysis of data regarding coping.

**Conclusions:** Patients with traumatic brain injury benefit significantly from the INR programme with regard to emotional well-being, and quality of life. The programme does not influence neuropsychological performance.

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#### **H. KAFADAR, Z. AKINCI & B. ÇAKIR. IQ UP Cognitive Training Program's Effect On The Cognitive Improve.**

**Objective:** In this research, whether IQ UP Cognitive Training Program, which has been prepared to solve various problems that may emerge depending upon the cognitive processes in daily life, is effective on healthy children was examined empirically.

**Participants and Methods:** IQ UP Cognitive Training Program is a brain training program enabling participants to use cognitive processes actively. To this end, 201 healthy participants between 10-12 years of age were included in the research. Neuropsychological tests measuring the cognitive processes such as memory, attention, problem solving, general ability, planning, and working memory were applied as pretest to the participants both in the experimental and control group. Following these tests, 131 participants in the experimental group took part in the IQ UP Cognitive Training Program for 30 days, 5 days in a week and 45 minutes per day. On the other hand, the participants in the control group did not receive any training. At the next stage, the neuropsychological tests were reapplied to the participants in both the experimental and control groups.

**Results:** The final neuropsychological test averages of the participants in experimental group were higher than those of the participants in the control group. According to the statistical analysis results, IQ UP Cognitive Training Program affects the cognitive development of children positively.

**Conclusions:** The benefits of the cognitive training programs are not limited to the healthy people. It is particularly crucial to search if these programs are effective as a treatment method for both children and adults with attention deficit, hyperactivity disorders, learning difficulty, dyslexia, autism, head trauma, mild cognitive disorder, dementia and other similar neurological and psychiatric illnesses. It is necessary to examine with various empirical research studies whether the IQ Up Cognitive Training Program also has effects on the aforementioned illnesses as a treatment method.

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#### **D. KIMURA, T. TAKEDA, N. SUNAHARA, T. FUJITA, K. NAKATANI & M. NOTOYA. Covariance structure analysis to determine the factor influencing cognitive functions in elderly people.**

**Objective:** In 2007, we started the Taketoyo Project (TKP) as a measure for dementia prevention. The aim was to determine the factor influencing cognitive functional decline using data from the TKP.

**Participants and Methods:** Data of 366 individuals who participated in the TKP between 2007 and 2011 was analyzed the present study. In the TKP, physical and cognitive functions and a self-administered questionnaire are evaluated every year. In this study, we used 15 variables, which covered the 3 components described by Fratiglioni et al. First; each variable was categorized for factor analysis. Then, we constructed a model in which a category affected the cognitive functional decline. Finally, we performed a covariance structure analysis to calculate the standardization coefficient and correlation coefficient for every factor.

**Results:** Using factor analysis, the categories were classified into the following five factors: "Mentality," "Cognition," "Communication," "Competence of life range," and "Going out." Using these factors, we performed a covariance structure analysis. The values for the goodness-of-fit, adjusted goodness-of-fit, and root mean square error of approximation were 0.95, 0.95, and 0.50, respectively, indicating a good fit for the covariance structure analysis. The standardization coefficient for "Competence of life range" (0.53) and "Going out" (0.51) indicated that these two factors strongly influenced cognitive functions. In addition, "Mentality" was related to "Competence of life range" (0.51) and "Going out" (-0.69).

**Conclusions:** "Going out" and "Competence of life range" are related to physical activeness. Walsh et al. reported that the social network of elderly people who are physically very active is strength. In addition, elderly people who go out frequently have good social networks. Furthermore, high competence of life range is required for having an enrichment social network. An enrichment social network has protective effects on cognitive functional decline.

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**G. KINSELLA, B. ONG, K. PIKE, E. MULLALY & E. RAND. Are Neuropsychological Measures Informative in Measuring Outcome of Memory Strategy Training in Older People?**

**Objective:** In response to the rapidly growing field of memory training for older people, there is a need to evaluate the most informative methods of measuring outcome. In this study we investigate outcome following a memory group program and evaluate the relationship between different measures of outcome.

**Participants and Methods:** In a randomized controlled trial, 113 healthy older adults (age  $M = 72.7$  years,  $SD 6.9$ ) were randomly allocated to an early or late six-week intervention (the LaTCH Memory Group Program) which provides knowledge about memory strategies and how to use such strategies in everyday activities. Outcomes included knowledge of memory strategies and when to use them, frequency of strategy use in everyday life (Multifactorial Memory Questionnaire), achievement of personal memory goals (using Goal Attainment Scaling), and performance on neuropsychological memory tests (including CVLT II).

**Results:** Following intervention, and co-varying for pre-intervention performance, the early intervention group of healthy older adults was found to have greater knowledge of memory strategies and when to use them ( $\eta^2 = .22$ ), used memory strategies more frequently in everyday activities (internal strategies  $\eta^2 = .20$ , external strategies  $\eta^2 = .09$ ) and achieved more of their own personal memory goals ( $\eta^2 = .09$ ). In contrast, memory performance on the CVLT II did not significantly change ( $\eta^2 < .01$ ). These group differences were maintained at 6 month follow-up.

**Conclusions:** Choice of an outcome measure for evaluating the effects of cognitive training for older people requires determining whether the focus is to minimise emerging disability in everyday activities by facilitating behavior change and using compensatory strategies, or whether the focus is to reduce primary impairment in memory as measured by standard neuropsychological tests. Gains from intervention may not be present in both domains.

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**A. KOLK, M. SAARD, K. MASSO, M. KALDOJA, T. RAUD, O. TEEVEER & K. SHIMON. Attention rehabilitation in children with neurological disorders using FORAMENRehab software – efficacy of two different rehabilitation designs.**

**Objective:** Few systematically controlled neurocognitive rehabilitation techniques for children exist.

The aim of our study was to create a better rehabilitation design for children with attention deficit. The efficacy of two different intervention designs was evaluated.

**Participants and Methods:** 16 children aged 9-12 years ( $M=10.79$  yr,  $SD=.86$ ) with focal epilepsy (FE) and mild traumatic brain injury (mTBI) participated. During 5-week-period patients received individual supervised computer-based training twice a week with the FORAMENRehab Attention software (Sarajuuri et al, 2000), which we modified for children.

Two different sets of baseline assessment tasks (easy; more advanced) and training protocols were used. First design included 8 patients with FE or mTBI, second design 8 patients with FE. Children's improvement in training was evaluated through change in baseline assessment tasks and compared separately for two designs.

**Results:** The first design (easier baseline assessment) demonstrated slight improvement in sustained and complex attention. Increase of correct choices and decrease in missing choices was revealed in paced search dual targets task (complex attention) ( $p<.01$ ).

The second design (more difficult) revealed improvement in sustained and complex attention, and in tracking. In simple search task solving time improved ( $p=.003$ ). In paced search dual targets task correct choices increased ( $p=.014$ ) and wrong and missing choices decreased ( $p<.02$ ). In addition task number of correct answers ( $p=.042$ ) increased. In word search task correct choices increased and missing choices decreased ( $p<.03$ ), the same occurred in PASAT task ( $p<.05$ ).

**Conclusions:** Modified FORAMENRehab intervention is efficient for attention deficit rehabilitation in children. The comparison of two designs revealed that when using more difficult baseline assessment, children's progress was more evident. New design showed important improvement in sustained attention, complex attention and tracking functions.

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**T. LOETSCHER & N.B. LINCOLN. Systematic Review Of Cognitive Interventions For Attention Deficits Following Stroke.**

**Objective:** Survivors of stroke frequently complain about impairments in attention. The aim of this systematic review was to assess the evidence from randomized controlled trials (RCTs) on the effectiveness of cognitive rehabilitation for attention after stroke. Primary outcomes of this review were measures of global attentional functions; secondary outcomes were measures of the domains of attention and functional abilities.

**Participants and Methods:** RCTs were identified through searches of the Cochrane Stroke Group Trials Register, Medline, EMBASE, CINAHL and PsychINFO databases (search Oct 2012). The review was confined to trials of cognitive rehabilitation specifically aimed at impairments of attention after stroke. Trials in which patient selection for attentional training was based on general cognitive impairments or other cognitive functions (e.g. aphasia) were excluded.

**Results:** Six RCTs with 223 participants met our inclusion criteria, but none of them had a low risk of bias in all methodological domains specified by the Cochrane Collaboration. Meta-analyses demonstrated no statistically significant long term effects of cognitive rehabilitation on global measures of attention, domains of attention or functional outcomes. In contrast, a statistically significant effect was found, in favour of cognitive rehabilitation, for immediate effects on measures of divided attention (SMD 0.67; 95% CI 0.35, 0.98). There were no significant immediate treatment effects on all other measures.

**Conclusions:** There was a significant effect of cognitive rehabilitation on divided attention at the end of the intervention period, but there was no evidence that these benefits persisted. In addition, there was no evidence to support or refute the effect of cognitive rehabilitation on other measures of attention, functional abilities, mood and quality of life. The methodological quality of the trials identified and the paucity of studies means that we can draw very limited conclusions about the effect of cognitive rehabilitation for attention.

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**E. BENGOTXEA, J. PEÑA, A. GARCÍA, P. SÁNCHEZ, E. ELIZAGÁRATE, J. EZCURRA, M. GUTIÉRREZ & N. OJEDA. Baseline predictors of functional outcome improvement after a cognitive remediation program.**

**Objective:** The efficacy of cognitive rehabilitation in the improvement of functional outcome in schizophrenia has been widely recognized. However, the improvement degree varies between patients. The goal of this study was to identify if socio-demographic, clinical and cognition variable at baseline predict the patients' functional improvement

**Participants and Methods:** Ninety-three patients with chronic schizophrenia were recruited to attend REHACOP during 3 months. This structured cognitive remediation program is designed to improve cognitive functioning and functional outcome. All subjects underwent pre and post treatment clinical, neuropsychological and functional assessment. In order to have a better understanding of functional improvement, four functional disability indicators were analyzed: self-care management, social competence, vocational outcome and family contact.

**Results:** Multiple linear regressions revealed that 49.8% of the variance in CAF was explained by verbal memory ( $\beta=6.56;p=0.031$ ), emotional distress ( $\beta=1.24;p=0.004$ ), and premorbid adjustment ( $\beta=0.19;p=0.034$ ). Improvement in DAS-WHO was partially predicted by attention ( $\beta=-1.52;p=0.049$ ), verbal memory ( $\beta=-1.83;p=0.005$ ), and emotional distress ( $\beta=-0.23;p=0.04$ ) ratings, explaining 44% of the variance. Emotional distress explained 18% of the variance in social

competence ( $\beta=-0.72;p=0.018$ ) and 33.6% in vocational outcome ( $\beta=0.11;p=0.002$ ). Emotional distress ( $\beta=-0.13;p=0.000$ ) and disorganization ( $\beta=0.08;p=0.012$ ) ratings explained 37.3% of the variance in family contact improvements. Positive symptoms ( $\beta=-0.79;p=0.013$ ) predicted improvement in self-care, explaining 63% of the variance.

**Conclusions:** Results suggest that specific baseline clinical symptoms and cognitive impairments partially predict functional outcome improvement obtained after cognitive remediation. According to these findings, we could partially predict the profile of patients that will benefit more from cognitive rehabilitation programs.

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**M. PITTERI, G. ARCARA, L. PASSARINI, F. MENEGHELLO & K. PRIFTIS. On The Need for Repeated Assessments in Neglect Rehabilitation: A Preliminary Investigation.**

**Objective:** Quantitative neuropsychological tests require consideration of performance variability. There are different types of variability and they might have different implications in clinical practice. The intra-individual variability (IIV) among consecutive administrations of the same test is the most important factor in assessing patients' performance. IIV could be present either within the same testing session, or over separate sessions of testing. It is well known that focal and large lesions, especially in the frontal lobe of the right hemisphere, result in increased IIV.

**Participants and Methods:** We present the case of a patient (GR) with left unilateral neglect (LUN), after right-hemisphere-damage, who showed high IIV in performance on some visuo-spatial tests, completed during repeated sessions of different rehabilitation treatments (e.g., Limb Activation Treatment -LAT- and Contralateral Arm Vibration -CAV-). An ABAB design was used; treatment A consisted of repeated sessions of LAT, whereas treatment B consisted of repeated sessions of LAT+CAV. Each rehabilitation block comprised ten sessions of one hour each, held one time a day, five days a week. The whole rehabilitation program was completed in about eight weeks.

**Results:** The effect of treatments was investigated by means of a time-series analysis (Young, 1941). Although consistent differences were not found between the two treatments, a generic effect of improvement in time was observed.

**Conclusions:** Theoretical considerations on the effects of IIV are provided, to show the potential impact of IIV on assessment and on monitoring the outcome of cognitive rehabilitation. We argue that having multiple, repeated measures of LUN patients' performance during cognitive rehabilitation might give a more clear picture of the presence (or absence) of patients' improvements. Informative visuo-spatial tests for observing the LUN patients' IIV during rehabilitation treatments are an essential strategy to adopt in the future.

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**T.S. RIVERO, E.H. QUIRINO, L.F. MALLOY-DINIZ, R. PIETROBON & O.F. AMODEO. Dissociation between attention and motor control in a video game a training: Prototype data.**

**Objective:** Our central goal involves the creation of a game that can train inhibitory control for adolescents with ADHD. We hypothesized that through a task in which adolescents needed to focus on a target who switches its behavior randomly, adolescents would have a better attentional performance assessed by several intra-game measurements.

**Participants and Methods:** 9 subjects (8 men) were evaluated during 12 game stages designed to train attentional control. The subjects' age ranged from 14 to 28 years ( $M = 19.33$ ,  $SD: 4.92$ ). All the behavioral measures were collected through Mechanical Turk (<https://www.mturk.com/>), a mechanism for online data collection. Three different behavioral measures were evaluated: Correct hits, Omissions and Commissions (hit the target too soon).

**Results:** Each of the three behavioral measures contained 12 observations. A statistical analysis performed involved 3 weighted points that were grouped as: stage 1 and 2 (initial performance), stage 5 and 6 (average performance) and stage 11 and 12 (final performance). To evaluate these three points in time, we used the nonparametric Friedman test.

There was a significant increase in correct hits,  $\chi^2(2) = 14,000$ ,  $p = 0.001$ , and significant decrease in omissions,  $\chi^2(2) = 7,538$ ,  $p = 0.023$ . No difference was found for commission measures. A Wilcoxon signed-rank test showed differences between the initials stage compared to final stages ( $Z = -2,371$ ,  $p = 0,18$ ), for correct hits. For omission we found a trend between the initial stage and final stage 11\_12 ( $Z = -1,890$ ,  $p = 0,59$ ).

**Conclusions:** Our data are still preliminary, considering that this is only the prototype task and out sample size. Our results tended to show that with training, our subjects, present more correct hits and trend to decreased attentional errors. These results associated with no significant change in motor behavior seems to point to the direction that our proposed training task can be selectively used for attentional control stimulation, without affecting the motor control.

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**M. SHIBASAKI & A. TAKASHITA. The Effectiveness of Cognitive Rehabilitation of Response Inhibition Deficits in a Patient with Chronic Prefrontal Lesions: A NIRS Study.**

**Objective:** Response inhibition, an important domain of executive function, is frequently impaired in patients with prefrontal cortex lesions, which may negatively influence both the patients' cognitive performances and social activities. This study investigated the effectiveness of cognitive rehabilitation of response inhibition deficits in a patient with chronic prefrontal lesions by using near-infrared spectroscopy (NIRS) and behavioral measurements.

**Participants and Methods:** OT, a 41-year-old right-handed man who exhibited chronic severe executive dysfunction due to bilateral prefrontal lesions received 6-month restorative cognitive rehabilitation to improve his response inhibition process. The intervention consisted of repeated computerized exercises with stimulus-response (S-R) compatibility tasks; the degree of response inhibition that was demanded by the tasks was manipulated. The target behaviors of the rehabilitation were decreases in error rates and reaction times of the tasks. A 16-channel NIRS device was used to measure prefrontal activation during the tasks before and after the training and at a 1-month follow-up. Sixteen healthy, right-handed participants performed the same S-R compatibility tasks, and their prefrontal activities during the tasks were recorded.

**Results:** OT exhibited severe response inhibition deficits in S-R incompatible conditions before the training, but his behavioral performances in the S-R incompatible conditions were markedly improved after the training. NIRS revealed that OT's left prefrontal activation in the conditions required higher response inhibition, which significantly increased after the training, and this effect was maintained at the 1-month follow-up.

**Conclusions:** The cognitive rehabilitation of response inhibition deficits influenced the behavioral measures and the patient's prefrontal activities, as measured by NIRS. These results suggested that cognitive rehabilitation intervention might produce plastic changes in the brains of patients with acquired, chronic brain injuries.

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**H.J. WESTERHOF - EVERS, A.C. VISSER - KEIZER & J.M. SPIKMAN. Emotion perception in traumatic brain injury: an exploratory eye tracking study.**

**Objective:** Many individuals who sustain a traumatic brain injury (TBI) are impaired in their ability to identify facial emotional expressions. However, the scanning pattern of these patients during emotion perception is not studied sufficiently so far. The aim of this study was to explore the visual scanning pattern of RS, a patient with traumatic brain injury suffering from deficits in social cognition. RS was tested before and after an intensive social cognition treatment (T-ScEmo) in which strategies for emotion perception were offered.

**Participants and Methods:** RS (38 year old male, 8 months after TBI) completed neuropsychological tasks including measures for emotion perception, before and after treatment. Eye-tracking was used to monitor scanning behavior of RS while looking at basic (anger, disgust, fear, happiness, sadness, surprise) and complex (embarrassment, contempt) facial emotional expressions.

**Results:** After treatment RS's visual scanning pattern had changed. In general the total fixation time spend on the regions of interest [eyes and mouth] increased, while his emotion perception had improved.

**Conclusions:** This exploratory data suggests a relation between the visual scanning of emotional faces and emotion perception. Therefore, training of emotion perception with regard to exploration of regions in the face might be helpful for patients struggling with this impairment.

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### Multiple Sclerosis/ALS/Demyelinating Disorders

**R.J. BLANKESPOOR, S.H. VOS, A.E. SPECKENS & B.A. DE JONG. Subjective and Objective Cognitive Functioning in Multiple Sclerosis Following Mindfulness-Based Cognitive Therapy.**

**Objective:** Cognitive impairment is an important cause of dysfunction in people with multiple sclerosis (MS) and affect quality of life. Mindfulness enhanced cognitive function in healthy subjects, and potentially improved health measures in MS patients. We report the preliminary findings of a pilot study in a sample of MS patients not cognitively impaired. We hypothesized that after mindfulness-based cognitive therapy (MBCT) 1) objective cognitive performance would improve and 2) self-reported memory complaints would diminish.

**Participants and Methods:** This study is an uncontrolled within-subject, pre-posttest design. 23 Patients attended 8 weekly 2.5hour MBCT-sessions. The following (parallel)tests were used pre- post-intervention: Rey Auditory Verbal Learning Test and Location Learning Task (LLT) (memory), Paced Auditory Serial Addition Task (PASAT) (complex information processing), Number-letter Sequencing (executive functioning), Letterfluency (verbal fluency), Multifactorial Memory Questionnaire (subjective memory). 8 Patients were excluded due to missing data (n=7) and deviating cognitive measures (<2SD; n=1). The final analysis included 15 patients (age M = 54.7 years, range 43-63).

**Results:** Paired sampled t-tests were used one-tailed, as direction of hypotheses were previously set. Performance on the LLT improved from pre- (M = 22.13, SE = 5.11) to posttest (M = 14.47, SE = 2.99),  $t(14) = 2.01$ ,  $p$  (one tailed) < .05,  $r = .47$ . Information processing tested with the PASAT also improved from pre- (M = 47.80, SE = 2.32) to posttest (M = 51.33, SE = 2.08),  $t(14) = -1.86$ ,  $p$  (one tailed) < .05,  $r = .45$ . Two other tests directed towards improvement, albeit not significant. Memory complaints decreased but not significant.

**Conclusions:** MBCT shows potential effects on objective and subjective cognition, as memory complaints, albeit non-significant, decreased, which was partly supported by objective measures. Future research should improve methodological and conceptual issues and focus on cognitively impaired patients.

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**K. CHEN, J. CAGA, S. HSIEH, M. KIERNAN & E. MIOSHI. Cognitive And Behavioural Deficits in Motor Neuron Disease Are Not Associated With Site of Disease Onset or Disease Progression.**

**Objective:** To investigate the relationship between disease staging and cognitive and behavioural changes in MND. We also investigated whether there were differences in cognitive and behavioural changes between limb-onset and bulbar-onset patient groups.

**Participants and Methods:** Fifty six patients were included following current ALS diagnostic criteria. Patients underwent general cognitive and neuropsychiatric assessments, with 56 patients completing an ACE-R and a corresponding ALSFRS-R, and a subset of 34 patients also completing a CBI-R. The resulting data was analysed using independent t-tests and Pearson correlation tests.

**Results:** 26.4% of patients were found to be cognitively impaired (below the 82 cut-off). There was no relationship found between the severity of disease and the level of cognitive impairment. Apathy was the most common (52%) behavioural dysfunction, followed

by disinhibition and stereotypical behaviour. There was an association between behavioural and cognitive changes, with apathy having a negative correlation with general cognition (ACE-R) scores. There was no significant difference between limb and bulbar onset groups in terms of cognitive deficits, disease staging or behavioural dysfunction.

**Conclusions:** The present findings demonstrated that site of disease onset is not an adequate categorization to identify patients who will present with cognitive and behavioural symptoms. MND patients with limb onset also present with non-motor symptoms and should be equally evaluated and receive appropriate advice, alongside their family members. Correspondence: *Eneida Mioshi, PhD, Neuroscience Research Australia, Barker St, PO Box 1165, Randwick, Sydney, NSW 2031, Australia. E-mail: e.mioshi@neura.edu.au*

**K. VAN DER HIELE, N. KAMMINGA, R. RUIMSCHOTEL, H. MIDDELKOOP & L. VISSER. How Accurate are Self-Reports of Executive Functioning in Patients with Multiple Sclerosis?**

**Objective:** Self-reports of cognitive functioning provide an important source of information for clinicians. These reports may not always be accurate, and are susceptible to psychological influences. Our main objective was to examine psychological characteristics of patients with Multiple Sclerosis (MS) who underestimate, overestimate or accurately estimate their executive performance.

**Participants and Methods:** 114 MS patients from a community-based sample completed questionnaires on cognitive complaints and psychological characteristics. A subset of participants underwent cognitive and neurological assessments. The Behavioural Assessment of the Dysexecutive Syndrome was used to provide self-ratings and informant-ratings of executive functioning, and to examine the patient's actual executive skills. Patients were then classified as underestimators (N=17; 14.9%), overestimators (N=16; 14.0%), or as accurately reporting no executive impairment (N=76; 66.7%). Parametric and non-parametric statistics were used as appropriate to examine group differences.

**Results:** We found that MS patients underestimating their executive performance were characterised by more depression, anxiety, and psychosocial stress, and more often used the coping style 'disclosure of emotions' than accurate estimators and overestimators ( $p$  values <=0.002). Underestimators displayed a more passive reaction pattern ( $p=0.014$ ) than accurate estimators. Informant-based reports decreased the percentage of underestimation but not overestimation.

**Conclusions:** The majority of self-reports of executive performance are reliable, but 29% of the MS patients either underestimated or overestimated their executive abilities. Underestimating executive abilities was related to psychological problems and dysfunctional coping styles. Our findings underline the limitations of self-report in patients with psychological difficulties. Informants provide more accurate reports, but should not be seen as the 'gold standard'.

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**K. VAN DER HIELE, N. KAMMINGA, R. RUIMSCHOTEL, H. MIDDELKOOP & L. VISSER. Psychosocial Stress in Patients with Multiple Sclerosis.**

**Objective:** Stress has been associated with increased relapse risk in Multiple Sclerosis (MS). Especially moderate chronic stressors, related to family, work or financial tensions, may lead to increased vulnerability to inflammation in MS. The current study focuses on daily hassles, which by their chronic and accumulating nature can cause considerable psychosocial stress. Our main aim was to investigate the frequency, associated distress and type of daily hassles encountered by Dutch MS patients from a large community-based sample. Our second aim was to examine which demographic, psychological and disease-related factors are associated with high levels of psychosocial stress.

**Participants and Methods:** 715 MS patients from a community-based sample completed questionnaires concerning demographics, disease characteristics, physical functioning, daily hassles, fatigue, depression and anxiety. Results concerning the frequency and distress associated with daily hassles were compared with published Dutch norm data. A logistic regression analysis was used to examine factors associated with high levels of psychosocial stress.

**Results:** More than 50% of the participants reported a high number of daily hassles (57.5%) and high levels of associated distress (55.7%). Frequently mentioned daily hassles concern personal functioning and social developments. A logistic regression model revealed that being female, being younger, having a higher educational level, using benzodiazepines, exhibiting more symptoms of anxiety, and a higher physical impact of fatigue were all independently associated with high levels of psychosocial stress.

**Conclusions:** A majority of MS patients experience high levels of psychosocial stress. Potential risk factors include being female, having a higher educational level, using benzodiazepines and exhibiting more symptoms of anxiety. These findings underline the need to incorporate stress and anxiety management strategies in (psycho)therapeutic interventions.

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### **S.H. VOS, R.J. BLANKESPOOR & B.A. DE JONG. Personality Traits in Multiple Sclerosis Relate to Subjective Cognitive Functioning.**

**Objective:** Multiple sclerosis (MS) is a progressive neurological disease of the central nervous system, characterized by physical and e.g. cognitive, personality and affective changes. Nowadays attention increases for cognitive dysfunction in MS. Consensus has emerged that roughly 50% of MS patients are cognitively impaired. In this study, we focus particularly on subjective memory complaints as we know from the neuropsychological literature that subjective complaints do not necessarily correlate with objective performance. We hypothesized that subjective cognitive function is related to personality traits in MS. That is, we tested as to whether MS patients scoring high on neuroticism also had more subjective memory complaints than patients with low scores.

**Participants and Methods:** As part of clinical care, 40 MS patients (age M = 51.2 years, range 34-67) filled in the Multifactorial Memory Questionnaire measuring a) memory worries b) daily forgetfulness and c) memory strategy use. The NEO Five Factor Inventory was used to investigate personality traits (e.g. Neuroticism). Patients performed the Rey Auditory Verbal Learning Test (RAVLT) to assess objective memory. Pearson correlation analyses were performed on all raw scores.

**Results:** Patients reported above average daily forgetfulness, but only two patients scored below 2 SD on the RAVLT. Subjective and objective memory performance scores did not correlate. Neuroticism scores were elevated, and correlated significantly with subjective feelings of daily forgetfulness ( $r(38) = .34, p < .05$ ), but not with objective memory performance.

**Conclusions:** The personality trait neuroticism was elevated in this clinical sample of MS patients, and correlated significantly with subjective feelings of daily forgetfulness but not with objective cognitive performance. Personality could be an important factor in how patients perceive their own cognitive functioning. This should be taken into account in both neuropsychological assessments and cognitive rehabilitation programs.

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## **Epilepsy/Seizures**

### **P. KLAAS, K. WADESON, N. SAMBAMURTY & J. MOSHER. Response Latencies to Median Nerve Stimulation in Patients with Intractable Epilepsy.**

**Objective:** Studies of evoked responses (visual and auditory) in small groups of patients with epilepsy have found that these individuals have longer cortical response latencies than other patient populations (Major, 2011). This investigation examines cortical response latencies to median nerve stimulation using magnetoencephalography (MEG). A prior research sample (Wikström et al., 1997) with a normal population identified primary somatosensory responses at 20, 35 and 60 ms. We sought to determine whether cortical response latencies would be different within a sample of patients with intractable epilepsy.

**Participants and Methods:** The group consisted of 43 patients (mean age 32.6, 22 males) with medically intractable epilepsy who had me-

dian nerve stimulation as part of the clinical protocol for MEG. Left and right median nerves were alternately stimulated at the wrist. Data were processed and analyzed with the BrainStorm software package and response latencies and demographic information were entered into an SPSS database for analysis.

**Results:** Intragroup analysis found a significant positive correlation between epilepsy duration and the M20 response; patients who had epilepsy longer had longer response latencies. Males had longer response latencies for the M20 in both hemispheres. A significant correlation also exists between age and M20 latencies for males and females. These patients demonstrated unusual patterns of cortical activation.

**Conclusions:** Patients with intractable epilepsy show a difference in the speed with which information reaches the somatosensory cortex. Examination of differences in cortical activation patterns and aspects of the MEG results could help in determining connectivity. Further research with a larger group would allow for examination of between group differences in patients with different epileptic foci.

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## **Birch Lecture:**

### **On Educational Neuropsychology and the Bridge between Research and the Educational Domain**

**Presenter: Jelle Jolles**

**4:45–5:45 p.m.**

### **J. JOLLES. On Educational Neuropsychology and the Bridge between Research and the Educational Domain.**

In the past two decades, there has been a tremendous increase in our understanding of the structure and functions of the human nervous system. Brain imaging research and neuropsychological investigations have been instrumental in this respect as well as studies in developmental psychology. On the domain of learning & education, the new insights have led the OECD to issue a report with the challenging title 'Understanding the Brain: The Birth of a Learning Science' (2006). A new field – 'Educational Neuropsychology' – now grows within the broader domain of Educational Neuroscience. The field is dedicated to both fundamental and applied aspects of the brain-behavior relationships which are pertinent to education and to the elaboration on their implications for educational practice. In past years, it was noted that 'the time is ripe to bridge the gap between neuroscience and the educational domain'. Examples of this vision will be given in this lecture.

The studies which will be described have been performed in the Centre for Brain & Learning in Amsterdam. Large scale neuropsychological studies investigated the determinants of underperformance and excellence in children and adolescents. They show that there are individual patterns in neurocognitive development. Both biological variables and psychosocial context appear to be a determinant of cognitive performance at school. Boy-girl differences, sleep and nutrition are much more important than hitherto recognized. In addition, particular executive functions and their development are a major factor in explaining school performance and learning motivation. Furthermore, complex visuo-perceptive functioning is particularly important given the lack of attention which it receives in schools up till now. Neuropsychological interventions directed at 'visualizing', 'mentalizing', but also courses based upon neuropsychological 'psycho-education' have potential for application in education: in school but also at home, and in sports and leisure activities. Educational Neuropsychology may have the potency to become a new and potent field because it can base itself upon the many years of experience obtained in clinical Neuropsychological settings.

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## FRIDAY MORNING, JULY 12, 2013

**Invited Address:****Rostral Prefrontal Cortex: the Seat of Metacognition****Presenter: Paul W. Burgess****8:45–9:45 a.m.****P.W. BURGESS. Rostral prefrontal cortex: the seat of metacognition.**

Most of the brain deals with information relating to present or past experience. In contrast, the frontal lobes are the seat of “the future” in human cognition. They support processing relating to “what if..?” thoughts, such as “what if X happened?” or “what would happen if I did it this way rather than the usual way?” They also then enable us to carry out these future new courses of action. The possibilities we consider are shaped by our knowledge of social rules, what we know or believe about ourselves or think that we know about other people, our risk preferences and how we understand them, and a range of other types of processing such as our propensity to mind-wander, to maintain an inner dialogue with ourselves, or conversely to attend carefully to the external world and not get distracted by our inner thoughts. Arguably, these are the highest cognitive functions of man. Very recently, work has begun to show that the largest single subpart of the frontal lobes (variously called rostral PFC, area 10, or frontopolar cortex), which is the anterior part just behind the forehead, plays a critical role in these kinds of “metacognitive” processes. People with damage to rostral PFC can show a range of problems in everyday life, including changes in social behaviour, judgement, and their ability to organise themselves, and carry out intended actions. Remarkably, the latest evidence from neuropsychological and neuroimaging studies, plus investigations of autism spectrum disorders, strongly suggests that rostral prefrontal cortex shows a high degree of functional specialisation, with different sub-regions contributing to different kinds of processing. The new discoveries about what this region does, after approximately 150 years of almost complete ignorance about it, holds the promise of understanding many clinical phenomena that have until now been considered mysterious and not amenable to assessment or intervention.

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**FESN Invited Symposium:****Neuropsychological Rehabilitation: From Bench to Bedside****Chair: Guy Vingerhoets****10:00–11:30 a.m.****G. VINGERHOETS. Neuropsychological Rehabilitation: From Bench to Bedside.**

**Symposium Description:** Neuropsychological rehabilitation is a rapidly expanding field of neuropsychology that for a long time lacked academic interest and empirical scrutiny. But things are clearly changing for the better. Improved assessment tools of parameters that are relevant for the cognitive recovery of brain injured patients are being developed, new treatment strategies are explored and compared to existing ones, and novel insights from neuroimaging and neurostimulation are gradually finding their way to the clinic.

The aim of this symposium is to bring together researchers working on various aspects of neurocognitive rehabilitation at the interplay between cognitive neuroscience, neuroimaging, and neuropsychology. Illustrative of the great diversity of this field, the contributions will address the problems of impaired awareness following brain injury and how to measure it, the importance of executive and working memory dysfunction and its assessment in rehabilitation, relevant predictors for recovery from disorders of consciousness and problems of communication in pa-

tients with reduced consciousness, and the obstacles for neurostimulation (research) in the clinical setting. The contributions of the presenters demonstrate an empirical and theoretically based approach of neurorehabilitation that gives rise to a valid and evidence-based therapeutic approach of the brain-damaged individual.

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**A. VANHAUDENHUYSE. How Neuroimaging Techniques Can Help to Diagnose Disorders of Consciousness?**

**Objective:** Survivors of severe brain damage classically go through different clinical entities before partially or fully recovering consciousness. Coma is defined as “unarousable unresponsiveness”.

**Participants and Methods:** After some days to weeks, comatose patients who recover will eventually open their eyes. When this return of “wakefulness” is only accompanied by reflexive motor activity and devoid of any voluntary interaction with the environment, the patient is considered in a vegetative state, entity recently renamed as the unresponsive wakefulness syndrome. This late stage may be a transition to further recovery, or not.

**Results:** Signs of voluntary motor activity should be actively searched for as they herald a minimally conscious state. Sometimes patients awaken from their coma fully conscious but paralyzed, only able to communicate by small eye movements - this condition is called the locked-in syndrome. These very challenging patients represent a major clinical problem in terms of clinical assessment, treatment, and daily management. Integration of neuroimaging and ERPs techniques should improve our ability to disentangle diagnostic and prognostic differences on the basis of underlying mechanisms and better guide our clinical therapeutic options in these patients. Moreover, by definition, patients in a minimally conscious state cannot communicate and the issue of well-being of these patients therefore remains open. Quality of life, however, can be investigated in patients with a locked-in syndrome. Healthy individuals and medical teams sometimes assume that the quality of life of these patients is such that their lives are not worth living.

**Conclusions:** In collaboration with the French Association for Locked-in syndrome, we observed that the majority of these patients suffering of severe disabilities may report a good quality of life despite being socially isolated or having major difficulties in activities of daily living.

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**H.C. DIJKERMAN, M. SMIT, J.M. VISSER-MEILLY, L.J. KAPPELLE, T.C. NIJBOER & D.G. SCHUTTER. Direct Current Stimulation in Rehabilitation of Hemispatial Neglect.**

**Objective:** Hemispatial neglect is a severely disabling disorder in which patients fail to attend to one side of space and/or their body. Hemispatial neglect following stroke has a high prevalence and it is an important predictor of poor functional outcome.

**Participants and Methods:** Many attempts have been made to ameliorate signs of neglect, and the therapeutic efficacy has been modest. A possible new intervention is low intensity transcranial direct current stimulation (tDCS), which is capable of modulating cortical excitability by polarizing neural tissue as a consequence of a constant voltage to the scalp. In particular, anodal tDCS is considered to increase cortical excitability, whereas cathodal tDCS decreases cortical excitability.

**Results:** Previous research on the neurophysiological basis of neglect suggests that inhibiting the overactive intact hemisphere and increasing the neuronal excitability in the damaged hemisphere might reduce hemispatial neglect. In the present, double blind placebo controlled study we tested this hypothesis by applying anodal stimulation over the damaged hemisphere, and cathodal stimulation over the contralateral intact hemisphere. Patients were stimulated daily for two periods of five days, with one period involving placebo and the other real tDCS.

**Conclusions:** In addition to presenting preliminary results of this study, several limitations of using tDCS in brain-damaged patients will be discussed.

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**C. VALLAT-AZOUVI. Rehabilitation of Working Memory in Patients With Brain Injury: Issues of Generalization and Specificity.**

**Objective:** Impairments of working memory have been widely documented in patients with stroke or traumatic brain injury (TBI). Such deficits may have disabling consequences in patients' everyday life and compromise social and vocational reintegration.

**Participants and Methods:** Recent studies suggested that intensive and adapted training may improve working memory in patients suffering from various neurological conditions. In this presentation, we will present single-case studies of rehabilitation of working memory with particular emphasis on two issues.

**Results:** The first one is generalization of the training effect to everyday life situations. To address this issue, we developed a specific scale, the Working Memory Questionnaire (WMQ), which is a self-administered questionnaire including 30 complaints related to storage, attentional and executive aspects of working memory in everyday life. The WMQ has been found sensitive to brain injury, as compared to healthy controls, and several single-case studies showed that it was sensitive to change after intensive working memory training.

The second issue is specificity of training. Previous studies used either one single training task, or a combination of tasks given in the same way in all patients, irrespective of their particular impairment within working memory. We present a new single-case study in which we assessed the specificity of training on different subdomains of working memory (i.e. modality specific storage systems dedicated to verbal and visuo-spatial information respectively and the multimodal central executive system). A patient with chronic stroke was given a three-step rehabilitation program, focusing successively on the three different subcomponents of working memory.

**Conclusions:** Results showed both domain-specific and generalisation effects, suggesting that rehabilitation should include different training tasks, individually adapted and tailored to each individual patient's impairments.

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**C. VAN HEUGTEN. Impaired Awareness Following Brain Injury.**

**Objective:** Lack of awareness of deficits after acquired brain injury (ABI) is a well known problem in the clinical setting.

**Participants and Methods:** Within the ABI literature unawareness of deficits is seen as the inability to appraise one's strengths and weaknesses and its implications on life at present and in the future. The incidence of this phenomenon has been reported to range from 30-97% depending on the measurement used, severity of injury, and time since injury. Patients often lack awareness of cognitive deficits, disturbing behaviour and interpersonal skills, and the effect of these on others. There is yet no consensus about the pathogenesis of this lack of awareness.

**Results:** However, frontal lobe dysfunction has often been related to this phenomenon. In this presentation an overview of measurements and interventions for unawareness after brain injury will be given, both based on a systematic literature review. Three instruments stood out in terms of good quality: Self-Awareness of Deficits Interview, Patient Competency Rating Scale, and Awareness Questionnaire. These are qualitative instruments that are useful tools in research. In the clinic they are restricted, since they do not measure all levels of awareness.

**Conclusions:** The use of these instruments will be illustrated with the data of 2 cohort studies. Interventions which consisted of multiple components, including education and multi-modal feedback on performance, have been shown promising in the management of unawareness.

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**Symposium 7:  
The Non-Unitariness of Anosognosia in Dementia**

**Chair: Robin G. Morris**

**10:00–11:30 a.m.**

**H. ROSEN, J. ZAKRZEWSKI & C. SCHERLING. Anosognosia in Frontotemporal Dementia vs. Alzheimer's disease: A Window onto the Mechanisms of Self-Appraisal.**

**Objective:** Anosognosia appears to be present to some degree in every form of dementia, including memory-predominant syndromes such as Alzheimer's disease (AD), but also syndromes primarily affecting social and emotional behavior, such as frontotemporal dementia (FTD). The variety of neurodegenerative contexts under which anosognosia occurs suggests that self-awareness may be a multifactorial process, and anosognosia can result from different mechanisms in different patients.

**Participants and Methods:** Our group has studied patients with FTD and AD using various methods for measurement of self-awareness, including classical metacognitive tasks (e.g. feeling of knowing), and experimental tasks tapping into online or emergent error awareness.

**Results:** Our results support the idea that anosognosia is more severe in some forms of FTD than in AD, and that FTD patients have very poor self-appraisal and impaired responses to even overt feedback despite intact awareness of errors. In addition our early work indicates that emotional processing of one's errors, possibly mediated by orbitofrontal regions, may play a unique role in producing anosognosia in FTD.

**Conclusions:** Continued study of anosognosia in a variety of dementia syndromes promises to provide a more comprehensive view of self-monitoring systems in the brain and how these systems can be compromised by brain dysfunction.

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**D. MOGRABI, R. BROWN & R. MORRIS. Short- and Long-term Implicit Adaptation in AD Despite Performance Anosognosia.**

**Objective:** Lack of awareness about performance in tasks is a common feature of Alzheimer's disease (AD). Nevertheless, clinical anecdotes have suggested that patients may show behavioural responses to the experience of failure despite expressing limited awareness. We explored this question experimentally using novel success/failure manipulation paradigms.

**Participants and Methods:** Computerised tasks which expose participants to systematic success or failure were developed in which performance success was titrated for each participant and then difficulty was set either above or below this level to establish individually success and failure levels. Two experiments were carried out: the first, investigated immediate emotional responses to failure; and the second, long-term task avoidance in a follow-up session.

**Results:** Results of the first study indicated that, relative to controls, AD patients exhibited impaired awareness of performance, but comparable differential reactivity to failure relative to success tasks, both in terms of self-report and facial expressions. Long-term adaptation in the second study was correlated with awareness in the first session, even though AD patients had no memory of doing the tasks.

**Conclusions:** These findings are discussed in relation to current theories of consciousness which emphasise access as its main feature.

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**R. MORRIS, R. BROWN, C. SALAS & D. MOGRABI. Anosognosia Correlates of Emotional Reactivity in People with Alzheimer's Disease to Viewing Emotional Film Material Including that Depicting Alzheimer's Disease.**

**Objective:** Lack of awareness of illness or neuropsychological deficit in people with Alzheimer's disease (AD) has been shown to dissociation for awareness of symptoms when viewing the symptoms of other people. The presented study investigated emotional reactivity when viewing film material depicting a person with AD, comparing this to viewing other film material. The correlates with anosognosia were explored.



**Participants and Methods:** A film depicting a person with Alzheimer's disease was shown. Emotional reactivity was compared to that following two other films, one including material from a UK light comedy television program that was predicted to produce positive mood and another film about a person with cancer, predicted to induce negative mood. Emotional reactivity in each case was measured using before and after measurement of mood state and also by filming participant facial expressions with Facial Affect Coding (FAC) ratings.

**Results:** The level of emotional reactivity was slightly less in people with Alzheimer's disease than in normal control participants, including the negative mood state associated with viewing the film about the person with Alzheimer's disease. Facial reaction was negatively correlated with the degree of awareness the people with Alzheimer's disease had in relation to their own illness. Emotional reaction to other film material was not associated with this awareness.

**Conclusions:** The early AD group showed emotional reactivity to the film material inducing positive and negative mood, including the Alzheimer film. The negative correlation with awareness of illness is interpreted as suggesting that heightened emotional reaction on confronting Alzheimer's disease symptoms might be predictive of less awareness due to emotionally induced inhibition. Alternative explanations for this finding are also considered.

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**C. BASTIN, H. JEDIDI, D. FEYERS, F. COLLETTE, M. AL BAHRI, M. JASPAR, A. D'ARGEMBEAU & E. SALMON. Dorsomedial Prefrontal Metabolism and Unawareness of Current Characteristics of Personality Traits in Alzheimer's Disease.**

**Objective:** Anosognosia is a complex symptom corresponding to a lack of awareness of one's current clinical status. Anosognosia for cognitive deficits has frequently been described in Alzheimer's disease (AD), while unawareness of current characteristics of personality traits has rarely been considered.

**Participants and Methods:** We used a questionnaire-based method in a group of 37 AD patients and in healthy controls to probe self- and hetero-evaluation of patients' personality and we calculated differential scores between each participant's and his/her relative's judgments. A brain-behavior correlation was performed using FDG-PET images.

**Results:** The behavioral data showed that AD patients presented with anosognosia for current characteristics of their personality and their anosognosia was primarily explained by impaired third perspective taking. The brain-behavior correlation analysis revealed a negative relationship between anosognosia for current characteristics of personality and dorsomedial prefrontal cortex (dMPFC) activity.

**Conclusions:** Behavioral and neuroimaging data are consistent with the view that impairment of different functions subserved by the dMPFC (self-evaluation, inferences regarding complex enduring dispositions of self and others, confrontation of perspectives in interpersonal scripts) plays a role in anosognosia for current characteristics of personality in AD patients.

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**S. GENON, J. SIMON, M. AL BAHRI, F. COLLETTE, C. SOUCHAY, M. JASPAR, E. SALMON & C. BASTIN. Specific Impairment of Metacognitive Judgements for Episodic Memories in Alzheimer's Disease: the Role of the Hippocampus.**

**Objective:** A wide range of metacognitive judgements for episodic memories is impaired in patients with Alzheimer's disease (AD). In contrast, metacognitive judgements for semantic knowledge seem to be relatively preserved. However, metacognitive judgements on episodic and semantic memory have never been directly compared within a single experimental design providing control for variability in results due to materials and procedure differences. Furthermore, little is known about the neural correlates of impaired metacognitive judgements for episodic memories in AD patients, the purpose of this study.

**Participants and Methods:** In the present study, 22 patients with mild stage AD and 17 healthy older controls (HO) were administered a recog-

nition task of famous (semantic items) and previously learned (episodic items) characters in combination with a feeling-of-knowing (FOK) procedure. A structural MRI image of AD patients was acquired and analysed with Voxel Based Morphometry (VBM). A correlation analysis was performed between FOK accuracy and VBM grey matter density.

**Results:** Our behavioral results revealed that FOK accuracy for episodic items was impaired whereas FOK for semantic items remained accurate in AD patients. Episodic FOK accuracy was correlated to grey matter density in the left hippocampus in the patients.

**Conclusions:** This is the first study that directly shows dissociation between metacognitive judgements on episodic and semantic material in AD patients. Our findings suggest that specific impairment of episodic metamemory might be related to deficient access to target-associated cues related to altered hippocampal structure.

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**R.G. MORRIS, H. ROSEN, S. GENON, C. BASTIN, D. MOGRABI & R. MORRIS. The Non-Unitariness of Anosognosia in Dementia.**

**Symposium Description:** Loss of awareness of neuropsychological deficit is a common feature in dementia. This symposium explores unawareness phenomena, invoking differential neurocognitive mechanisms as explanatory concepts. Dissociation in the manner in which these are affected is shown account for the presentations of unawareness in dementia, including those associated with self-monitoring systems, metacognitive judgments concerning memory retrieval, awareness of personality characteristics and implicit and emotional factors that modulate the expression of awareness.

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### Symposium 8: Advances in Paediatric Social Neuroscience: the Foundations for Assessment and Intervention?

**Chair: Anna-Lynne R. Adlam**

**Discussant: Vicki Anderson**

**10:00–11:30 a.m.**

**A.R. ADLAM, H.W. WILLIAMS, B. GUROGLU, S. ADAMS & V. ANDERSON. Advances in paediatric social neuroscience: the foundations for assessment and intervention?**

**Symposium Description:** Neurological and neurodevelopmental disorders in childhood are a leading cause of disability worldwide. Such conditions can lead to long-term, even lifelong difficulties, resulting in significant burden to the individual, their family, and wider society. There is growing interest in understanding the socio-emotional difficulties that can result from these disorders, especially given the increased vulnerability of these children in terms of their mental health, academic and vocational progression, and risk of criminal offending. This symposium will demonstrate how an increased understanding of socio-emotional processing can guide the development of targeted assessments and effective interventions. The first speaker, Professor Huw Williams (University of Exeter), will present findings to demonstrate the impact of paediatric brain injury on socio-emotional processing and offending behaviours. The second speaker, Dr Berna Guroglu (University of Leiden), will demonstrate the interaction between reward and social context related factors in neural activation patterns across adolescence. Finally, Dr Sally Adams (University of Bristol), will explore the role of emotion recognition bias in guiding behaviour, and will provide evidence supporting the efficacy of a novel intervention. The symposium will end with a discussion, led by Professor Vicki Anderson (Murdoch Children's Research Institute), to consider how the findings from the presentations can guide paediatric assessment and intervention approaches.

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### H.W. WILLIAMS. Neuroscience and Violence: What We Can Do To Lessen Hurt and Harm and Promote Social Inclusion.

**Objective:** Recent advances in developmental neuroscience provide insights into how disorders such as Traumatic Brain Injury (TBI) can be linked to social violence. This is because key neurological systems in the developing brain are not fully matured for complex social reasoning and, if injured, a child's brain may be vulnerable to long term deficits in social reasoning linked to behavioural disturbance.

**Participants and Methods:** Our work with adolescent and adult offenders – which have indicated a substantial degree of early TBI in such groups - provide a compelling case for the need for an exploration of legal and policy frameworks that might better address how such issues can be managed. Particularly from a perspective of providing earlier, targeted interventions to reduce lifetime risk of social violence.

**Results:** Crucially, research has shown that injury to the brain during early (childhood) development can lead to problems later on in adolescence in the ability to engage with others and with society as a whole. Those injured may suffer disorders of cognition and behavioural dyscontrol (anger). Related research with prison populations indicate that when childhood brain injury is not treated, an individual may be predisposed to violent crime in adulthood (organic personality change).

**Conclusions:** Affected individuals may therefore fail to develop the sophisticated levels of executive decision-making required to make coherent, cogent decisions related to their own well-being. At the same time, however, there are indications that children who receive adequate treatment for such injuries at an early stage in their development may deal more successfully with social integration at a later stage - such as children provided with rehabilitation after brain injury may avoid violent offending.

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### B. GUROGLU. Reward Processing in Adolescence: A Role for Social Context.

**Objective:** Adolescence is a time of major social-cognitive and affective change, including increasing reward sensitivity as well focus on peer relationships. An explanation for the increase in reward sensitivity could be an overactive reward system. The ventral striatum, previously found to be important for neural responses to rewards (Delgado, 2007) is thought to develop earlier than fronto-parietal brain regions, which are responsible for executive functions such as inhibition (Somerville, Jones & Casey, 2010). The increasing sensitivity to the peer context is also supported by findings showing higher striatum activation in adolescents than other age groups during risk-taking behavior in the presence of peers (Chein et al., 2010). The current study aimed to examine the interaction between reward and social context related factors in neural activation patterns across adolescence.

**Participants and Methods:** Participants were 249 healthy children, adolescents and young adults in the age range of 8-25. Participants performed a gambling task in the scanner, in which they could win or lose money. Probabilities for winning or losing were 50%. Participants played for themselves, their best friend, whom they identified before the start of the experiment, or another (disliked) participant in the study.

**Results:** Preliminary findings show that whereas winning for Self and Friend result in bilateral ventral striatum activation, losing for Self and Friend resulted in striatum deactivation. The pattern for winning and losing for Antagonist was reversed. Regression analysis with age showed a quadratic effect when playing for Self with peak activation in mid-adolescence, whereas playing for Friend showed a linearly increasing pattern with age.

**Conclusions:** These findings indicate the importance of contextual factor in modulating striatum response to reward. Findings will be discussed in relation to the social brain regions that are still developing in adolescence.

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### S. ADAMS, I. PENTON-VOAK & M. MUNAFO. Facing up to Faces: Modifying Face Emotion Perception to Improve Emotional Processing.

**Objective:** Our pilot work has indicated that it is possible to modify how individuals perceive emotional expression, such that when viewing computer generated 'morph sequences' running from one emotion to another, individuals see a change in the emotion somewhere in the middle. This balance point can be used to provide false feedback in the training phase, whereby participants can be trained to judge expressions previously judged as neutral as happy.

**Participants and Methods:** In a sample of young offenders in South Wales, we demonstrated that training participants to classify more ambiguous faces as happy rather than angry had a substantial positive effect on their self-reported aggressive feelings, and on ratings of their behaviour by carers who were blind to the manipulation. In another pilot study using happy to sad morph sequences, we demonstrated relatively increased positive affect following training to perceive faces as happy.

**Results:** Our approach targets biases in emotional processing, and can be delivered automatically via computer, internet or smartphone. It therefore has exciting potential to be a valuable cost-effective adjunctive treatment which may be used together with more traditional psychotherapy, cognitive-behavioural therapy and pharmacotherapy.

**Conclusions:** This approach is a well-validated method in the wider basic psychology literature, and provides a useful model which we are attempting to extend in other populations.

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## Poster Session 4: Behav Neurology / CNS/ Language / Executive Function / Electrophysiology / Drugs

11:30 a.m.–1:00 p.m.

### Behavioral Neurology

#### D. YI, M. BERTOUX, E. MIOSHI, J. HODGES & M. HORNBERGER. Fronto-striatal correlates of neuropsychiatric dysfunction in frontotemporal dementia (FTD) and Alzheimer's disease (AD).

**Objective:** To investigate prefrontal cortical and striatal contributions to neuropsychiatric symptoms in FTD.

**Participants and Methods:** One hundred and eighty-two participants (87 FTD patients, 39 AD patients and 56 controls) were included. Behavioural profiles were established using the Cambridge Behavioural Inventory Revised (CBI-R) and Frontal System Behaviour Scale (FrSBe). Atrophy in prefrontal (VMPFC, DLPFC) and striatal (caudate, putamen) regions was established via a 5-point visual rating scale of the MRI scans. Behavioural scores were correlated with atrophy rating scores.

**Results:** Behavioural and atrophy ratings demonstrated that patients were significantly impaired compared to controls, with bvFTD being most severely affected. Behavioural-anatomical correlations revealed that VMPFC atrophy was closely related to abnormal behaviour and motivation disturbances. Stereotypical behaviours were associated with both prefrontal and striatal atrophy. By contrast, disturbance of eating was found to be related to striatal atrophy only.

**Conclusions:** Frontal and striatal atrophy contributed to the behavioural disturbances seen in FTD, with some behaviours related to frontal, striatal or combined fronto-striatal pathology. Consideration of striatal contributions to the generation of behavioral disturbances should be taken into account when assessing patients with potential FTD.

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**M. PITTERI, M. GARZON & S. ALBANESE. The Brainstem and Cognitive (Dys)functions: From Neural Disconnection to Behavioural Disregulation.**

**Objective:** The traditional view on the link between brainstem lesion and cognitive functions has recently been challenged by results from neuroimaging and clinical studies on groups (Baillieux et al., 2010) and single cases (Maeshima et al., 2010). The potential for brainstem lesions to produce severe and chronic cognitive impairments is not widely recognized.

**Participants and Methods:** We describe a 46-year-old, right-handed man (BS), with 13 years of education, who suffered from a lesion in the right pontine area. In the post-acute phase, BS presented with dysarthria, diplopia, ataxic gait, deficit of fine motility of the right hand, and a constellation of neuropsychological deficits. These signs remained unchanged after physical and speech therapy. At about one year from lesion onset, MRI disclosed a small hemorrhage involving the right mesencephalic tegmentum and tectum, without affecting the red nucleus. The superior cerebellar peduncle was also involved, leading to pseudohypertrophy of the left inferior olivary nucleus because of transynaptic degeneration. A PET scan showed hypometabolism of the brainstem, the right cerebellum, and the left cerebral hemisphere, particularly in the thalamus, the insula, and the frontal area.

**Results:** BS had cognitive and behavioural disorders and mild speech defects. His prosody was altered in cadence and voice intonation, suggesting a plausible foreign accent syndrome (Dankovičová & Hunt, 2011). In addition, with respect to other cases already described in the literature, BS showed a pronounced pragmatic deficit, characterized by difficulty taking turns in the conversation, scarce pertinence on the argument, poor exhaustivity of verbal messages, and sudden changes of argument during conversation.

**Conclusions:** To the best of our knowledge, this is the first report of a patient affected by severe pragmatic disorder after brainstem lesion. We suggest that diaschisis-related disorders should be carefully contemplated in clinical practice.

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## Cognitive Neuroscience

**I. BRAZIL, L. HUNT, E. BULTEN, R. KESSELS, E. DE BRUIJN & R. MARS. Psychopathic Traits And The Use Of Social And Non-social Information During Associative Learning: A Computational Approach.**

**Objective:** Psychopathy is a personality disorder related to impaired reinforcement-guided adaptation of behavior, and the same core deficit is believed to hamper learning from social information. Recent work suggests that these disturbances might not be due to impaired learning, but by a deficit in actively using information to change behavior. However, the amount of information actually used to guide behavior has never been quantified, nor has there been a specification of how personality traits related to psychopathy might covary with the use of information.

**Participants and Methods:** Forty (non-clinical) subjects were recruited based on their scores on a self-report psychopathy list and performed a task involving simultaneous learning of social and reward-based information. A computational model was used to quantify how much of each type of information subjects used. Subsequently, the psychopathic personality traits with the highest explanatory power for each parameter were isolated through a statistical variable selection procedure, and we used correlation analyses to assess how these covaried with model parameters.

**Results:** For each source of information, the variable selection routine identified distinct traits as possible moderators. Use of reward-history information was negatively related to levels of trait fearlessness and anxiety, while less social advice was used as trait guiltlessness and the perceived ability to manipulate others increased.

**Conclusions:** High trait fearlessness, low anxiety, guiltlessness and manipulateness are believed to be core features of psychopathy relative to general antisociality. Thus, these results converge with previous findings indicating reduced use of information in clinical psychopathy and provide a specification of the psychopathic personality traits that might moderate this deficiency

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**A. GALVEZ, ÁLVARO. DARRIBA, J. VILLACAMPA, R. MARTORELL, L. PRADA & F. BARCELÓ. Aging and Executive Control Effects on the Flexible Shifting of Stimulus-Response Mappings in a Novel Bi-field Visuomotor Task with Increasing Cognitive Demands.**

**Objective:** Age-related cognitive decline has been linked to executive deficits in shifting, updating and maintenance of task-set information. Here we explored effects of Age and Executive control on behavioural indexes of S-R mappings reconfiguration in working memory.

**Participants and Methods:** Two groups of middle-aged (51–60 yo. N=24) and older (61–80 yo. N=22) adults were split into high vs. low Executive control subgroups according to six neuropsychological measures (Stroop, TMT-B, Digits, COWAT, Brixton). Participants performed three versions of a new bi-field visuomotor task that involved distinct S-R mappings each, but identical visual load consisting of frequent coloured Gabor patches ( $p=0.9$ ) and randomly interspersed grey Gabor patches ( $p=0.1$ ). In a Switch task version, two grey patches intermittently cued to switch or repeat the task rule (colour vs. thickness). Alternatively, the same patches were distractors in two perceptually identical single-task versions (NoGo; Oddball task).

**Results:** Sequence effects showed that grey patches, as distractors or informative cues, influenced mean RTs differently across the task versions. Mean accuracy and reaction time (RT) costs showed significant decreases in performance with higher cognitive demands. Main effects for Age and Executive control were only found in the Switch task, with middle-aged and high-control participants responding faster and more accurately than older and low-control individuals respectively. Moreover no interaction between Age and Executive control was found.

**Conclusions:** The observed association between Age and Executive control for behavioural measures suggests a differential influence of these factors upon two successive stages in the executive control of task-switching: anticipatory “goal shifting” and “rule activation”, respectively (Rubinstein et al., 2001). We conclude that the new bi-field task-switching protocol offers a sensitive assessment of dysexecutive symptoms for elderly people and patients with unilateral brain lesions.

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**L. SERPATI & A.R. LOUGHAN. The importance of neuroeducation: Perspectives from special educators.**

**Objective:** Neuroeducation is a discipline that transcends the fields of neuroscience, psychology, and pedagogy. However, more effort is needed to bridge these three fields, which in combination show great promise for improving the science of learning and teaching. Recent noteworthy contributions to neuroeducation literature include research on how students with dyslexia, autism, epilepsy, and ADHD learn. Daily, special education teachers in primary and secondary schools around the world are faced with teaching these medical and neurodevelopmental populations, but we know very little about teachers knowledge and perspectives regarding neuroeducation. Therefore, the purpose of this study was to understand special education teachers' perspectives of neurological research and its ability to impact their pedagogy.

**Participants and Methods:** A geographically diverse sample of special education teachers was surveyed from the United States (N = 79; 91% female). All teachers in the sample were certified in their state. Forty nine percent had over ten years of experience in the classroom, while 16.5% had taught for less than five years, and 34% had taught for 5 - 10 years. Participants were asked to report their experience and perspectives regarding neuroeducation.

**Results:** Results indicated that 84% of special education teachers worked with students with neuropsychological disorders often and 97% of special education teachers believe that they required an understanding of neuropsychological research to inform their practice. However, most had little to no education or training in neuropsychology and its application to classroom practice, with 61% of special education teachers reporting that “biological or brain-based behavior courses were not part of their training program”.

**Conclusions:** Implications for special education teacher preparation and continuous professional development will be discussed, particularly in the context of engaging the neuropsychology community in this trans-disciplinary effort.

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**I. MESKAL, M. SALDEN, G. RUTTEN & M. SITSKOORN. Cognitive deficits in patients with trigeminal neuralgia.**

**Objective:** Reviews have shown adverse effects of chronic pain and pain medication on cognition. Yet, no study has explored cognitive performance in patients with trigeminal neuralgia (TN), which is known as a severe chronic pain disorder. We examined whether patients with TN show cognitive deficits in comparison with healthy controls of comparable age, gender and education.

**Participants and Methods:** Cognitive function in patients (n=25) diagnosed with TN was assessed and compared with two control groups of healthy subjects: a normative American control group (n=1069), and a Dutch control group (n=19). Subjects were administered a computerized test battery of cognitive tests (i.e., CNS Vital Signs).

**Results:** Patients diagnosed with TN scored significantly below healthy controls from the normative American sample on measures of composite memory, psychomotor speed, reaction time, and general cognitive functioning. Comparisons between patients and a control group of Dutch subjects, showed significant differences in scores on measures of psychomotor speed and reaction time, with patients performing worse than healthy Dutch controls. These results were all in agreement with previous data of patients with chronic pain conditions. In contrast, no differences were found in scores of complex attention and cognitive flexibility (i.e., executive functioning) for comparisons between patients and both control groups. However, indirectly, subtle cognitive deficits on executive functioning were shown. In order to check the clinical relevance of scores on CNS Vital Signs, proportions of patients were evaluated. 25% (highest proportion) of the patients with TN had deficits on psychomotor speed and reaction time.

**Conclusions:** Given the high frequency of cognitive deficits in patients with TN in comparison with healthy controls of two different samples, patients need to be carefully evaluated for cognitive deficits. Diagnosis and treatment of these cognitive deficits should help improve treatment outcomes in patients with TN.

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**A. PINA RODRIGUES, M. CASTELO-BRANCO & M. VAN ASSELEN. Attentional Cueing Processing is Eccentricity Dependent in Developmental Dyslexia.**

**Objective:** Developmental dyslexia is characterized by impaired reading despite of a normal level of intelligence. It has been suggested that dyslexics show visual attention and visual peripheral deficits. We aimed to examine both issues by investigating the relation between exogenous attention and visual eccentricity.

**Participants and Methods:** An exogenous visual attention task using low level stimuli (Gabor patches) was conducted. Dyslexics and age matched controls were asked to discriminate the orientation of the patches. Exogenous attention was manipulated using valid, invalid and neutral cues. Subjects were asked to fixate a cross while stimuli were presented at 4 levels of visual eccentricity (8, 10, 12 and 14 degrees).

**Results:** A Repeated Measures analysis showed that, overall, dyslexics and controls performed faster when a valid cue was displayed than when an invalid cue was displayed ( $p < 0.01$ ). Also, both groups responded faster to lower eccentricity stimuli ( $p < 0.01$ ). Interestingly, an interaction effect was found for Eccentricity  $\times$  Cue-type  $\times$  Group ( $p < 0.05$ ). Repeated measures ANOVA were performed for each eccentricity, showing an interaction for cue type and group at 10 degrees ( $p < 0.05$ ) and a trend at 14 degrees ( $p = 0.057$ ). Accordingly, at 10 degrees dyslexics did not show an effect for the invalid cue, and showed a larger effect than the controls for the valid cue ( $p < 0.05$ ). In contrast, at 14 degrees, the controls responded faster when a valid cue was displayed, whereas dyslexics responded slower ( $p < 0.05$ ). Furthermore, when an invalid cue was displayed, the dyslexics showed a larger effect than the controls ( $p < 0.05$ ).

**Conclusions:** The results indicate a different attentional cueing effect on dyslexics, depending on the viewing eccentricity. These findings suggest an impairment of exogenous visual attention mechanisms even in the absence of the contribution of phonological processes. Future studies using high level stimuli should elucidate how dyslexics' performance is modulated by increasing stimulus complexity.

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**A. RASMUS, E. ORLOWSKA & M. GIERACH. Verbal fluency in metabolic syndr.**

**Objective:** Metabolic syndrome (MetS) is characterized by abdominal obesity, hypertension, lipid disorders such as atherogenic dyslipidemia and carbohydrates disorders such as impaired fasting glucose or diabetes mellitus type 2. It has also been linked to Alzheimer's disease, accelerated aging-induced frontal-subcortical syndrome, risk of cardiovascular disease and is known to contribute to the development of cognitive dysfunction.

Though verbal fluency is traditionally correlated with frontal lobe activity and is known to be an important factor in neuropsychological assessment, little is known about its impairment in this group of patients. Depending on instruction of fluency task authors describe many fluency types. Semantic and phonemic fluency are amongst the most commonly assessed and are known to be a good predictors of Alzheimer disease and vascular dementia. This study was designed in order to establish fluency pattern characteristic for MetS.

**Participants and Methods:** The performances of 40 patients with MetS and 40 demographically matched normal control subjects were compared on two verbal fluency measures : semantic and phonemic fluency.

**Results:** Statistical analyses revealed no significant differences in general performance between MetS patients and controls. Clustering (i.e. generating words within subcategories) and switching (i.e. shifting between subcategories) analyses showed a distinctive pattern. In comparison to controls MetS patients switched less frequently and produced smaller clusters. Performance by MetS patients was not consistent across fluency task. On phonemic fluency MetS patients were impaired on both switching and clustering. On semantic fluency MetS patients were impaired on switching only.

**Conclusions:** Result suggest that in MetS phonemic fluency appears to be more sensitive and switching is more impaired. Differences in qualitative analyses are consistent with reports that show clustering to be related to temporal lobe functioning and switching to frontal lobe activity.

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**M.N. SERVAAS, J. VAN DER VELDE, S.G. COSTAFREDA, P. HORTON, J. ORMEL, H. RIESE & A. ALEMAN. Neuroticism and the Processing of Negative Emotions: Evidence from a Quantitative Meta-analysis of Neuroimaging Studies.**

**Objective:** Neuroticism is a robust personality trait that constitutes a risk factor for mood disorders (Costa and McCrae, 1989). Neuroimaging findings related to neuroticism have been inconsistent across studies and hardly integrated into a model of the underlying neural correlates of neuroticism. Therefore, the aim of the current meta-analysis was to provide a quantitative summary of the literature related to neuroticism (18 studies).

**Participants and Methods:** Using a parametric coordinate-based meta-analysis (PCM) approach (Costafreda, 2012), data were pooled together for emotion processing tasks investigating the contrasts (negative>neutral) and (positive>neutral) to identify brain regions that are consistently associated with neuroticism across studies.

**Results:** Significant negative and positive correlations with neuroticism were only found for the contrast (negative>neutral) after multiple comparisons correction. The results show that individuals scoring higher on neuroticism displayed increased activation in brain regions involved in fear learning, including the hippocampal-parahippocampal complex. Together with the maintenance of a negative cognitive processing bias (Chan et al., 2007), this may lead to the observed tendency in these individuals to appraise life events as more threatening (Suls and Martin, 2005). Furthermore, brain areas associated with the anticipation of

aversive stimuli showed decreased activation in high neurotic individuals, such as the anterior and posterior cingulate cortex and striatum. Presumably, this indicates the maladaptive coding of aversive prediction errors and creates feelings of uncertainty (Delgado et al., 2008). Moreover, individuals scoring higher on neuroticism showed increased activation in frontal as well as cingulate regions related to emotion processing and regulation (Ochsner and Gross, 2005), possibly suggesting greater regulatory efforts.

**Conclusions:** These brain activation differences may render high neurotic individuals vulnerable to the development of mood disorders.

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**A. SILVESTRE, R. MENDES, M. GONÇALVES, M. FIGUEIRA, R. BISPO & P. BREIA. Neuropsychology in Down Syndrome – What Happens One Year Later?**

**Objective:** The aim of this study is to analyse the neuropsychological progression of a sample of Portuguese adults with Down syndrome (DS) in one year.

**Participants and Methods:** The sample is composed by 16 DS adults with ages between 26 and 50 years old. They were assessed with a neuropsychological battery (MMSE, attention, executive functions, praxis, constructive ability and memory) at the beginning (T1) and at the 12-month follow-up (T2). The collected data were statistically analysed.

**Results:** There are no significant differences in MMSE scores in the two evaluation times, although 6 patients presented lower MMSE mean values after one year. In T2, they had more difficulties in MMSE attention and calculation, constructive ability and digit span, and the performance of 6 individuals on semantic verbal oral initiative, Raven's progressive matrices and verbal memory with interference had deteriorated. We found a moderate correlation between the individuals' age and their performance on the neuropsychological tasks. In T1 and T2, the older individuals had worse performance in motor initiative, semantic verbal oral initiative and MMSE retention task. In T2, the younger subjects had lower results in semantic verbal oral initiative.

When comparing genders, males had better performance than females in MMSE in both moments. They had higher scores in orientation ( $U=8.5, p<.05$ ) and MMSE retention task ( $U=8.5, p<.05$ ) in T1. Females had lower scores in language tasks, i.e., naming ( $U=9, p<.05$ ) and comprehension ( $U=12.5, p<.05$ ), and clock drawing ( $U=15, p<.05$ ) in T2. There were no significant differences in terms of frontal behaviour.

**Conclusions:** As happens with the general population, older subjects tend to deteriorate first. Frontal lobe cognitive functions were compromised in our sample. Attention and working memory were initially impaired and may have interfered with the other tasks. Executive function was the most affected cognitive domain after one year and may suggest, like other studies, the beginning of cognitive decline.

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**K. THISAYAKORN, S. MEDHASI, C. THISAYAKORN, V. KHUEYNOK, K. SRIYAM, D. PAHUSI & C. BANJONGLIKITKUL. Atropine Induced Amnesia in Aged Rats Possibly Due to the Accumulation of Aβ Production: A Rat Model of Cognitive Impairment Measuring by Operant Behavior.**

**Objective:** Atropine, a competitive inhibitor of acetylcholine on muscarinic receptors, impairs the function of the central cholinergic system causing memory impairment. It has been evidenced that a reduction in cholinergic neurotransmission involves in the proteolytic processing of amyloid precursor protein (APP) expression enhancing leading to Aβ increasing. The accumulation of beta-amyloid (Aβ) peptide in the brain believing to represent in the patients with Alzheimer's disease is formed by APP. Operant conditioning technique is a type of learning process in which the likelihood of a behavior is increased or decreased through rewards and/or punishments. This method deals with cognitive thought process. Therefore, the objective of this study was to determine whether atropine could induce learning and memory impairment in aged rats via operant conditioning procedure. Moreover, atropine could produce Aβ accumulation in the rat brain leading to cognitive impairment.

**Participants and Methods:** To develop amnesic state in rats, atropine was administered in 18 aged-rats for 12 weeks. Learning and memory behaviors were analyzed using operant conditioning system. Aβ levels in the brain were measured by ELISA technique.

**Results:** Atropine (2.5 mg/kg body weight) successfully induced amnesia in aged rats. Rats receiving atropine injection showed significantly poorer performance with error operations of operant behaviors than the control group did. Related with memory impairment, atropine rats exhibited the tendency of higher amounts of Aβ levels in the brain than the control group did.

**Conclusions:** These findings suggest that learning and memory impairment by atropine administration possibly involve an increase in the production of Aβ levels in the rat brain through the cholinergic pathway.

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**A. UENO, A. ITO, I. KAWASAKI, Y. KAWACHI, K. YOSHIDA, Y. MURAKAMI, S. SAKAI, T. IJIMA, Y. MATSUE & T. FUJII. Neural correlates of facial recognition with and without cosmetics: an fMRI study.**

**Objective:** Recent psychological studies have shown that the act of make-up enhance attractiveness and increase woman's self-evaluation. Besides, previous neuropsychological studies have revealed the involvement of the ventromedial prefrontal cortex (vmPFC) and the ventral striatum, what is called "the reward value system", in processing the value of facial attractiveness. However, there are few cognitive neuroscience studies on the increase of attractiveness by cosmetics. We used functional magnetic resonance imaging (fMRI) to explore neural correlates of facial recognition with and without cosmetics.

**Participants and Methods:** Twenty-eight healthy volunteers were paid for their participation in this study (14 males, mean age 20.7 years, age range 20-26 years). During fMRI scanning, the subjects were presented with 144 face photographs (48 with cosmetics, 48 without cosmetics, and 48 scrambled photographs) one by one in random order, and were asked to rate each stimulus for attractiveness. This rating was graded from 1 (very unattractive) to 6 (very attractive). Data preprocessing and statistical analysis were performed using SPM8 (Wellcome Department of Imaging Neuroscience, London, UK).

**Results:** The face photographs with cosmetics were rated more attractive than those without cosmetics. Imaging data showed that face photographs with cosmetics, compared with those without cosmetics, activated the orbitofrontal cortex and the hippocampus.

**Conclusions:** We speculate that orbitofrontal activation is associated with increased facial attractiveness and hippocampal activation with enhanced memory encoding.

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**J. VILLACAMPA, ÁLVARO. DARRIBA, A. GÁLVEZ, R. MARTORELL, L. PRADA & F. BARCELO. Unspecific Restart and Mixing Costs: Combined Effects of Aging and Executive Control on Maintenance Task-Set Inhibition as Indexed by Task-Switch.**

**Objective:** Age-related cognitive decline has been linked to executive deficits in the shifting, updating and maintenance of task-set information. Here we explored the combined influence of Age and Executive control on two behavioural indexes of task-switch unspecific costs putatively related to task-set inhibition and maintenance operations.

**Participants and Methods:** Two groups of middle-aged and older adults were split into high vs. low Executive control groups according to their median Z-score in six neuropsychological measures (Stroop, TMT-B, Digits, COWAT, Brixton). Participants performed three versions of a new bi-field visuomotor task that involved distinct S-R mappings but identical visual stimulation consisting of frequent coloured ( $p=0.9$ ) and randomly interspersed grey Gabor patches ( $p=0.1$ ). In a Switch task version, the grey patches cued to switch or repeat the task rule. Alternatively, the same patches were distractors in two perceptually identical single-task versions (NoGo and Oddball).

**Results:** Results revealed restart costs only in those tasks with a larger amount of information in the form of possible S-R mappings (Switch

and NoGo). These affected only first target responses following a cue, and showed significant effects for Age and Executive control. Mixing costs were also observed when comparing performance in the Switch with that in the NoGo task, and main effects for Age were also observed in this index, with costs being higher for older subjects. Interaction between Age and Executive control was significant neither for restart nor for mixing costs.

**Conclusions:** The additive association found between Age and Executive control for these costs suggests a differential role of these factors upon two successive stages in the executive control of task-switching: anticipatory “goal shifting” and “rule activation”, respectively (Rubinstein et al., 2001). We conclude that this new protocol may provide a sensitive assessment of dysexecutive symptoms for elderly people and patients with unilateral brain lesions.

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### G. VINGERHOETS, J. NYS, P. HONORÉ, E. VANDEKERCKHOVE & P. VANDEMAELE. Task Difficulty Modulates Left Inferior Frontal Cortex During Matching of Hand Posture to Object Use.

**Objective:** Visuomotor transformations for grasping have been associated with a fronto-parietal network in the monkey brain. Whereas the human homologue of the parietal monkey region (AIP) has been identified as the anterior part of the intraparietal sulcus (aIPS), the putative human equivalent of the monkey frontal region (F5) is less well documented. Results from animal studies suggest that monkey F5 is involved in the selection of appropriate hand postures relative to the constraints of the task. The present study aimed to identify modulation in brain areas sensitive to the difficulty level of tool object - hand posture matching.

**Participants and Methods:** Seventeen healthy right handed participants underwent fMRI while observing pictures of familiar tool objects followed by pictures of hand postures. The task was to decide whether the hand posture matched the functional use of the previously shown object. Mismatch conditions were manipulated for level of difficulty.

**Results:** Compared to a picture matching control task, the tool object - hand posture matching conditions conjointly showed increased modulation in several left hemispheric regions of the superior and inferior parietal lobules (including aIPS), the middle occipital gyrus, and the inferior temporal gyrus. Comparison of easy versus hard conditions selectively modulated the left inferior frontal gyrus with peak activity located in its opercular part (Brodmann area (BA) 44).

**Conclusions:** The results of the present study support the ventral premotor cortex (vPMC), in particular the opercular region, as the putative human homologue of monkey F5. We suggest that in the human brain, vPMC/BA44 is involved in the matching of hand posture configurations in accordance with visual and functional demands.

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## Language and Speech Functions/Aphasia

### E. DE WITTE, D. SATOER, E. ROBERT, H. COLLE, E. VISCHBRINK & P. MARIËN. A Standard Neurolinguistic Approach to Awake Brain Surgery.

**Objective:** Intraoperative direct electrical stimulation (DES) is increasingly used in patients operated on for tumours in eloquent areas. Although a positive impact of DES on postoperative linguistic outcome is generally advocated, information about the neurolinguistic methods applied in awake surgery is scarce. Neurolinguistic testing during DES is generally limited to object naming. No studies exist in which a standardised neurolinguistic protocol is used to reliably identify the critical zones. Therefore, we developed a standardised neurolinguistic test battery for awake surgery.

**Participants and Methods:** The standardised test battery, called DuLIP (Dutch Linguistic Intraoperative Protocol) includes a variety of phonological, semantic and syntactic tests. The test items were controlled for

several linguistic variables. A normative study of the test battery was carried out in a control group of native Dutch-speaking adults (N=250). In addition, DuLIP was administered in a pilot group of tumour patients (N=10) undergoing awake surgery. Means and standard deviations were calculated and the data between groups were compared using T-tests.

**Results:** Analysis of control data revealed that performance on all linguistic tests from DuLIP is affected by age and years of education, resulting in distinctive age groups (18-49y; 50-74y; >75y) and education groups (primary, secondary, tertiary). Means and standard deviations are provided for each linguistic task. The intraoperative data of the pilot group showed anatomoclinical correlations that not always matched the preoperative fMRI findings (N=3) or classic language-brain models (N=4).

**Conclusions:** With the development of a standardised linguistic test battery a valuable instrument has become available to reliably identify linguistic functions in the intraoperative phase. The preliminary patient data showed that using the test battery during DES enables to increase intraoperative comfort and to detect eloquent language regions that are variably located among individuals.

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### F. LUCHELLI & E. MARTINI. Unusual Speech Abnormalities in Behavioural Variant Fronto-Temporal Degeneration: a Single Case Study.

**Objective:** Speech impairment in behavioural variant fronto-temporal degeneration (bv-FTD) has been much less investigated than in semantic variant and progressive nonfluent aphasia. Impaired narrative organization consequent to executive deficits has been reported as the most typical deficit in bv-FTD.

**Participants and Methods:** IM, an 81-year-old, right-handed man and former HR manager, was referred for evaluation of altered speech and mood/personality changes of about 1 year duration, consisting of apathy alternating with restlessness and inappropriate behaviour. Clinical and cognitive assessment led to a diagnosis of bv-FTD. Neurologic examination was normal and extrapyramidal signs were notably absent. A18F-FDG PET study showed severe frontal and temporal hypometabolism. Speech disturbances, consisting of frequent and long pauses, were reported as his first and most prominent symptom.

**Results:** IM's spontaneous speech was characterized by an unusual pattern of exceedingly long pauses (up to 20-30 seconds) intermingled with fluent production of utterances and fairly structured sentences, in some cases triggered by the examiner's prompts. Frequency and length of pauses interfered significantly with narratives. Perseverative contents and mild discourse disorganization were also evident. Formal assessment of language failed to show significant deficits, with the only exception of reduced verbal fluency. Slowing or abnormally long pauses were not observed in any standardized test, including narratives elicited by verbal memory tasks. Rather, IM's performance provided evidence of disinhibition and production of perseverative or irrelevant details. A variable pattern of dysexecutive deficits showed up on formal testing.

**Conclusions:** It may be hypothesized that IM's unusual presentation of speech disturbances is related both to disruption of behavioural control and executive impairment, highlighted by the challenging task of spontaneously producing an effective narrative.

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### A. SZYMASZEK, A. ORON, T. WOLAK & E. SZELAG. Temporal Information Processing Underlies Auditory Speech Comprehension: Clinical Evidence From Aphasic Patients.

**Objective:** Temporal information processing (TIP) underlies many aspects of human cognition, mainly auditory speech comprehension as well as memory, attention and motor control. Experimental studies often indicated parallel TIP and comprehension deficits in brain-injured patients with aphasia. Our study aimed at testing relationships between deteriorated TIP and declined cognitive functions in aphasic patients.

**Participants and Methods:** Thirty three post-stroke aphasic patients were investigated. Neuroanatomical verification of lesioned areas was evidenced in MRI/CT. Following left hemispheric structures were dam-

aged: superior and middle temporal gyrus, Heschl's gyrus, Rolandic operculum, insula, putamen and frontal inferior orbital lobe. TIP was tested, using auditory temporal-order-threshold (ATOT). Moreover, auditory speech comprehension was assessed with Token Test, Phoneme Discrimination Test (PDT) and Voice - Onset - Time (VOT) Test. Furthermore, two aspects of attention were evaluated: alertness and vigilance.

**Results:** Significant correlations between elevated values of ATOT and deteriorated performance on all applied language tests were indicated. Such relationship found its support in neuroanatomical overlapping of lesioned structures critical for both TIP and auditory speech comprehension. Moreover, significant correlations were evidenced between elevated ATOT and alertness. Finally, we found positive correlations between particular language tests, i.e. (1) Token Test and PDT; (2) Token Test and VOT Test; (3) PDT and VOT Test, as well as between PDT and both attentional tasks.

**Conclusions:** These results provide further clinical evidence supporting the thesis that time perception constitutes the core process incorporated in both language and attentional resources. Hence, the deterioration of such timing mechanism may cause impaired auditory comprehension as well as deficient attention.

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#### **I. VAN DER MEULEN, M. VAN DE SANDT, E.G. VISCH-BRINK, M. HEIJENBROK-KAL & G.M. RIBBERS. Melodic Intonation Therapy (MIT) in subacute aphasia.**

**Objective:** MIT uses the melodic elements of speech, such as intonation and rhythm, to facilitate and improve language production in people with severe nonfluent aphasia. So far, most effect studies have evaluated MIT in chronic aphasia.

The aims of this study are to investigate 1) the efficacy of MIT in the subacute phase post stroke 2) the effect of timing of MIT.

**Participants and Methods:** A waiting-list randomized controlled design was used (N=27, 2-3 mths post stroke). The experimental group received MIT (6 wk, 5 h/wk). The control group received control therapy (6wk, 5h/wk), followed by -delayed- MIT (6 wk, 5h/wk). Assessments were performed pre-treatment (T1), after 6 weeks (T2) and 6 weeks later (T3). Efficacy of MIT was tested by comparing language improvement in both groups at T2. Timing was evaluated by comparing language improvement after early MIT (T1-T2; experimental group) and after delayed MIT (T2-T3; control group) (linear regression analyses, corrected for baseline).

**Results:** Efficacy:

At T2, the MIT group showed significantly more improvement on repetition of trained material ( $\beta=15.0, p=.001$ ) and there was a trend for the improvement in everyday communication (Amsterdam-Nijmegen Everyday Language Test (ANELT) in favor of the MIT group ( $\beta=4.1, p=.067$ )).

Timing:  
The experimental MIT group improved significantly more than the delayed MIT group on language repetition ( $\beta=7.97, p=.02$ ) and on the ANELT ( $\beta=6.1, p=.02$ ).

**Conclusions:** MIT has a positive effect on language production in subacute aphasia: we found significantly more improvement on language repetition after MIT than after a control treatment of the same intensity, starting at the same time post stroke. The considerable difference between the MIT and the control group on the ANELT suggests that the effect of MIT is not limited to language repetition, but may generalize to verbal communication. In addition, we found a clear effect of timing: a delay of only six weeks was related to less improvement, not only in repetition, but also on the ANELT.

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#### **Executive Functions/Frontal Lobes**

#### **L.R. ARROYO, I. GANDARA, A. DE LA CRUZ, A. GARCÍA, C. RAMÍREZ & P. VALDEZ. Changes in Prevision from Preadolescence to Adolescence.**

**Objective:** Prevision is the capacity to anticipate the conditions required to solve a problem. The objective of this study was to determine the changes in prevision from preadolescence to adolescence.

**Participants and Methods:** Thirty-three participants were recorded, 17 preadolescents (11-12 year of age, 9 female and 8 male) and 16 adolescents (17-18 year of age, 10 female and 8 male). Prevision was analyzed with a 10 maps task. Each map had an area of 20 x 18 cm, four entrances at the top and four exits at the bottom, and had different figures drawn to simulate a city with "blocks" and "streets". Numbers 1 to 6 were distributed in six different blocks inside the map. Participants had to draw the shortest path as quick as possible from an entrance to an exit, passing next to each number in consecutive order. Also, they were required not to: lift the pencil from the paper, omit numbers, cross lines or use the same path twice.

**Results:** Compared to preadolescents, adolescents completed more correct maps (adolescents  $6.56 \pm 1.31$  maps, preadolescents  $4.65 \pm 1.32$  maps  $U=42.5, P<0.05$ ) and attained a higher number in the maps (adolescents  $6.31 \pm 0.30$  numbers, preadolescents  $5.64 \pm 0.40$  numbers,  $U=23.5, P<0.05$ ). Adolescents chose indirect paths to go to the number two, while preadolescents followed a direct path in this segment.

**Conclusions:** This study shows that prevision improves during in adolescents, compared to preadolescents, suggesting frontal lobe maturation in adolescence.

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#### **D. BERTENS, N. FRANKENMOLEN, D. BOELEN, L. FASOTTI & R. KESSELS. Diagnostic Utility of a New Scoring Method of a Modified Six Elements Test Measuring Executive Function.**

**Objective:** The Modified Six Elements Test (MSET) is a widely used neuropsychological test to assess executive impairments in brain-injured patients. However, ceiling effects limit its use as an indicator of executive deficits in clinical practice. The objective of this study is to examine if a different scoring method prevents ceiling effects and could improve the diagnostic utility of the MSET.

**Participants and Methods:** The MSET and six other executive tests were administered in patients with acquired brain injury in the chronic phase. The patient group was divided into 'low-executive functioning' ( $\geq 1$ SD below the normative mean on  $\geq 3$  out of 6 executive tests) and 'normal-executive functioning'. The newly proposed scoring method, which takes into account the amount of time spent on each subtask, was examined for its discriminative value using Receiver Operating Characteristic (ROC) analysis and compared to the conventional scoring method. Moreover, correlations with the six executive tests were evaluated.

**Results:** Forty participants enrolled in the study: 21 participants in the 'normal-executive' group (males 14, mean age: 47.7, sd 14.6, mean estimated IQ: 109.2, sd 15.4); 19 in the 'low-executive' group (males 10, mean age: 50.1, sd 11.5, mean estimated IQ: 101.6, sd 16.4). The new MSET scoring method discriminated significantly between normal and low executive functioning ( $AUC=0.714, p=.021$ ), sensitivity and specificity were low and no optimal cut-off score could be determined. The conventional raw MSET scores did not discriminate between the two groups ( $AUC=0.629, p=.163$ ). Low to moderate correlations were found between the new MSET scores and 3 other executive tests.

**Conclusions:** The present study shows that a new MSET scoring method is able to distinguish between a normal and low level of executive functioning in brain-injured patients. However, due to low sensitivity and specificity, the method is not an accurate indicator of executive impairments. Studies with a larger sample size are warranted.

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#### **D.H. BIECHOWSKA & E. ORLOWSKA. Executive functioning in type 2 diabetes.**

**Objective:** Diabetes is characterized by chronic hyperglycemia with the disorder of metabolism of carbohydrates, fat and proteins as a result of giving off defects and/or working insulin. Diabetic patients are affected by accelerated aging. Therefore, it would be expected that this group would more often present cognitive disturbances strictly depending on the biological age. The studies do not

show however a coherent pattern of cognitive impairment. Most researchers agree that the cognitive functioning varies depending on diabetes type, as they have different consequences. The devastating impact of type 2 diabetes mellitus (DM) on vascular, renal, and peripheral nerve functions has been well documented. This type is associated with cardio- and cerebrovascular diseases and has been identified as a significant risk factor for cognitive impairments and dementia. Although still poorly recognized, the impact of type 2 DM on cognition appears to extend across a broad range of functions. Associations between type 2 DM and executive dysfunction have not been uniformly demonstrated. The aim of this study is to characterize the different aspects of executive functions in DM patients population.

**Participants and Methods:** The group of 50 people with type 2 DM were individually examined. Authors assessed executive functions using different neuropsychological methods: Wisconsin Card Sorting Test, Trail Making Test, Verbal Fluency Test and elements of Behavioral Assessment of the Dysexecutive Syndrome.

**Results:** Subjects exhibited impairment in the planning, coordinating, sequencing and monitoring of cognitive operations. Shifting attention, planning and inhibition were amongst the most impaired aspects of executive functioning.

**Conclusions:** Results of this study are consistent with other research showing dysexecutive syndrome as one of type 2 DM consequences. Implications include the need to assess executive functioning with more than two methods and opening a discussion on executive impairment model characteristic for diabetic patients.

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**A. EMMANOUEL, E. MOUZA, R. P.C. KESSELS & L. FASOTTI. The Effects of Lesion Location on Daily Dysexecutive Symptoms of Brain Injured Patients using the DEX Questionnaire. The Associations of the DEX with the BADS and two other Open – Ended Real-Life Executive Measures, the EDT and the TQT.**

**Objective:** Our first aim was to investigate whether the lesion location can affect on the ability of the DEX to identify differences in the frequency of the daily dysexecutive symptoms of brain injured patients in clinical settings completed either by the patients or by their therapists. The strength of associations of the DEX patients' and their therapists' reports with the BADS total score, 6 BADS subtests sensitive and specific to anterior dysfunction and other real life executive measures, the EDT and the TQT was additionally examined.

**Participants and Methods:** We compared the total DEX scores of 30 anteriorly lesioned patients and those of 22 posteriorly damaged patients and also their therapists' DEX ratings. 29 healthy participants and their relatives were included as controls. Non parametric statistical tests were used due to the non normal distribution of the data.

**Results:** Mann-Whitney pairwise comparisons revealed more frequent daily executive problems for the anteriorly lesioned patients than for the posteriorly damaged patients as reported in the DEX by the therapists of both groups. No significant differences were found in the DEX self reports between the two patient groups. Spearman correlations showed significant negative correlations between the DEX therapists' reports and the patients' performances on the BADS, the EDT and the TQT. Non significant associations were found between the DEX patients' reports and the above executive measures. Further multiple regression analysis indicated the BADS total score and the BADS MSET as the unique predictors of the DEX therapists' ratings.

**Conclusions:** The DEX is able to accurately detect differences in the frequency of patients' everyday dysexecutive behaviours according to the location of their brain damage provided it is completed by their therapists in clinical settings. The EDT and the TQT are also proposed to be ecological valid executive measures. Finally, the BADS MSET is suggested to be as sensitive to daily executive dysfunction as the whole BADS battery.

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**M. RODRÍGUEZ-BAILÓN, G.W. HUMPHREYS & M.J. FUNES. Errors in Everyday Life actions after frontal lobe damage: Which kind of distracters are more harmful?**

**Objective:** Cognitive impairment following brain damage can lead to important alterations in routine activities of daily living (ADL). However little is known about whether different brain lesions produce different error patterns in ADL actions. The first aim of the present study is to specify the error pattern that best characterize ADL performance in frontal patients suffering executive function deficits. Second, we aim at understanding the impact that different kind of distractor objects and their relationship with target objects may have on performance.

**Participants and Methods:** The execution of a group of frontal lobe patients was compared with performance of patients with brain damage outside the frontal lobe, while performing four different cooking activities under 4 different distractor conditions, depending on 1. whether the distracters shared actions with the target objects and 2. whether the distracters shared the semantic context with the target objects

**Results:** Compared with the non-frontal group, frontal patients produce more errors related with a response inhibition deficit, such as toying and action repetitions. More interesting, we found that the nature of distracters have a differential effect on both groups. Frontal patients made more toying errors when distracters shared actions with the target items and made more omissions when distracters and target objects belonged to the same semantic context. However the distractor manipulation had a null or opposite effect on the non-frontal patient group

**Conclusions:** We conclude that this pattern of results might have potential implications for the appropriate design of specific rehabilitation programs of ADL activities for different brain lesion patients.

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**M.A. GARCIA-BARRERA, J.E. KARR, C.N. ARESHENKOFF, D.C. JEWETT, G. TUTT & C. MCMYNN. The Elusive Outcomes of Executive Control after Concussive Events: A Meta-Review and Empirical Study.**

**Objective:** Described as a 'silent epidemic', Mild Traumatic Brain Injury (mTBI) in sports (concussion) is a growing and costly public health concern. Debate surrounds the long-term cognitive outcomes of mTBI, but we believe it is within the reach of neuropsychology to elucidate its impact on cognition, with particular interest in examining its effects on executive control.

**Participants and Methods:** This research involved two phases: (1) A systematic review of meta-analyses (N=10) identified high variability in cognitive effect sizes (range: .12-.81), with pronounced variability in executive functions (range: -.11-.72) deriving from insufficient definitions and measurements of these constructs. (2) A novel study applied an established three-factor model of executive functions (inhibition, shifting, updating working memory; Miyake et al., 2000) as measured with computerized tasks, comparing group outcomes based on positive or negative mTBI history. This study included 138 athletes (Mage=19.88 [1.91], 39% Male) with 39.1% reporting mTBI history.

**Results:** On a Go/NoGo task (inhibition), mTBI athletes showed greater post-error slowing ( $t=2.07, p=.04$ ). On a Local-Global task (shifting), mTBI athletes presented greater response times (RT;  $t=2.8, p=.005$ ), with an increase in RT with a greater number of mTBIs ( $\beta=.09, p=.004$ ). On a N-Back task (updating), groups did not differ in RT ( $t=0.34, p=.74$ ) nor accuracy ( $t=.03, p=.98$ ). Post-hoc variability analyses showed greater response variability with mTBI for Go/NoGo ( $t=2.3, p=0.02$ ), with a trend of increased variability with greater number of mTBIs ( $\beta=0.005, p=0.05$ ) and a mild trend of increased response variability in concussed participants for the Local-Global ( $t=1.6, p=0.1$ ).

**Conclusions:** These findings present preliminary evidence for the sensitivity of a three-factor model at detecting long-term executive-related outcomes of mTBI in young athletes. Following post-hoc findings, our future analyses will focus on intra-individual variability as a novel indicator of post-mTBI deficits.

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**C.N. ARESHENKOFF, J.E. KARR & M.A. GARCIA-BARRERA. Performance Patterns on Card Selection during the Iowa Gambling Task: Preliminary Evidence of High Sensitivity to Losses after mTBI.**

**Objective:** Previous research has suggested that mTBI is associated with a number of adverse cognitive outcomes, although the exact nature of these deficits is poorly understood. The current study attempted to better understand the effect of mTBI on reward/loss based decision-making using a novel analysis devised by Horstmann et al. (2012) for the Iowa Gambling Task (IGT).

**Participants and Methods:** The study included 138 athletes (Mage=19.88 [1.91], 39% Male, 39.1% reporting history of mTBI) assessed through a computerized version of the IGT, with task outcomes compared based on mTBI history. A novel approach to IGT performance analysis included the examination of patterns of card selection within the “bad” and the “good” decks to assess the impact of probability of rewards versus losses on decision-making.

**Results:** The final 25 trials (out of 100) were analyzed separately in order to determine how well participants had learned the values of the decks. Participants reporting no mTBI displayed no clear preference for high-value/good decks over bad ( $p>0.5$ ) and no preference for one good deck over another ( $p>0.5$ ). Interestingly, participants with a history of mTBI displayed a strong trend towards a preference for good decks over bad ( $p = 0.06$ ), and in particular, a strong preference for one good deck over another ( $p<0.05$ ). Both groups display a strong preference for a particular high reward frequency bad deck over other individual decks ( $p<0.05$ ).

**Conclusions:** Control participants’ failure to reliably learn high-value decks is consistent with the literature, as is their disproportionate preference for the high reward frequency bad deck. Paradoxically, participants with history of mTBI more reliably selected high-value decks than did controls. We discuss this result in the context of existing theories on task performance in the IGT, and over evidence that superficially superior performance in participants with mTBI may result from changes in sensitivity to certain deck characteristics, such as reward frequency and loss salience.

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**E. HINDMAN, J. NELSON, J.F. DONNELLY, J.R. HODGES & G.A. BROE. Executive Functioning in Young People from Disadvantaged Backgrounds.**

**Objective:** The project investigated the nature of the relationship between quality of early life experiences (ELE) and cognitive proficiency, as assessed by performance on a battery of executive functioning tasks.

**Participants and Methods:** Participants ( $n = 101$ ) aged 13 to 25 years ( $M = 17.5$ ;  $SD = .49$ ) from predominantly disadvantaged social backgrounds completed a comprehensive demographic interview, two executive functioning tasks (Wisconsin Card Sorting Task (WCST), D-KEFS Tower Test), and a computerised battery of cognitive tasks designed to measure abilities associated with the ‘switching’, ‘updating’, and ‘inhibition’ constructs. Differences in the quality of early-life environment (high – low) was used as a between-groups’ factor.

**Results:** Participants with higher quality ELEs performed better, at statistically significant levels, than their counterparts on the WCST ( $t(73) = 2.91$ ,  $p < .01$ ) and D-KEFS Tower Test ( $t(73) = 2.64$ ,  $p < .01$ ). Members of the higher quality ELE group performed better on all of the cognitive tasks. Subsequent regression analyses showed that specific ELEs (childhood health, premature birth, head injury, family size) predicted differences in executive functioning proficiency at statistically significant levels.

**Conclusions:** This research provides evidence of relationships between ELEs and the proficiency of the brain’s executive functions. Further research identifying which early-life experiences affect cognitive proficiency would assist in implementing programs that optimise cognitive development in children growing up in challenging environments.

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**A. HOOD & D. WHITE. The effects of variability in blood phenylalanine levels on IQ and executive abilities in children with PKU.**

**Objective:** Phenylketonuria (PKU) is a metabolic genetic disorder that, if untreated, results in accumulation of phenylalanine (Phe) and typically leads to cognitive disability. Previous research has established the link between higher lifetime Phe and lower IQ. However, a few studies suggest that variability in Phe may be a better predictor of IQ. Building on that work, we hypothesized that greater variability in Phe may be predictive of the ability to engage in higher-order cognitive processes that involve executive abilities.

**Participants and Methods:** We calculated indices of Phe control related to average Phe levels (mean and slope) and variability in Phe levels (standard deviation and standard error of the estimate) over the lifetime of 47 children (25 boys) with early and continuously treated PKU, who ranged from 6 to 18 years of age. These indices of Phe control were correlated with performance on tasks assessing IQ and executive abilities.

**Results:** Supporting our hypotheses, results showed that variability was negatively associated with IQ ( $p = .03$ ), while average lifetime Phe levels were not ( $p = .24$ ). A regression model showed that variability in blood Phe was a significant predictor of IQ,  $p = .04$ , and for every 100  $\mu\text{mol/L}$  increase in variability there was a 5.2 decrease in children’s IQ. With regard to executive abilities, variability was negatively related to a task assessing strategic processing ( $p = .01$ ). After controlling for age, both the mean and variability in Phe levels were negatively related to a working memory task ( $p < .05$ ).

**Conclusions:** These data suggest that while variability in Phe levels may be a better predictor of IQ, the ideal scenario for children with PKU is to maintain low and stable Phe levels across their lifetimes. Further, our results provide evidence that high and variable Phe levels particularly comprised executive abilities. It is therefore important that treatment strategies target stability in Phe levels even for those children who adhere to current treatment recommendations.

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**J. KOERTS, L. TUCHA, K.W. LANGE & O. TUCHA. The Influence of Cognitive Reserve on Impairments in Executive Functioning in Parkinson’s Disease.**

**Objective:** Parkinson’s disease is, apart from the well-known motor symptoms, characterized by impairments in executive functioning. There are however, considerable differences between Parkinson’s disease patients, i.e. some patients show severe impairments in executive functioning, while others show no impairments in this cognitive domain. These individual differences might be explained by the theory of cognitive reserve. This theory states that high intellectual abilities (i.e. a high cognitive reserve) provide a buffer against the development of cognitive impairments. The aim of this study was to determine the influence of cognitive reserve on specific aspects of executive functioning in Parkinson’s disease.

**Participants and Methods:** Fifty-two Parkinson’s disease patients were included. All were assessed with proxies of cognitive reserve, tests of executive functioning as well as measures of disease characteristics and symptoms of depression.

**Results:** Measures of cognitive flexibility, working memory and divergent thinking (i.e. the performance on respectively the Trail Making Test part B, Digit Span backward and Phonemic Fluency test) were significantly predicted by cognitive reserve. The performance on semantic verbal fluency tests was however not associated with cognitive reserve, instead the severity of motor symptoms was a significant predictor. Inhibition (i.e. the Stroop interference index) was neither predicted by cognitive reserve nor by disease characteristics or symptoms of depression.

**Conclusions:** Several aspects of executive functioning are influenced by cognitive reserve in Parkinson’s disease, i.e. patients with a low cognitive reserve show more impairments in executive functioning than patients with a high cognitive reserve. When monitoring the evolution of executive functioning in patients with Parkinson’s disease, cognitive reserve thus needs to be taken into account.

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**F. LORAINS, P.G. ENTICOTT, J.L. BRADSHAW, N.A. DOWLING & J.C. STOUT. Problem Gamblers' Decision Making Under Risk and Ambiguity.**

**Objective:** Problem gamblers often demonstrate poor decision making, however, evidence suggests subtypes of problem gamblers may exist according to preferred gambling form. The current study attempted to delineate some of the underlying factors associated with problem gamblers decision making using a cognitive modelling procedure, and examined choice behaviour in subtypes of problem gamblers.

**Participants and Methods:** Participants were 39 treatment-seeking problem gamblers and 41 age, gender and IQ matched controls. Problem gamblers were grouped into strategic (e.g. sports-betting, casino games) or non-strategic (e.g. electronic gaming machines) gamblers according to preferred gambling form. Participants completed the Iowa Gambling task (IGT; a task proposed to simulate real-life decision making) and a Loss Aversion Task (measuring choices on a series of hypothetical loss alternatives). The Prospect Valence Learning model was used to provide an explanation of cognitive, motivational and response style factors involved in IGT performance.

**Results:** Overall, problem gamblers made more disadvantageous choices on the IGT ( $p=.03$ ) and were less sensitive to losses on the Loss Aversion Task ( $p=.03$ ) than controls. Problem gamblers' decisions during the IGT were influenced by heightened attention to gains ( $p=.006$ ) and less consistency in their responses ( $p<.001$ ), whilst sensitivity to losses and the ability to learn from previous outcomes was not associated with decisions. Compared to matched controls, non-strategic problem gamblers performed more poorly on the IGT ( $p=.03$ ) and were less loss averse ( $p=.02$ ), whilst strategic problem gamblers did not differ from matched controls.

**Conclusions:** Problem gamblers' poor decision making was associated with aberrant reward processing and differences in decision making were present between subtypes of problem gamblers based on preferred gambling form. These findings underscore the necessity to disentangle the heterogeneity evident in problem gamblers.

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**U. MUELLER. Self-Control in 4-Year-Olds: Executive Function, Parenting, and Temperament.**

**Objective:** The present study used a longitudinal design to gauge the contribution of temperament, Executive Function (EF), parenting style to emerging self-control. Temperament, EF, and parenting style were measured when children were 2 years old; self-control was assessed at 4 years. We hypothesized that the effortful control aspect of temperament, authoritative parenting style, and EF skills would account for a significant amount of individual differences in self-control.

**Participants and Methods:** The sample consisted of 81 children (43 boys and 38 girls). Children were assessed at 2 years ( $M = 25$  months; range = 20–31) and 4 years ( $M = 50$  months; range = 37–58).

Measures

At age 2 years, children were administered five EF tasks: Shape Stroop, Spatial Span, Spin the Pots, Reverse Categorization, and Delayed Alternation. The Surgency, Negative Emotionality, and Effortful Control scales of the Children's Behavior Questionnaire (CBQ; Putnam & Rothbart, 2006) were used as measures temperament.

The Parental Authority Questionnaire (PAQ) was used as a measure of authoritative parenting style (Buri, 1991).

The self-control scale from the Social Skills Rating System (SSRS; Preschool version; Gresham, Elliott, 1990) was used as a measure of self-control when children were 4 years old.

**Results:** To assess whether aspects of temperament, EF, and parenting style at age 2 years predicted self-control scores at age 4 years, we ran a multiple regression analysis, using surgency, effortful control, negative emotionality, EF, and authoritative parenting as predictors, and self-control as the outcome. The model explained a significant amount of variance ( $r^2 = .225$ ) in self-control. However, only authoritative parenting style ( $\beta = .28$ ;  $t = 2.03$ ,  $p < .05$ ) and EF ( $\beta = .30$ ;  $t = 2.08$ ,  $p < .05$ ) explained a significant amount of variance in self-control.

**Conclusions:** The findings of the present study support the suggestions that EF and parenting play important roles in the development of self-control.

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**A. NAJAS GARCIA, R. GRANERO & L. EZPELETA. Executive Functions in Preschoolers with ODD, ADHD and comorbid ODD-ADHD: Evidence from the preschool version of Behavior Rating Inventory of Executive Function (BRIEF-P).**

**Objective:** This study examines executive functioning in 3-year old preschoolers with attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), comorbid ADHD+ODD, and children without any of these conditions (control group).

**Participants and Methods:** Participants were part of a longitudinal study of risk factors in developmental psychopathology. A total of 621 children aged 3 years old and their parents agreed participate in this study. According to a diagnostic interview, the sample was classified into four groups and the followed instruments were employed:

The Diagnostic Interview for Children and Adolescents (DICA; Reich, 2000) that evaluates the main psychopathologies in childhood and adolescence according to the Diagnostic and Statistical Manual of Mental Disorders criteria (DSM-IV)

The Behavior Rating Inventory of Executive Function preschool version (BRIEF-P; Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L., 2000) is a standardized rating scale that assesses the executive function in preschool children.

The Kaufman Brief Intelligence Test (K-Kit; Kaufman, 1990) is a brief intelligence test with two subtests, Vocabulary and Matrix, providing a composite IQ score.

**Results:** The ADHD group performed worse in all scales of the BRIEF-P than the ODD and Control groups, while no statistical differences emerged in the comparison of ADHD and comorbid groups. The ODD group had worse scores in the inhibition scale than the control group.

**Conclusions:** In conclusion, our findings suggest that EF are specific to children with ADHD although difficulties with inhibition are also found in 3-year-old children with ODD, which could impede satisfactory development. These findings have important implications for the understanding of the neuropsychological characteristics of disruptive disorders and should be taken into account with regard to several aspects of clinical practice contributing to the early identification of children with ADHD and ODD, and also to the design of EF treatment strategies.

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**L. OKRUSZEK & A. RUTKOWSKA. Executive Dysfunction in Patients with Frontal Lobe Lesions and in Patients with Schizophrenia: Can We Tell the Difference with Commonly Used Neuropsychological Tests?**

**Objective:** Executive function deficits are one of the most frequently observed neuropsychological deficits in schizophrenia. Their importance is being emphasized, especially in the context of neurodevelopmental theory of schizophrenia and abnormalities in prefrontal cortex structure and function observed among patients. Executive dysfunction is also a common sequelae of the frontal lobe lesions. Between groups comparison of executive functioning of patients with schizophrenia and patients with frontal lobe lesions has been analyzed only in a handful of studies. The aim of this study was to compare results of healthy men, men with schizophrenia and men with localized frontal lobe lesions on the battery of the commonly used tests of executive functioning.

**Participants and Methods:** Men diagnosed with schizophrenia according to ICD-10 ( $n=30$ ) and men with localized frontal lobe lesions of various etiology ( $n=30$ ) were assessed with battery of commonly used tests of executive functioning (Wisconsin Card Sorting Test, Stroop Test, Verbal Fluency, Tower of London task). Their scores were compared with the scores of the controls ( $n=30$ ) matched on age and level of education.

**Results:** Compared to healthy controls, both groups of patients demonstrated significant impairment in all of the measures of executive functioning which were applied. At the same time neither of the scores of the tests differentiated one group of the patients from the other.

**Conclusions:** The results are consistent with the results of previous studies indicating that executive dysfunction may be observed both in patients with schizophrenia and in patients with frontal lobe lesions. Since no differences between patients groups were found in any of the quantitative scores of the popular tests of executive functioning, it is recommended that qualitative assessment of patients performance is carried out and analyzed.

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**M. RIOS-LAGO, J. PERIANEZ, R. MARTINEZ-ÁLVAREZ & J. ALVAREZ-LINERA. Neuropsychological consequences of psychosurgery in Obsessive-Compulsive Disorder: dissociations in cognitive flexibility.**

**Objective:** Executive difficulties are often associated to Obsessive-Compulsive Disorder (OCD) leading researchers to predict a poor performance in classical executive test. There seems to exist an association between OCD symptoms and performance on cognitive flexibility tasks, so that the more obsessive symptoms, the less cognitive flexibility. Once this relationship is established, the objective of the present study is to know to what extent the decline in obsessive symptoms after treatment is related to an improvement in neuropsychological performance.

**Participants and Methods:** 5 treatment-refractory OCD patients underwent MRI-guided stereotactic bilateral cingulotomy and anterior capsulotomy. All patients completed a neuropsychological assessment before and after neurosurgical intervention. 5 healthy controls (HC) matched for age, education and gender took also part in the study. The assessment included WCST, TMT, Stroop, Memory span, Symbol search, DSMT and Y-BOCS.

**Results:** Patients (before surgery) scored within the severe range in the Y-BOCS and differed significantly with HC. Regarding neuropsychological performance, no differences were found in none of the tests but in WCST perseverative errors, where HC outperformed OCD patients. In addition a positive correlation was found between Y-BOCS and perseverative errors. Pre-post analysis showed a significant increase in perseverative errors after surgery. No other differences were found.

**Conclusions:** Comparisons between presurgery OCD patients and HC confirm previous results, establishing a possible relationship between obsessive symptoms and flexibility. However, the comparison between pre and post measures indicates a clear reduction of obsessive symptoms after surgery while, conversely, perseverative errors increased after treatment. This establishes a dissociation between these mechanisms usually considered to be related. This decline is not a result of global neuropsychological impairment as a result of surgery, given the absence of other neuropsychological changes.

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**R.M. ROTH, M.J. HOLCOMB, A.S. FISCHER, L. KENEALY & P.K. ISQUITH. Two vs Three Factor Model Scores on the BRIEF in Children and Adults with ADHD.**

**Objective:** Executive dysfunction is observed in both children and adults with ADHD. Recent confirmatory factor analyses of the Behavior Rating Inventory of Executive Function (BRIEF) in healthy children and adults indicated that its factor structure may be better reflected by a three- rather than two-factor model. We evaluated BRIEF scores using the two models in children and adults with ADHD to determine whether the three-factor model provides additional clinically relevant information.

**Participants and Methods:** The pediatric sample consisted of 133 children with ADHD and 133 age and gender matched healthy children having BRIEF Parent report scores. The adult sample consisted of 19 individuals with ADHD and 19 matched healthy controls with Self-Report BRIEF-A scores. Group differences on the two (Behavioral Regulation, Metacognition) and three (Behavioral Regulation, Emotional Regulation, Cognitive Regulation) factor models were evaluated.

**Results:** Children with Inattentive and Combined subtypes of ADHD had poorer executive function across all factors relative to the control group. Poorer Behavioral Regulation and Emotional Regulation were found for the ADHD Combined relative to the Inattentive Type. Group difference for Behavioral Regulation in the two-factor model was better accounted for by poorer Behavioral Regulation (Inhibit and Self Monitor scales) than Emotional Regulation (Emotional Control and Shift scales) using the three-factor model, especially for ADHD Combined type. Adults with ADHD had greater difficulty than controls on the Metacognition factor but not Behavioral Regulation when using the two-factor model. In contrast, the three-factor model revealed poorer Behavioral Regulation and Cognitive Regulation but not Emotional Regulation in the adult ADHD group.

**Conclusions:** The present findings support the clinical usefulness of the three-factor model for the BRIEF and BRIEF-A in both children and adults with ADHD, and further specify the profile of executive function weaknesses in subtypes of the disorder.

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**K. WELSH, R.M. ROTH & P. ISQUITH. Self-Reported Executive Function in Adolescents and Perceived Risk-Taking in Others.**

**Objective:** Adolescents' perceptions of risk taking behavior in their peers may reflect their own perceived self-regulatory capabilities. We examined teens' perceptions of their own self-regulation in relation to how they view risk taking in peers. We hypothesized those adolescents who describe themselves as more dysregulated would view risk taking amongst their peers as more common than adolescents who report being better self-regulated.

**Participants and Methods:** Twenty-two boys and 47 girls between the ages of 12 and 18 years ( $M=15.25$ ,  $SD=1.73$ ) completed the Behavior Rating Inventory of Executive Function, Self Report version (BRIEF-SR), a measure of executive functioning in everyday life in adolescents, and a six-item Risk Perception questionnaire that asked about the percentage of peers they believed engaged in substance use, smoking, sexual activity, driving under the influence, had thoughts of self-harm, or were in an abusive relationship ( $\alpha = .71$ ).

**Results:** Teens' perception of greater risk taking in their peers was associated with greater self-reported difficulties on the BRIEF-SR Inhibit, Emotional Control, Working Memory and Monitor scales. Teens who described themselves as being more impulsive, emotionally volatile, inattentive and less aware of their impact on others, were more likely to view their peers as engaging in risk-taking behaviors. This relationship was not dependent on age. The strongest relationships were seen between the belief that peers were in abusive relationships and self-reported impulsivity and self-monitoring, and between the perception that peers had suicidal thoughts and self-reported emotional volatility.

**Conclusions:** Adolescents who describe themselves as more dysregulated tend to view their peers as more likely to engage in risky behaviors. These findings raise the possibility that an interaction between executive dysregulation and perception of peer behavior augments the likelihood of engaging in risk taking behavior in adolescents.

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**M. ABECASSIS, R.M. ROTH, P.K. ISQUITH & P.R. GIANCOLA. Parenting Style in Childhood and Executive Functions in the Everyday Life in Young Adults.**

**Objective:** Parenting style impacts behavioral outcomes and executive functions in children. The impact of parenting style in childhood on executive function in adults remains to be elucidated. We therefore evaluated whether childhood parenting style is associated with executive functions in the current everyday life of young adults.

**Participants and Methods:** A sample of 390 young adults completed the Beck Depression Inventory (BDI), Behavior Rating Inventory of Executive Function-Adult version (BRIEF-A; self-report measure of executive function in everyday life over the past month), and Parental Bonding Inventory (PBI). The PBI asks respondents about their childhood experience of their parent's parenting style, classifying their style as Optimal Parenting (high care, low overprotection), Affectionate Constraint (high care, high overprotection), Affectionless Control (low care, high overprotection), and Neglectful (low care, low overprotection).

**Results:** Parenting style was associated with mood (thus BDI was used as a covariate). No interaction between mother parenting style and respondent gender was observed. Better executive function was found in those whose mothers had an optimal style rather than affectionate constraint or affectionless control. A neglectful style in mothers had a negative impact only on emotional control. Father parenting style was not associated with executive functions in male respondents. In contrast, in females, better executive function was reported when fathers had an optimal style, while poorest executive function was seen with affectionless control.

**Conclusions:** Childhood parenting style is associated with the extent of current difficulties with executive function in young adults. In particular, a style involving low care but also overprotectiveness was most consistently associated with worse executive functions. In general, overprotectiveness appears to impinge on the capacity to hone executive capacities, possibly by hindering reasoning and exploration associated with normative daily challenges.

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**A. SOLER, A. CAMPABADAL, C. GALISTEO, M. LARROSA, M. MASDEU, L. VIGIL & M. JÓDAR. Attention and working memory in fibromyalgia and chronic pain.**

**Objective:** Many patients with fibromyalgia syndrome (FM) complain about concentration problems. Some studies have found lower performance in complex tasks of attention and working memory compared with healthy population. Furthermore these differences are usually explained by pain. The aim of this study is to compare attention and working memory in patients with FM and chronic pain (CP)

**Participants and Methods:** The sample includes 31 FM patients (FM) who meet ACR/90 criteria and 30 control subjects with chronic pain (CP). Exclusion criteria were: neurological diseases, moderate-severe depression (Beck>20), and pharmacological treatment. Attention was assessed using Digit Span forward (WAIS-III) and Spatial Span forward (WMS-III). Digit Span backward (WAIS-III), Spatial Span backward and Letter Number (WMS-III) were used to measure working memory. Complex working memory and sustained attention was evaluated with the PASAT task

**Results:** Statistical analysis using a T Student shows no significant differences between FM and CP in age ( $p=0.18$ ) and education ( $p=0.94$ ). No significant differences were found in Digit Span forward ( $p=0.20$ ), Digit Span backward ( $p=0.46$ ), Spatial Span forward ( $p=0.99$ ), Letter Number ( $p=0.09$ ), PASAT correct answers ( $p=0.92$ ), PASAT errors ( $p=0.97$ ) and PASAT omissions ( $p=0.95$ ). Significant results were just found in Spatial Span backward ( $p=0.04$ ). Although all means are in the normal range, FM patients scores slightly lower than CP group

**Conclusions:** Focal attention and working memory is not impaired in FM and CP patients considering normative data, although both groups score slightly below normal population. Pain could be related to this finding. Furthermore, FM patients tend to have greater difficulty than CP patients, especially in visual working memory. These findings might be explained by concomitant factors, such as sleep or neuroendocrine changes, associated with FM disorders and that can affect cognition. Funded by the Fundació La Marató de TV3.

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**L.I. THOMPSON, B.E. WELLS, J.T. PARSONS & S.A. GOLUB. Emotional Distress and Affective Decision-Making Processes Involved in Sex Under the Influence of Alcohol Among Emerging Adults.**

**Objective:** Sexual activity under the influence of alcohol (UI) is consistently associated with unintended pregnancy and STD infection, but rates remain high, especially among emerging adults (ages 18-29). To develop successful interventions that curb sexual risk-taking, we must better understand the decision making process involved in sex UI. This study investigates the extent to which Iowa Gambling Task (IGT) performance (i.e. affective decision-making) interacts with emotional distress (depression, anxiety or both) to predict percentage of sex acts UI.

**Participants and Methods:** An NYC sample of 176 heterosexual emerging adults (55% female) were recruited as part of an NIH-funded research project. Measures of affective decision making (IGT, Bechara et al., 1994), depression and anxiety (Brief Symptom Inventory, Derogatis & Melisaratos, 1983), and behavioral data were collected. ANCOVA was used to examine the relationship between IGT performance and affective factors in the prediction of percentage of sex acts UI.

**Results:** Anxiety and depression interacted with IGT performance similarly, such that while sex UI decreased with better IGT performance among non-distressed participants, the opposite association was found for anxious and depressed participants,  $F(1,168) = 5.5, p < .05$  and  $F(1,168) = 11.5, p < .01$ , respectively. A four group ANCOVA (no distress, anxiety, depression, comorbid) revealed a distress by IGT performance interaction driven by the comorbid group (Beta = -1.6, SE = .53,  $t = -3.1, p < .01$ ), suggesting greater variability in percentage of sex UI in this group as a function of IGT performance. Highest rates of sex UI were reported in the anxious-only group.

**Conclusions:** Functional affective decision making ability, as assessed by the IGT, may facilitate the negative impact of emotional distress on sex UI. Further, emerging adults experiencing anxiety appear to engage in the highest rates of sex UI overall, with implications for sexual risk-taking prevention efforts.

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**E. UEHARA, A. FILGUEIRAS, H. CHARCHAT-FICHMAN & J. LANDEIRA-FERNANDEZ. Preliminary evidence of the reliability and validity of a Brazilian executive function computer task for children: The Circus Magic Cards Game.**

**Objective:** The Circus Magic Cards Game (CMCG) is a computerized task based on the Dimensional Change Card Sorting Task. The CMCG is designed for use in elementary school-aged children to evaluate executive function, including inhibition, working memory, and mental flexibility. The CMCG has three phases: color phase (12 items), shape phase (12 items), and border phase (24 items).

**Participants and Methods:** Seventy-one typically developing children, aged 3 to 6 years, participated in the study. The children were administered the CMCG, neuropsychological assessments of executive functioning, and additional measures. Convergent validity was assessed using Pearson's correlations, and internal consistency was determined using Cronbach's alpha. Following an exploratory factor analysis, a varimax rotation was performed.

**Results:** Preliminary evidence of convergent validity was reflected by fruit verbal fluency ( $r = 0.51$ ), the Stroop Day and Night test ( $r = 0.53$ ), and forward ( $r = 0.45$ ) and backward ( $r = 0.56$ ) Digit Span. These data indicate that performance on the CMCG is moderately correlated with classic executive function paradigms. The exploratory factor analysis suggested a three-factor solution in the varimax rotation. Internal consistency was demonstrated for CMCG total score ( $\alpha = 0.83$ ), Phase 1 score ( $\alpha = 0.79$ ), Phase 2 score ( $\alpha = 0.89$ ), and Phase 3 score ( $\alpha = 0.80$ ).

**Conclusions:** These preliminary results showed good reliability for the CMCG, and it may be useful in the future as a clinical, computerized neuropsychological research tool for evaluating executive function among typically developing children. Future studies with a clinical population should determine how well this tool is suited for tracking executive dysfunction and early intervention.

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**E.L. VARGENS. Children and Adolescents Performance Profile on Executive Function Assessed by NEPSY II.**

**Objective:** The present study aimed to investigate the development of executive functions, through the performance of students aged 5 to 16 years in executive functions subtests of the NEPSY II (Auditory Attention and Response Set, Animal Sorting, Design Fluency, Inhibiting and Verbal Fluency).

**Participants and Methods:** We evaluated 267 children from public and private schools, of both genders, in São Paulo, grouped into the following age groups: 5-6 years, 7-8 years, 9-10 years, 11-12 years, 13-14 years and 15-16 years.

**Results:** ANOVA, ANCOVA and post hoc Bonferroni were conducted in order to investigate the effect of age, gender and type of School on performance in the tests. In this sample, it was possible to identify suggestions of executive functions developmental milestones over the age groups. Auditory Attention had two moments of growth: 5-6 and 7-8 years, with a drop in the number of errors from 7-8 years and 13-14 years after. The ability to inhibit responses reaches the ceiling effect at around 13-14 years of age and generating words at 15-16 years. This study identified no significant effect of gender on the performance of students in the executive function components evaluated but there were differences between public and private school groups performance for the indices presented except for semantic verbal fluency and auditory selective attention.

**Conclusions:** The results indicated a heterogeneous and non-linear development of executive functioning components depending on age.

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**T. VLASMA, T. VAN LAAR, O. TUCHA, J. KOERTS, H. DIJKSTRA & J. SPIKMAN. The Goal Setting Approach Within Treatment For Dysexecutive Functioning; Do Parkinson's Disease Patients Set Different Goals Than Patients With ABI?**

**Objective:** During the last decades the use of the goal planning approach, a clinical approach that is centered on the patient's preferences and needs became much more important. The principle of this approach is that patients, together with the neuropsychologist, set a number of goals they want to achieve by means of the treatment. Being involved in goal setting increases patient's motivation and the likelihood of actually achieving these goals. To our knowledge there have been no studies on content related aspects of goals setting. Therefore we study goal setting in patients with Parkinson's Disease and ABI, who are/have been treated for deficits in executive functioning. Because deficits in EF are observed in both patient groups, but they differ with respect to brain pathology and the domains of EF that are most impaired, we aimed to explore whether PD patients set goals in different domains of EF and with different levels of concreteness compared to ABI patients. In addition, we study the relation between the level of self-awareness and concrete goal setting.

**Participants and Methods:** 217 Goals of 73 patients with ABI and 48 goals of 16 PD patients were categorized into domains of EF: planning, regulation, time management, initiative and insight and were labeled as either global or concrete. The difference between proxy and patient rating on the DEX was used as a measure of self-awareness. The following analyses have been used: Chi-square, Spearman's correlation and t-tests.

**Results:** PD patients set significantly more goals in the domain of time management when compared to ABI patients, but the other domains showed no significant differences. Further, results showed that there was no relation between self-awareness and concrete goal setting.

**Conclusions:** This indicates that even though both groups differ in etiology and brain pathology and are thought to have different EF dysfunction profiles, the deficits in daily life they experience as most restricting are almost similar.

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**Z. YEH, M. TSAI, M. TSAI & C. LO. Investigation of theory of mind and empathy performance in patients with frontal lobe damage.**

**Objective:** The present study aimed to investigate (1) theory of mind and empathy performance in patients with frontal lobe damage; (2) frontal lobe-related cognitive performance, and cognitive functions including emotional face recognition, decision-making, executive function, and working memory, in patients with frontal lobe damage; and (3) the corresponding relationships of damage to the ventromedial (VM) and dorsolateral (DL) portions of the frontal lobe with performance levels of cognitive and emotional aspects of theory of mind and empathy.

**Participants and Methods:** The participants included 3 groups: patients with ventromedial prefrontal cortex lesions (n=8), patients with dorsolateral prefrontal cortex lesions (n=15) from a medical center, and

normal controls (n=19). All participants were assessed to determine basic cognitive function, including the Mini Mental State Examination (MMSE), working memory, and intelligence. Theory of mind tasks, empathy scales, emotional facial recognition, decision-making, and executive function tasks were used to test our hypothesis.

**Results:** The results showed that theory of mind performance was significantly lower in the dorsolateral (DL) frontal lobe damage group than in the control group, and that the performance of personal distress items of empathy was significantly lower in the ventromedial (VM) frontal lobe damage group than in the dorsolateral (DL) frontal lobe damage group. However, after controlling for executive function scores, the significant difference between the DL and VM groups on the tasks of theory of mind and empathy disappeared. Multiple regression analysis revealed that deficits in executive function could explain about 43.6% of the performance on theory of mind in patients with frontal lobe damage.

**Conclusions:** Since we did not find differences between the cognitive and affective aspects of theory of mind in the DL and VM frontal lobe patients, the deficit in executive function may play an important role in the performance of these social cognitive abilities.

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### Electrophysiology/EEG/ERP

**S.C. ANDREWS, P. ENTICOTT, K. HOY & P. FITZGERALD. Exploring Mirror Systems and Social Cognitive Deficits in Bipolar Disorder and Schizophrenia.**

**Objective:** Social cognitive deficits are common in schizophrenia (SZ) and bipolar disorder (BP), and affect quality of life. The biological basis of these impairments is not fully understood. The mirror system theory of social cognition posits that mirror neurons, which fire both during the action and observation of motor activity, may help enable social cognition. Mirror systems have been explored separately in SZ and BP, using both TMS (motor resonance) and EEG (mu suppression), with mixed results. This study further explored mirror systems in these disorders, and their relationship with social cognition.

**Participants and Methods:** 19 SZ, 15 euthymic BP and 19 age- and gender-matched healthy control participants took part in this TMS and EEG study. Single-pulse TMS was applied to M1 during the observation of hand movements designed to elicit mirror system activity, while EEG electrodes at C3, CZ and C4 recorded brain activity. Subjects also completed social cognitive measures assessing facial emotion recognition and theory of mind (ToM).

**Results:** Consistent with previous research, SZ patients showed both emotion recognition and 2nd order ToM deficits, while BP patients showed selective ToM deficits. In BP but not SZ participants, EEG mu suppression (a putative measure of mirror systems) was significantly reduced compared to controls. All groups showed a similar pattern of TMS motor resonance. Despite these differing results, the EEG and TMS mirror system measures correlated with one another, suggesting a common underlying brain mechanism. As a group, TMS motor resonance correlated with 2nd order affective ToM.

**Conclusions:** These results indicate that individuals with bipolar disorder, more so than schizophrenia, may have an underactive mirror system. This could be contributing to the more specific theory of mind deficits present in bipolar disorder, however further research is required to elucidate the precise relationship between social cognition and the mirror system in both healthy and clinical populations.

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**I. BERNARDINO, J. CASTELHANO, R. FARIVAR & M. CASTELO-BRANCO. Neural Correlates of Visual Integration in Williams Syndrome: an EEG Study.**

**Objective:** Williams syndrome (WS) is a model of dorsal stream vulnerability and impaired visual integration. However, the neurophysiological correlates of such impairments in this condition remain unknown. Our goal was to characterize neural underpinnings of sensory and cognitive processes associated with visual integration in WS.

**Participants and Methods:** Nine WS subjects (Fish test; mean age $\pm$ SE=21.44 $\pm$ 2.30) and 8 healthy controls (mean age $\pm$ SE=21.89 $\pm$ 2.40) matched for chronological age, gender and handedness were included. We used a 3D structure-from-motion(SFM) task in which movies of SFM defined faces parametrically modulated in 3D depth (three depth levels) were shown. Subjects indicated with a button press, after stimulus offset, if they identified a face or not. EEG data were recorded using a 64 channel Quick-Cap and processed offline (filtering, artifact correction, epoch segmentation). Event Related Potentials (ERPs), Independent Component Analysis (ICA), source localization and time-frequency analyses were performed.

**Results:** We found that the electrophysiological (EEG/ERP) correlates of 3D coherent percepts were distinct across groups. ICA revealed a novel component in WS with a late positivity around 200ms that was absent in controls. Source localization analysis of ERP signals showed a posterior occipital shift and reduced parietal dorsal stream sources in WS. Moreover, low gamma-band oscillations (20-40Hz) specifically induced by this 3D integration task were significantly stronger in WS whereas high gamma-band oscillations (60-80Hz) were reduced in this clinical model of impaired visual coherence, as compared to controls.

**Conclusions:** Our results suggest that dorsal stream processing of 3D SFM stimuli has distinct neural correlates in WS and that possibly different cognitive strategies are employed by WS to reach visual coherence. These findings also suggest that different sub-bands (20-40Hz/60-80Hz) within the gamma range can be dissociated concerning the respective contribution to the coherent percepts formation.

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**O. BOUCHER, F. D'HONDT, F. LEPORE, J. TREMBLAY, P. VANNASING, A. BOUTHILLIER, M. LASSONDE & D.K. NGUYEN. Emotion Processing in the Human Insula: an Intracranial ERP Study.**

**Objective:** The insular cortex is a key region in emotion processing which specific role remains nonetheless unclear. While it has previously been associated with the processing of disgust, growing evidence now suggests a broader involvement, notably in conscious experience of emotion. In this context, functional imaging studies have inconsistently reported insular activations in relation to emotional valence and arousal level of a stimulus, and the precise timing of these activations remains undocumented.

**Participants and Methods:** We recorded intracranial event-related potentials (ERPs) in the insula of two female patients (Pt.1: 38 yrs, left insula; Pt.2: 35 yrs, right insula) undergoing pre-surgical monitoring for intractable epilepsy while they viewed a series of unpleasant, pleasant and neutral pictures. Subjects were then asked to rate each picture on its emotional valence, from very unpleasant to very pleasant. Pt.2 was also asked to rate pictures on their level of emotional arousal, from null to very arousing. Non-parametric permutation tests were performed to compare ERP data according to valence (Pt.1 & 2) and arousal (Pt.2).

**Results:** In both patients, statistical differences between the unpleasant and neutral pictures were found between 250 and 350 ms post-stimulus onset. At this time, negative ERP components were larger for unpleasant pictures; this was observed at insular electrodes located in the anterior long gyrus in Pt.1, and in the posterior short gyrus in Pt.2. Testing for arousal effects in Pt.2 revealed a significant difference at 150-200 ms: independently of the stimulus valence, arousing pictures elicited an early positive component which was not seen for non-arousing pictures. Again, this effect was found in the posterior short insular gyrus.

**Conclusions:** These results support an early involvement of the insula in arousal processing, possibly associated with its role in interoception, and a later involvement in emotional valence processing which might be associated with conscious emotional experience.

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**H. ERLBECK, A. KÜBLER, B. KOTCHOUBEY & S. VESER. Effects of Attention and Passiveness on Event-Related Potentials.**

**Objective:** In patients with disorders of consciousness (DOC), event-related potentials (ERP) have been proven to be a successful tool to com-

plement clinical assessment and to detect residual cognitive functions. These recordings of ERPs are usually accomplished using passive instructions to "just listen". However, to assess cognitive functions of patients, their data are then compared to data from healthy participants that are usually recorded using active instructions. The present study investigates the effect of attentive modulations and especially the effect of passiveness on the ERP components mismatch negativity (MMN) and N400.

**Participants and Methods:** A sample of 18 healthy participants listened to three auditory paradigms: one oddball paradigm (1000 tones, 900 standards, 100 deviants), one sentence-based paradigm (100 congruent sentences, 100 sentences ending on a highly unexpected word) and one word-based paradigm (100 related and 100 unrelated word-pairs). Each paradigm was presented three times with different attentive tasks: attention focused on the stimuli (pressing a key in reaction to the auditory stimuli), passive listening ("just listen") and attention to concurrent stimuli (pressing a key in reaction to a specific scene in a silent movie). After each task, the participants indicated their subjective effort.

**Results:** Results reveal that all three ERPs varied significantly according to the attentive modulation. An MMN was elicited in all tasks, an N400 to the unexpected sentence-endings or unrelated word-pairs was only elicited when attention was directly on the stimuli but not when the instruction was to listen passively or with a concurrent task. Subjective effort varied significantly according to the tasks and was perceived equally high for attention to the stimuli and passive listening and lower for attention to a concurrent task.

**Conclusions:** We conclude that passiveness raises high subjective effort, leads to diminished ERPs in semantic material (N400), but does not affect preattentive processing (MMN).

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**G. FRAGA GONZALEZ, G. ZARIC, M. BONTE, L. BLOMERT, J. TIJMS & M. VAN DER MOLEN. Differences in visual processing of printed words in dyslectic children.**

**Objective:** The specialization of visual areas for fast processing of printed words plays an important role in the acquisition of reading skills. Differences in the development of these neural processes may be among the deficits underlying developmental dyslexia. The present study looks at the word activation specificity in dyslexic children in 3rd grade by comparing early components of brain potentials elicited by visually presented words or string of meaningless letter-like symbols. The aim is to explore the level of word specific activation after the first two years of reading and, most importantly, how dyslexics and normal readers differ at this stage of reading development.

**Participants and Methods:** A sample of 40 children with the diagnosis of dyslexia and 20 control readers with ages between 8 and 9 year old were recruited and both behavioral and ERP measurements were taken. The ERP measurements are taken during a visual task in which high frequency words and strings of meaningless symbols with similar visual features are presented

**Results:** Preliminary results show a more pronounced N1 component for words compared to symbols for both groups. In contrast to previous findings, the dyslexic group showed larger left-lateralized and word-specific N1 responses than the normal reading group.

**Conclusions:** The results suggest that the interpretation of this early word specific response may be more complicated than previously assumed. They will be discussed with special reference to the visual features of letters vs. symbols and the relation of the N1 differences with several behavioral measurements will be further examined.

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**I. LEBEDEVA, N. SEMENOVA, S. SIDORIN, V. KALEDA, A. BARKHATOVA & T. AKHADOV. Auditory Oddball N100, Single-voxel 1H-MRS and DTI of the Corpus Callosum Genu in Young Male Patients with Schizophrenia.**

**Objective:** The aim of the study was to analyze the peculiarities of some neurophysiological, metabolic and microstructural data in schizophrenia.

**Participants and Methods:** 22 young (18-28 years old) male medicated right-handed remitted patients with schizophrenia and 18 age and sex matched controls were examined. Auditory ERPs in the standard auditory oddball paradigm (60 dB, 80% non-targets (1000 Hz), 20% targets (2000 Hz) tones) were recorded and analyzed on BrainWin (Russia) mapping system. Single-voxel 1H magnetic resonance spectroscopy and DTI were conducted on 3T Phillips Achieva scanner (sequences PRESS, TE = 35, TR = 2000 and DTI high iso TE= 70 ms, TR= 6589 ms, respectively). In 1H-MRS, the voxel (20x15x10 mm<sup>3</sup>) was placed in the corpus callosum genu (CCG). The ratio of NAA/H<sub>2</sub>O and Cho/ H<sub>2</sub>O were analyzed.

**Results:** Patients with schizophrenia had smaller N100 and smaller fractional anisotropy in the CCG whereas no intergroup differences for MRS data were found. Neurophysiological and neuroimaging data did not correlate with each other.

**Conclusions:** The microstructural abnormalities of the white matter tracts were found in the CCG while metabolic properties of the CCG were either normal or "normalized" due to the treatment. The neurophysiological findings assumed the impairment of the early stages of auditory information processing however this abnormality was relatively independent of the structural anomalies.

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#### **J. UNDERHILL, Z. NADASDY & R. BUCHANAN. Does Verbal TMS Decrease the Negative Symptoms of Schizophrenia? A Case Study.**

**Objective:** Currently, there are virtually no treatment interventions for the negative symptoms of SCH. The negative symptoms of SCH, which includes social withdrawal, affective flattening, and apathy, point to the subcortical structures of the Papez circuit as potential targets of intervention. However, these structures are difficult to selectively modulate by pharmacological treatment, and are too deep to target by non-invasive stimulation. We hypothesized, that the cerebellum may provide a potential access point for TMS to modulate the ventrolateral thalamus through the cerebello-thalamic pathway affecting the negative symptoms of SCH.

**Participants and Methods:** Participant: The subject was a 38 year old Caucasian male, who was free of positive symptoms.

**Method:** The subject's cognitive abilities were measured prior to intervention using a wide variety of neuropsychological measures. Both the raters and the subject were blinded. Using a double circular 90 mm coil, connected to a Magstim Rapid 2 stimulator 1000 rTMS stimuli were delivered at 10 Hz with an intensity of 120% of resting motor threshold to Lobule VII of the cerebellar vermis. Treatment was composed of 4 weeks of bi-weekly intervention, followed by 4 weeks of observation and measurement. The subject was then reassigned to 1000 TMS pulses delivered at 1 Hz.

**Results:** Cognitive measures were obscured by ceiling effects. During the active phase of intervention, the subject demonstrated a 11% improvement during the 10Hz treatment phase and an 7% improvement during the 1Hz treatment phase on SANS scales.

**Conclusions:** Transcranial magnetic stimulation appears to be a useful intervention for the negative symptoms of schizophrenia. Future investigation should focus upon variations of the aforementioned protocols.

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#### **Drug/Toxin-Related Disorders (Including Alcoholism)**

##### **O.M. ALHASSOON, M.J. TAYLOR, B.C. SCHWEINSBURG, S.F. SORG, C.L. KIMMEL & I. GRANT. Neuropsychological Characteristics of Anxious and Depressed Alcohol-Dependent Patients.**

**Objective:** Alcohol typologies often differentiate patients on the existence or lack of comorbid antisocial personality characteristics. However, the existence of comorbid anxiety and depression is another hallmark of recently detoxified alcoholics (RDA). In the current study, we examine differences in neuropsychological performance between anxious and/or depressed alcoholics (ADA) and antisocial alcoholics (AA).

**Participants and Methods:** Utilizing a sample of 246 male recently detoxified alcoholics, latent class analysis was applied to items of Scale-

4. Using the Akaike Information Criterion as a parsimony index, a two-class model was found to best fit the data. One group (AA) was found to endorse more antisocial items on the MMPI while the other group was found to endorse items related to anxiety and depression (ADA). Cases were assigned to their likely class using posterior probabilities. Based on previous research that has found relationships between certain NP tests and anxiety/depression and antisocial personality, we compared the two groups on the Halstead Category Test, Trail Making Test, and California Verbal Learning Test-II (CVLT-II).

**Results:** On the Category Test, the two classes differed significantly  $t(152) = 6.13, p < 0.001$  with the AA (Mean T-score=39.6, SD=10.6) performing worse than the ADA (Mean T-score=45.8, SD=11.9). The two groups were not found to differ significantly on NP measures thought to be associated with depression and anxiety such as motor speed (Trails-A) or CVLT-II Trial 1.

**Conclusions:** These results indicate that although depression and anxiety are sometimes associated with motor slowing and learning difficulties, among RDA these domains are spared. (VA Merit Review Grant SA-320) Correspondence: *Omar M. Alhassoon, Ph.D., UCSD/CSPP, 10455 Pomerado Road, San Diego, CA 92131. E-mail: oalhassoon@ucsd.edu*

##### **C.A. MUNRO, C. SULLIVAN, L. EMERY, S. BARR, T.D. VANNORS DALL & D.J. SCHRETLEN. Childhood Lead Exposure and High School Graduation Rates in Men and Women.**

**Objective:** Numerous studies have found associations between childhood blood lead levels (BLLs) and intelligence. Based on this, one might expect childhood BLLs to influence rates of high school graduation in young adults. In this study, we used childhood BLLs to predict rates of high school graduation in young adults referred by defense counsel for examination in the context of lead poisoning litigation.

**Participants and Methods:** The sample were all plaintiffs ( $n=122$ ; 60 men) referred to the Johns Hopkins Medical Psychology Clinic for neuropsychological assessment between 2005 and 2012 who were at least 18 years of age. This exclusively African-American sample ranged in age from 18 to 25 ( $M = 20.7 + 1.5$ ) years. Each person's lowest ( $M = 7.7 + 4.4\mu\text{g/dL}$ ), highest ( $M = 19.7 + 8.1\mu\text{g/dL}$ ), and mean ( $M = 13.4 + 5.1\mu\text{g/dL}$ ) BLLs were used as predictors of high-school graduation.

**Results:** Among the examinees in this study, 65 (53%) graduated from high school. Childhood BLLs did not predict completion of high school ( $p$  values  $> .36$ ). Women were 1.6 times more likely than men to finish high school. Consequently, we explored other predictors of high school completion by men and women separately. In both sexes, having a history of mental health treatment was associated with failure to graduate from high school ( $p < .008$ ). Among men (but not women), having a history of drug or alcohol abuse also predicted failure to finish high school ( $p < .01$ ). Among women, the number of pregnancies ( $p < .005$ ) and number of children ( $p < .05$ ) both predicted failure to graduate from high school. None of these predictor variables was correlated with childhood BLLs.

**Conclusions:** Individual differences in blood lead concentration during childhood are unrelated to whether affected individuals later graduate from high school, receive mental health treatment, abuse drugs, or become pregnant. Instead, whether lead-exposed children later finish high school depends on their sex and history of mental health treatment, drug abuse, and early pregnancy.

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##### **C. RUIS, A. POSTMA & I. VAN DER HAM. Navigation and Memory Problems after Sporadic Ecstasy Use.**

**Objective:** Memory problems and changes in hippocampal structures after chronic ecstasy use are well described in the literature. Cognitive problems after sporadic ecstasy use are rare, and the few patients described in case reports returned to their normal cognitive level after a relative short period. Persistent cognitive problems after sporadic ecstasy use have not been documented.

**Participants and Methods:** FV is a 39-year old man who used an ecstasy tablet in 2005. After that, he was severely confused for a few days. The confusion was followed by persistent memory complaints and difficulties orientating in new surroundings. Seven years later, the complaints still existed and a neuropsychological assessment and experimental navigation task were administered, even as a MRI scan of the brain.

**Results:** The extensive neuropsychological examination revealed a severe memory disorder. Furthermore, FV's performance on a virtual reality test measuring navigation skills (Tübingen task) showed serious problems navigating in new surroundings. In comparison with matched control subjects (Bayesian approach for single case studies) his scores were significantly impaired. On the MRI-scan of the brain hippocampal atrophy and sclerosis were seen, comparable to previous studies describing hippocampal damage following ecstasy ingestion.

**Conclusions:** This case report indicates a relation between persistent memory impairment, navigation problems, and hippocampal damage after sporadic ecstasy use.

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**V. SMITHIES, R. CONDUIT, A. VERDEJO-GARCIA & J. BROADBEAR. Overnight Memory Consolidation in Ecstasy-Polydrug Users: Findings From an Online Visual Memory Task.**

**Objective:** Recreational use of ecstasy has long been associated with 'short-term' memory impairment (retention across 10–30 mins), however it is unknown whether ecstasy-polydrug users demonstrate memory impairments over longer periods that include sleep (24 hrs). We predicted that overnight memory performance would be impaired in ecstasy-polydrug users relative to non-drug users.

**Participants and Methods:** Ecstasy-polydrug users (n=58) and non-drug users (n=27) participated in an online visual memory task. Participants were initially exposed to a series of images. Recognition testing was conducted either in the short-term (average=15 min), or after a period of overnight consolidation (24 hrs).

**Results:** On short-term testing, ecstasy-polydrug users obtained less true positive responses relative to non-drug users; results approached significance,  $p=.058$ . However, on overnight consolidation testing there was no significant difference in true positive responses between groups. Examination of individual drug group accuracy (true positive minus false positive responses) revealed that ecstasy-polydrug users exhibited significantly lower accuracy on the overnight consolidation memory task relative to the short-term memory task,  $p=.02$ . This finding was not evident in the non-drug group. Accuracy comparisons across drug groups revealed that there was no significant difference in accuracy among ecstasy-polydrug users and non-drug controls at either testing time-point.

**Conclusions:** The results of this study support previous findings that short term retention of visual material is reduced in ecstasy-polydrug

users. Whilst there appears to be no additional loss of material during extended consolidation periods that contain sleep, ecstasy-polydrug users demonstrated a decrease in overnight consolidation accuracy relative to short-term memory accuracy, a finding that was not observed in non-drug using controls. This research highlights the importance of employing accuracy measures when assessing memory in ecstasy-polydrug users.

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## ADHD/Attentional Functions

**J. BRAMHAM, R. PEEL, T. OWENS & I. CURRAN. The impact of depression on cognitive functioning in adults with ADHD.**

**Objective:** There are high levels of comorbid depression in adults with ADHD. Given that depression also affects attentional processes, this study aimed to determine how depression may further compromise cognitive functioning in adults with ADHD.

**Participants and Methods:** Participants were divided into four groups: ADHD alone (N=51); depression alone (N=28); comorbid ADHD and depression (N=29); healthy controls (N=32). Measures of cognitive functioning were chosen to assess general intellectual functioning, selective attention, divided attention, switching attention, working memory, and response inhibition. ADHD and depression symptom rating scales were also administered.

**Results:** The comorbid ADHD and depression group had significantly worse scores in selective attention and working memory in comparison with the ADHD alone and depression alone groups. When compared to the control group, all three clinical groups had working memory deficits, but only the ADHD group had deficits in response inhibition.

**Conclusions:** Depression appears to exacerbate certain aspects of attentional functioning in the context of ADHD. However, both depression and ADHD alone have a significant impact on cognitive functioning and it is important for neuropsychologists to be aware of the similarities in neuropsychological profiles when making a differential diagnosis.

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## FRIDAY AFTERNOON, JULY 12, 2013

### Invited Address:

#### Functional Heterogeneity for Memory of the Medial Temporal Lobes and their Connections

**Presenter: Andrew Mayes**

**12:00–1:00 p.m.**

**A. MAYES. Functional Heterogeneity for Memory of the Medial Temporal Lobes and their Connections.**

Organic amnesia typically involves impaired recall and recognition of both pre- and post-morbidly encountered facts and experiences. It is caused by lesions to the medial temporal lobes (MTL) or of structures, such as parts of the midline diencephalon, basal forebrain, or retrosplenial cortex, with which the different parts of the MTL have extensive structural connections. The impaired memory functions depend on many processes, but disagreement still persists about which of them are disrupted in amnesia and which impaired processes are mediated by which MTL and other 'amnesia-related' structures. In particular, dispute continues about whether different structures in the MTL help mediate recall- and familiarity-based memory. Although strongly connected, the cytoarchitecture of the palaeocortical hippocampus differs considerably from that of the neocortical perirhinal and parahippocampal cortices so it probably processes its inputs differently from the other two structures and there is evidence that all three receive different inputs.

There is now also extensive lesion and fMRI evidence relevant to this dispute. So, my talk will consider this long-standing dispute about whether the kinds of memory indicated by recall and familiarity depend on distinct MTL structures and their extra-MTL functional connections, but it will also consider the evidence that these structures differentially mediate other memory-related processes.

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### Paper Session 6: Oncology

**12:00–1:30 p.m.**

**F.W. BOELE, M. ZANT, E.C. HEINE, N.K. AARONSON, M.J. TAPHOORN, J.C. REIJNEVELD, J.J. HEIMANS & M. KLEIN. Associations Between Cognitive Functioning and Health-Related Quality of Life in Glioma Patients.**

**Objective:** Patients with a malignant brain tumor (e.g. glioma) are not only confronted with the diagnosis and treatment of cancer, but also with changes in cognitive and neurological functioning that can profoundly affect their daily lives. We aim to explore the associations between cognitive functioning and health-related quality of life (HRQOL) of both low-grade and high-grade glioma (LGG and HGG) patients.

**Participants and Methods:** Patients and healthy matched controls underwent neuropsychological testing and completed self-report measures



of HRQOL (SF-36 Health Survey) and disease-specific HRQOL (EORTC BN20). LGG patients were diagnosed 6 years prior to data collection, while HGG patients were included after diagnosis and prior to treatment. Associations were explored with Bonferroni corrected Pearson correlations.

**Results:** 195 LGG and 68 HGG patients participated. In LGG patients, positive correlations were found between physical health (SF-36 Physical Component Summary) and psychomotor speed, attention, information processing, working memory, verbal memory, and executive functioning (all  $p < 0.001$ ). Mental health (SF-36 Mental Component Summary) was positively associated with psychomotor speed, information processing, working memory and executive functioning (all  $p < 0.001$ ). Negative associations were found between a wide range of disease-specific HRQOL scales and cognitive domains. In HGG patients, no statistically significant correlations were found between cognition and the SF-36 Component Summaries. Disease-specific HRQOL was only sparingly associated with executive functioning, attention, working memory and information processing.

**Conclusions:** In LGG patients in a period of stable disease, cognitive functioning is related to generic and disease-specific HRQOL. In HGG patients in the acute phase this is only the case for several disease-specific aspects of HRQOL. The association between cognitive functioning and HRQOL is influenced by patient-related factors such as disease phase.

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#### **M. VAN ZANDVOORT, I. HUENGES WAJER, N. TER MOLEN, T. SNIJDER, M. BROEKMAN & P. ROBE. Intraoperative Monitoring of Executive Functioning in Brain Tumors Patients.**

**Objective:** Awake brain surgery allows extensive intraoperative monitoring of not only motor, sensory, and language, but also of executive functioning. The Stroop effect is assumed robust and sensitive to frontal lobe dysfunctioning. Feasibility and implications of adapted Stroop paradigm are investigated and related to neuronavigation screen captures and pre and post-surgery neuropsychological examination.

**Participants and Methods:** 52 patients (38 left and 13 right hemisphere; 29 low-grade and 23 high-grade gliomas) underwent debulking in an awake-awake-awake procedure and had intraoperative cognitive monitoring according to clinical care as usual. Patients are grouped on Stroop error (including slowness) or not, and the influence of lesion side and site (screen captures superimposed on normalized brain) and histotype will be analyzed (nonparametric). In addition, neuropsychological performance pre and at 6 months post surgery will be taken into account (univariate anova corrected for demographics).

**Results:** The Stroop paradigm was applied intraoperatively in 32 (10 right hemisphere) of the 52 patients. In 13 patients the Stroop was not feasible to pre-existing deficits (4 language impairments, 1 language barrier, 2 executive impairments, 1 fatigue) or clinical priorities on language or motor functioning. In 7 patients the Stroop was not applied (debulking of parietal/occipital tumors). Deficits on stimulation was found in 75% of the patients and in 62% of the patients influenced resection. No significant differences are found between left and right hemisphere. Feasibility level was in favor of low-grade gliomas.

**Conclusions:** The intraoperative Stroop paradigm is feasible in both high and low-grade frontal primary brain tumor patients in whom preoperative Stroop is feasible. No differences in either feasibility nor elicited Stroop effect between right and left frontal tumors was found. Findings with respect to site of the lesion and relation with overall neuropsychological functioning will be discussed.

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#### **I. SCHUITTEMA, L.M. DE SONNEVILLE, C. VAN DEN BOS & A.J. VEERMAN. Neurocognitive Deficiencies in Adult Survivors of Childhood Leukemia, 25 Years after Treatment.**

**Objective:** Treatment for childhood leukemia with cranial radiation therapy (CRT) and/or intrathecal chemotherapy (CT) can cause long-term neuropsychological deficits, especially in executive functioning. Awareness and accurate profiling of these deficits are prerequisites for developing neuropsychological interventions.

**Participants and Methods:** The effects 25 years after treatment were investigated using subtests of the Amsterdam Neuropsychological Tasks program evaluating reaction times, pattern recognition, working memory, sustained attention, inhibition, cognitive flexibility, visuomotor control and visuospatial memory. Fifty-three survivors treated with CRT and 58 treated with CT were compared with 58 controls.

**Results:** CRT-treated survivors performed worse than controls on all subtests, but most prominently on visuomotor control, sustained attention, inhibition, cognitive flexibility, and visuospatial memory ( $z < -1$ ). Older age at assessment was significantly associated with worse scores on visuomotor control, inhibition, pattern recognition and visuospatial memory, which was not seen in controls. This suggests accelerated aging after CRT. Performance of the CT-treated survivors was within the normal range, but a subgroup scored 1SD or more below the norm on visuomotor control and visuospatial memory. There were no signs of accelerated aging after CT.

**Conclusions:** In long-term survivors of childhood leukemia, cognitive deficits in the domains of sustained attention, flexibility, inhibition and visuomotor control are to be expected, especially after cranial irradiation. CRT is suspected to cause accelerated aging of the brain, with increased risk of early-onset dementia. Cognitive decline should therefore be monitored. Performance correlated highly with white matter integrity (Schuitema et al., *in press*). CRT also increases the risk of secondary tumors and vascular pathology, which warrants neuroimaging when suspecting organic etiology of cognitive complaints.

*This research has been funded by the Dutch Cancer Society.*

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#### **S.K. PATEL & A.L. WONG. Pro-inflammatory Cytokines and Comorbidity Predict Neurobehavioral Functioning in Women with Cancer.**

**Objective:** Neurobehavioral dysfunction in cancer patients is primarily attributed to chemotherapy effects; however, recent studies suggest these symptoms are present prior to adjuvant treatments. We investigated recent speculation that pre-treatment symptoms are caused by tumor-activated cytokine changes. In addition, we hypothesized that lower cognitive performance prior to cancer treatment would be associated with comorbid health conditions.

**Participants and Methods:** 181 post-menopausal women newly diagnosed with non-metastatic breast cancer were seen for neurobehavioral assessment and blood draw prior to any cancer treatment. The validated Charlson Comorbidity Index was calculated for each patient using medical records. A total of 95 (52.5%) women had at least one qualifying comorbidity such as diabetes or hypertension. ELISAs were conducted to determine levels of selected pro-inflammatory cytokines that are typically associated with systematic inflammation. Skewed data was log transformed to normality. Hierarchical regression models controlling for age and education effects, as well as body mass index, were conducted to evaluate the contribution of cytokine levels and comorbidity toward pre-treatment neurobehavioral functioning.

**Results:** Our regression model predicted 25% of the variance in patients' pre-treatment performance for executive functioning,  $F(1, 124) = 4.07, p = .04$ , and 20% for processing speed,  $F(1, 122) = 6.13, p = .01$ . The presence of at least one co-morbid health condition significantly predicted lower processing speed performance, but not executive functioning, even after controlling for the effects of other variables, including circulating levels of cytokines. Neither cytokines nor comorbidity significantly predicted other neurocognitive domains.

**Conclusions:** Higher circulating levels of selected pro-inflammatory cytokines and comorbidity are associated with relatively lower neurobehavioral performance prior to any cancer treatment in women with newly diagnosed breast cancer.

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#### **J. FAULKNER. A New Test Battery for Assessing Language in Brain Tumour Patients.**

**Objective:** In patients undergoing tumour resection surgery, assessment of language is vital, given its crucial role in everyday social functioning.

However, despite the unique neuropathological mechanisms in tumours, there is currently no language protocols designed specifically for this population (Miceli et al., 2012; Papango et al., 2012). This study describes a brief and freely accessible computerized test battery for assessing language in brain tumour patients. The battery adopts a 'core skills' approach, which identifies and tests 12 cognitive skills based on current psycholinguistic theory. We are evaluating the battery based on 3 criteria: 1) overall sensitivity, 2) discriminatory power, and 3) sensitivity to change.

**Participants and Methods:** In this study, we administer the battery to a large cohort of undifferentiated tumour surgery patients, both pre and postoperatively and at 3 months post surgery. Also tested are 3 groups of healthy controls (18-30, 30-55 and 55+yrs).

**Results:** Preliminary results from 30 tumour patients reveal that the battery has very high overall sensitivity. 94% of patients were impaired in at least one test administered. Verb generation was the most sensitive task, with 50% of patients impaired postoperatively. In regards to discriminatory power, the battery is able to reveal contrasting language profiles between different patients. For example, PM – who had a glioma in the left supplementary motor area, was impaired in verb generation, Stroop and letter fluency tasks but performed normally on other tasks. In contrast, BCA – who had a glioblastoma in the temporo-occipital junction, was impaired in picture naming, category fluency and picture word verification (with semantic distractors). These profiles are broadly consistent with predictions from independent lesion studies.

**Conclusions:** We conclude that the battery holds considerable promise as a clinical tool for assessing language in tumour surgery patients. Correspondence: *Josh Faulkner, PhD Candidate, Victoria University, 2 Anderson Tce, Mount Cook, Wellington 6021, New Zealand. E-mail: joshua.faulkner@ruw.ac.nz*

### NIP Invited Symposium: Quality of Neuropsychological Tests: New Developments and Techniques

Chair: Rudolf Ponds

2:00–3:30 p.m.

**R. PONDS, P. HURKS, M. HENDRIKS, B. SCHMAND & D. SCHRETLEN. Quality of neuropsychological tests: new developments and techniques.**

**Symposium Description:** The quality of neuropsychological tests depends on their reliability, validity, standardisation and, perhaps most important, good normative data. Although assessment topics are mostly not in the middle of the scientific arena, they are of great importance for our daily clinical work. Petra Hurks will talk about the stringent Dutch evaluation system for test quality and compare this system with other international evaluation systems. Marc Hendriks will discuss the advantages and disadvantages of internet-based applications of neuropsychological tests, also known as Remote Neuropsychological Assessment (RNA). Ben Schmand presents the design of ANDI (Advanced Neuropsychological Diagnostics Infrastructure), a user-friendly web-based interface with accumulated normative data of healthy control subjects that formerly participated in neuropsychological and other behavioural health studies in the Netherlands. David Schretlen also demonstrates the power of combining previously published normative data within INNDI (International Neuropsychological Database Initiative). This ambitious project will include at least 20,000 healthy participants, representing at least 10% of the countries in the world. The Dutch Association of Psychologists, division Neuropsychology, sponsors this symposium.

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**P. HURKS. The utility of review systems for evaluating quality of psychological tests.**

**Objective:** Psychological testing is an important aspect of virtually every aspect of professional psychology in current society. At the same

time, evaluating the quality of psychological tests has become a booming business worldwide (e.g., Evers, 2012; Reynolds & Livingston, 2012). Examples of review systems (recently) developed to measure test quality are: the Dutch COTAN Evaluation system for test quality (Evers et al., 2009; 2010), the German Test Review System of the Committee on Tests (Testkuratorium, 2006; Hagemester et al., 2012), and the US review system at the Buros Center for Testing (Carlson & Geisinger, 2012). These systems mostly agree on "which" test qualities have to be reviewed, such as reliability, validity, and standardisation. However, they often dissent on "how" to assess these test qualities. In this presentation, dr. Hurks will provide an overview on "reviewing test qualities" as well as discuss its value, strengths, weaknesses, and challenges.

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**B. SCHMAND, H. HUIZINGA & J. MURRE. Advanced Neuropsychological Diagnostics Infrastructure (ANDI).**

**Objective:** Well-validated neuropsychological tests, behaviour rating scales and symptom checklists assist in diagnosis and treatment evaluation of neurologic and psychiatric diseases. These tests are typically stand-alone instruments with stand-alone normative data. In the diagnostic work-up they are used separately. Viewed from a statistical stance, this is a univariate approach. However, diagnostic tasks are of a multivariate nature, because with few exceptions multiple behavioural characteristics have to be evaluated before a diagnostic decision can be made. During the last decades powerful statistical techniques have been developed that may enable clinicians and researchers to do these tasks, provided the availability of a large normative databank. Such data are hidden in numerous research projects. Given the increasing preparedness of investigators to share their data, we founded a consortium of 20 Dutch research groups with the aim to create an Advanced Neuropsychological Diagnostics Infrastructure (ANDI).

ANDI will be a user-friendly web-based interface with accumulated normative data of healthy subjects (currently including data of about 60 tests and  $N > 11000$ ). The data will come from people who served as control subjects in neuropsychological and other behavioural health studies. ANDI will use advanced, multivariate statistical techniques to solve diagnostic and outcome assessment problems. With ANDI, researchers and clinicians will be able to more easily locate patients who, for example, fulfil particular diagnostic criteria, are cognitively impaired or otherwise show an abnormal pattern of cognitive or behavioural characteristics, respond particularly well to a treatment, et cetera.

In this contribution we will present the design of ANDI, discuss its possible applications, and give a few proofs-of-principle.

ANDI is financially supported by the Netherlands Organization for Scientific Research, and will be realized with the help of the Netherlands eScience Center.

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**M. HENDRIKS. Developments in the application of computer-based neuropsychological assessment.**

**Objective:** Recently the American Academy of Clinical Neuropsychology and the National Academy of Neuropsychology have published their position on standards and conventions of computerized neuropsychological assessment devices (Bauer, et al 2012). Ever since the introduction of computer devices in neuropsychological assessment, neuropsychologists struggle with the balance between the competent and appropriate development and utilization of computerized tests and the competent interpretation of data. Furthermore, also the enormous growth of the applicability of the internet (i.e. Remote Neuropsychological Assessment, RNA), has increased the potential to administer, score, and interpret neuropsychological tests online. However, RNA is still in its infancy. All these technological progress has to be welcomed critically in neuropsychological assessment and rehabilitation, but the speed of progress is not in concordance with developments in clinical neuropsychology. For this, guidelines have to be developed to ensure ethical and professional compliance, to establish a solid empirical bases for RNA. Clinical neuropsychologists have to take responsibility for technologi-

cal applications within their discipline, instead of considering this to be the responsibility of the technical developers. In this presentation the advantages and disadvantages of computerized neuropsychological assessment devices will be presented, with specific attention on the internet-based applications.

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#### **D. SCHRETLEN. The International Neuropsychological Normative Database Initiative.**

**Objective:** This presentation will introduce INNDI, the International Neuropsychological Normative Database Initiative. INNDI involves the aggregation of previously published normative data for selected cognitive tests into a single database for each. Using these data, we are developing polynomial regression equations that convert raw test scores to percentile ranks based on a person's unique combination of demographic characteristics, including his or her age, sex, educational level, primary language, and country of origin. The resulting equations will be used to publish articles that present INNDI norms. The articles will include look-up tables for interpreting an individual's test performance. For example, INNDI will enable one to determine if a Mini-Mental State Exam score of 24 is normal for a 79-year-old Brazilian woman with 7 years of schooling but abnormal for a 64-year-old French man with 13 years of schooling. Each INNDI database will include at least 20,000 healthy participants and represent at least 10% of the countries of the world. In this way, INNDI will provide a global normative resource to personalize the diagnosis and treatment of cognitive disorders. INNDI could prove useful for multi-national research initiatives, such as randomized clinical trials. This presentation will provide an overview of the methods used to verify the quality of INNDI data and derive regression-based norms for each test. Finally, the current status of countries represented in the INNDI database, the scientists who have contributed data, and the institutions in which the normative research was conducted will be presented.

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### **Symposium 9: Social Cognition in Neurodegenerative and Psychiatric Conditions**

**Chair: Olivier Piguet**

**2:00–3:30 p.m.**

#### **J.S. SNOWDEN, J.C. THOMPSON, C.L. STOPFORD, D. NEARY & D. CRAUFURD. Drawing Inferences in Frontotemporal Dementia and Huntington's Disease.**

**Objective:** Social breakdown is common in both behavioural variant frontotemporal dementia (bvFTD) and Huntington's disease (HD). Whether this has a common basis is unclear. The study compared bvFTD and HD performance on hinting and story theory of mind (TOM) tasks with the aim of elucidating factors that might contribute to social breakdown.

**Participants and Methods:** 13 bvFTD, 17 HD and 13 controls took part in the study. In the hinting test, participants were presented with sentences describing a situational context, followed by an elliptical comment from the protagonist. Participants indicated what was meant by the remark. If they could not a more direct hint was given. In the story task, participants were presented with brief narratives, illustrated by cartoons, and answered factual comprehension, first and second order false belief and deception and general inference questions.

**Results:** Analyses of variance revealed that bvFTD patients were impaired compared to controls at interpreting even direct hints ( $p < 0.001$ ). Most responses were concrete. By contrast, HD patients were impaired only in the 'subtle hint' condition ( $p = 0.01$ ). Most er-

rors constituted faulty inferences. In the story task bvFTD patients were profoundly impaired ( $p < 0.001$ ) in both first and second order TOM. HD patients showed mild impairment only for second order questions ( $p = 0.02$ ). By contrast, they were significantly impaired in drawing general inferences about the situational context ( $p = 0.005$ ).

**Conclusions:** There were qualitative as well as quantitative differences in performance in the two patient groups. bvFTD patients showed markedly impaired ability to infer a person's feelings, intentions and beliefs in keeping with loss of theory of mind. By contrast, HD patients' performance was characterised by misconstruction and faulty inferences rather than failure to ascribe mental states. The findings suggest that distinct factors may underlie the social breakdown in bvFTD and HD. Correspondence: *Julie S. Snowden, Greater Manchester Neuroscience Centre, Cerebral Function Unit, Salford M6 SHD, United Kingdom. E-mail: julie.snowden@manchester.ac.uk*

#### **T. TORRALVA, M. ROCA, M. POSE, M. CETKOVICH, A. IBANEZ, E. GLEICHGERRCHT & F. MANES. Comparative Neuropsychology of Behavioural-Variant Frontotemporal Dementia and Bipolar Disorder.**

**Objective:** In early behavioural-variant frontotemporal dementia (bvFTD), psychiatric symptoms such as changes in personality or behavioral disorders are common, and reflect the progressive degeneration of the frontal and anterior temporal lobes. These symptoms mimic those found in affective disorders such as Bipolar Disorder (BD). Previous research has characterized these two disorders independently, but comparisons of these pathologies have been carried out from a neuropsychological perspective. This study compared the neuropsychological and social cognition profile of bvFTD and BD to understand how cognitive assessment can contribute to their differential diagnosis.

**Participants and Methods:** 16 BD patients and 33 early bvFTD patients (CDR = 1) were included in this study. Participants were assessed using a comprehensive neuropsychological battery which included measures of memory, language, attention, executive function, and visuospatial abilities. Mood symptoms were assessed by means of the total score on the Beck Depression Inventory – II (BDI).

**Results:** A significant age difference between groups was found ( $p < .001$ ), as expected given the different nature of these two diseases. However, years of education, BDI scores were comparable between the groups, revealing that cognitive performance cannot be directly linked to potential differences in levels of education or mood symptoms. After covarying for age, performance of bvFTD and BD patients was remarkably similar, with no significant group differences found on any of the neuropsychological tests.

**Conclusions:** No significant differences were found between bvFTD and BD patients on measures of attention or executive functions. Both clinical groups scored significantly lower than controls on most of the neuropsychological tasks. Comparing the neuropsychological profile of these disorders can shed light on the involvement of shared neuroanatomical circuits.

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#### **M. IRISH, J.R. HODGES & O. PIGUET. Elucidating the Neural Correlates of Theory of Mind Deficits in Neurodegenerative Disorders.**

**Objective:** The capacity to infer the thoughts, beliefs, and perspectives of others is fundamental to successful social interactions, and relies on the integrity of theory of mind reasoning (ToM). Changes in interpersonal functioning and theory of mind are hallmark features of the behavioural variant of frontotemporal dementia (bvFTD), however, much less is known regarding the status of complex social cognitive processes in semantic dementia (SD).

**Participants and Methods:** Here we sought to elucidate the capacity for ToM inference in SD ( $n = 11$ ) and bvFTD ( $n = 10$ ) and contrasted their performance with Alzheimer's disease (AD,  $n = 10$ ) and healthy matched Control ( $n = 14$ ) participants. A simple cartoons task was used to reduce the verbal demands on SD patients, consisting of Physical (no ToM attribution required) and Mental (ToM attribution required) components.

**Results:** Overall, irrespective of patient group, significant impairments were evident on both subscales of the task. When we controlled for semantic comprehension, however, deficits on the Physical subscale were ameliorated in SD and AD. Critically, both SD and bvFTD groups continued to show profound and comparable difficulties for ToM reasoning, whereas AD patients scored in line with Controls. Voxel-based morphometry analyses revealed that atrophy predominantly in the right temporal pole, bilateral amygdalae, left insular and temporal cortices, and bilateral orbitofrontal cortex correlated with ToM impairment in SD. Similarly, in bvFTD, the right anterior temporal lobe, extending into orbitofrontal and prefrontal cortices bilaterally, was implicated, as well as the right hippocampus, bilateral insular cortex, and right caudate.

**Conclusions:** Our study confirms recent reports of marked deficits in ToM reasoning in SD not exclusively attributable to semantic processing impairments, and points to the pivotal role of the right anterior temporal lobe and prefrontal cortex in facilitating the capacity for complex social cognitive functions.

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**O. PIGUET, S. HSIEH, M. IRISH, N. DAVESON & J.R. HODGES. Loss of Empathy and its Effect on Carers of Patients with Frontotemporal Dementia and Alzheimer's disease.**

**Objective:** Loss of empathy – the ability to understand the feelings of others and take their perspective – is an early clinical feature reported by carers of patients with frontotemporal dementia (FTD). Given the importance of empathy to engage in appropriate social interactions, we hypothesised that loss of empathy would have a negative impact on carers and their well being.

**Participants and Methods:** Carers of patients diagnosed with the behavioural-variant of FTD (bvFTD = 18) or the semantic variant of FTD (SD = 14) were compared to carers of patients diagnosed with Alzheimer's disease (AD = 18). Carers completed the Interpersonal Reactivity Index (IRI), a standardised questionnaire of empathy, as well as a measure of perceived burden (Zarit Burden Interview) and the quality of the marital relationship (Intimate Bond Measure). Patient ratings were also obtained on the IRI.

**Results:** Loss of empathy was most striking in the bvFTD group with a marked discrepancy observed between carer and patient ratings for change in emotional warmth and the ability to take the perspective of others. Empathy loss in bvFTD was associated with a loss of a caring marital relationship. Empathic deficits in SD were milder by comparison to bvFTD and correlated with disease severity and increased perceived carer burden. The behavioural pattern observed in AD differed from the FTD syndromes: deficits were observed only for measures of personal distress with carers reporting that patients were less able to handle emotionally evocative situations.

**Conclusions:** Results highlight that changes in aspects of empathy differ across dementia syndromes and are associated with differing carer and clinical variables. These findings might be explained by the progression of atrophy in regions which are known to be critical for empathy and social behaviour and has implications for the delivery and planning of services in dementia.

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**O. PIGUET, J. SNOWDEN, T. TORRALVA, M. IRISH & O. PIGUET. Social Cognition in Neurodegenerative and Psychiatric Conditions.**

**Symposium Description:** Social cognition is integral to interindividual interactions and central to interpersonal relationships. It comprises a number of facets, such as the capacity to modulate behaviour based on the reactions of others, the ability to understand and apply social rules, or to infer intention in others. Investigations of social cognition are relatively recent compared to those on other aspects of cognition. This symposium will highlight recent research developments on social cognition in neurodegenerative conditions and psychiatric disorders. A particular focus will be on frontotemporal dementia, a devastating dementia syndrome in which disturbance of social cognition features prominently. This symposium will explore social cognition from complementary angles. The first two presentations will compare social cognition in

frontotemporal dementia and conditions where social breakdown is also common. First, Julie Snowden will contrast the capacity to infer intentions in others between frontotemporal dementia and Huntington's disease. Then, Teresa Torralva will explore how neuropsychology and social cognition investigations can help with the differential diagnosis between bipolar disorder and frontotemporal dementia. This presentation will be followed by Muireann Irish who will discuss the neural correlates of social cognition using frontotemporal dementia subtypes as a lesion model. Finally, Olivier Piguet will examine the impact of social cognition deficits on carers of dementia patients, demonstrating that deficits in social cognition have broader implications than on the patients themselves.

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**Invited Symposium:  
The Neuropsychology of Parietal Lobe Function**

**Chair: Chris Dijkerman**

**2:00–3:30 p.m.**

**C. DIJKERMAN, M. HUSAIN, A.R. O'CONNOR, A. FARNE & G. VINGERHOETS. The neuropsychology of parietal lobe function.**

**Symposium Description:** The parietal lobe is involved in various cognitive functions, ranging from visuomotor control to spatial attention, body representation, working and episodic memory. It is therefore not surprising that damage to parietal areas has been associated with a variety of cognitive impairments, including hemispatial neglect, apraxia, body representation impairments etc.

During the last decades, advances in cognitive neuroscientific methodology have resulted in increased research into the neurocognitive architecture of parietal lobe function. This has provided novel insights into its function, which has implications for our understanding of cognitive deficits after parietal lesions. The aim of the current symposium is to bring together researchers working on a variety of parietal lobe functions at the intersection between cognitive neuroscience and neuropsychology. The cognitive functions that will be discussed include spatial attention, episodic memory, body representations and sensorimotor control. The contributions of the presenters are founded in cognitive neuroscientific theoretical models, and are of direct relevance for understanding neuropsychological deficits.

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**G. VINGERHOETS. Contributions of the posterior parietal cortex to motor cognition.**

**Objective:** Motor cognition refers to the representation of action and its associated processes. Its neural representation is complex and involves predominantly frontal and parietal cortex. It has proved difficult to disentangle the contribution of either region to purposeful action. Lesion studies report symptoms of apraxia following frontal and parietal damage and neuroimaging reveals substantial fronto-parietal activity in a wide variety of paradigms involving transitive actions. The focus of this talk will be on the role of the posterior parietal cortex in object manipulation. By reviewing studies on tool perception, action observation, action imagery, object prehension, and tool use (pantomiming), I aim to outline the major posterior parietal foci that contribute to visuomotor action and discuss their potential role.

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**M. HUSAIN. Attention, working memory and pharmacological modulation of the neglect syndrome.**

**Objective:** In humans, damage to the parietal lobe, particularly of the right hemisphere, leads to the syndrome of neglect or inattention to ob-

jects in contralesional space. Recent studies have begun to dissect the interacting, cognitive mechanisms that might underlie neglect, providing important insights into the role of posterior parietal cortex in directing spatial attention, maintaining sustained attention and in visual working memory.

While it is clear that the neglect syndrome is associated with a significant directional bias in directing attention, our approach has been to examine whether there are deficits that can be observed even after one corrects for such biases: by presenting stimuli at central fixation or on the vertical meridian. A series of studies employing this strategy have revealed that there may be important deficits in deployment of attention, sustained attention and working memory in right-hemisphere neglect patients.

Some of these components of the neglect syndrome may be differentially ameliorated by noradrenergic or dopaminergic therapies. Proof-of-concept studies using guanfacine (an alpha-2 noradrenergic agonist) have revealed that it can improve neglect by its effect on sustained attention. By contrast, rotigotine (a dopamine receptor agonist) improved neglect in some neglect patients by its effects on selective attention.

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**R.D. MILL & A. O'CONNOR. Frontoparietal contributions to establishing and evaluating expectations that aid memory decision-making.**

**Objective:** The inferior parietal cortex (IPC) is one of the most reliably activated brain regions in neuroimaging studies of recognition memory. However, the lack of primary memory impairment observed in neuropsychological studies of parietal patients, and recent findings which suggest a more complex role of the IPC in the integration of expectations and memory retrieval, necessitate further exploration of its involvement in memory. O'Connor et al (2010) previously used a Posner-like episodic cueing procedure in which participants were given probabilistic cues (e.g. "likely old") before making old/new recognition judgements. They recovered frontoparietal activation in both retrieval success (hits > correct rejections) and invalid cueing (invalidly cued > validly cued items) contrasts, suggesting that expectation violation may contribute to the activation typically observed in studies of recognition.

**Participants and Methods:** Here, we tested 18 participants in an fMRI experiment using a similar episodic cueing procedure. We varied the cue wording and introduced high/low confidence response options to tease apart the contributions of cue strength and evidence strength to the frontoparietal expectation violation response. We also adopted a refined model that accounted for trial-by-trial variation in response duration.

**Results:** Our results dissociate the roles of parietal and prefrontal regions reported together in prior recognition experiments. Prefrontal regions, particularly mPFC increased activation to violated recognition expectations according to both the strength of the violated expectations and the strength of evidence countermanding them. IPC showed a more nuanced pattern of activation associated with cue characteristics.

**Conclusions:** We discuss these findings with respect to parietal contributions to frontoparietal memory and control networks, and neuroimaging recognition memory research in general.

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**A. FARNÈ. Multisensory Perception for Action.**

**Objective:** The binding of visual information available outside the body with tactile information arising on the body, allows for the representation of the space lying in between, which is often the theatre of our interactions with objects. The definition of what has become known as "peripersonal space", originates from single-unit electrophysiological studies in monkeys, based on multisensory, mainly visual-tactile neurons. Such neurons in parietal and premotor regions of the monkey brain, respond to visual and tactile stimuli, their visually evoked responses being stronger when objects are closer to the tactile receptive field. These functional properties allow for the coding of visual information in advance to the contact with the hands, in a body-part centred reference frame. Here, we will first review the behavioural and neuroimaging evidence that suggested the existence of a similar representation of the

peripersonal space in humans, which is similarly based upon a network of parietal and premotor areas. We'll present results indicating that, similar to non-human primates, the peri-hand space in humans is represented in hand-centred coordinates. Our focus will be the following question: what is the function of such multisensory systems? We will provide behavioural and electrophysiological evidence for their implication in the planning and execution of both defensive (avoidance) and appetitive (reach-to-grasp) actions on nearby objects. This evidence demonstrates how multi-sensory-motor systems may process hand-related visual inputs within just 70 ms following a sudden event, and before the execution of a grasping action. Overall, previous and on-going work in our laboratory indicate that performing actions induce a fast remapping of the multisensory peripersonal space, as a function of on-line sensorimotor requirements, thus supporting the hypothesis of a role for peripersonal space in the generation and control of rapid hand-centred avoidance and acquisitive actions.

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**Poster Session 5:  
Imaging / Stroke / Memory / Visuospatial**

**3:30–5:00 p.m.**

**Imaging (Functional)**

**A. ITO, T. FUJII, N. ABE, I. KAWASAKI, A. HAYASHI, A. UENO, K. YOSHIDA, S. SAKAI, S. MUGIKURA, S. TAKAHASHI & E. MORI. Gender differences in the patterns of vmPFC activity associated with preference judgments for faces.**

**Objective:** Previous neuroimaging studies implicated the ventromedial prefrontal cortex (vmPFC) as a key region in a preference judgment. However, gender differences in vmPFC activity during the preference judgment remain unclear.

**Participants and Methods:** We prepared 256 face photographs (64 elderly female, 64 elderly male, 64 young female, and 64 young male) as experimental stimuli. The experiment consisted of two tasks: a pleasantness rating task during fMRI and a preference judgment task after fMRI. During the pleasantness rating task, 33 subjects (17 females, mean age: 21.2 years) were presented with the face photographs one by one, and were asked to rate each stimulus based on how pleasant it was (1; the lowest, 5; the highest). During the preference judgment task, the subjects were presented with the pairs of face photographs side by side and were asked to choose one they preferred.

**Results:** We found that the scores of pleasantness rating tasks were positively correlated with the vmPFC activity. We then directly compared the first-level statistical maps of females and those of males using a two-sample t-test, but we found no significant difference between these two groups. Next, for each subject group (i.e., the female group and the male group), we extracted the signal changes in the cluster of the vmPFC and conducted a ROI analysis using three-way ANOVAs with the gender of face stimulus (female and male), the age of face stimulus (elderly and young), and the subject's preference (preferred and not preferred) as factors. The ANOVA for the data of females revealed only a significant main effect of the subject's preference. The ANOVA for the data of males showed significant main effects of the gender and the age of face stimulus, but showed no significant main effect of the subject's preference.

**Conclusions:** These findings suggest that the age and gender differences of face stimulus impact on the patterns of the vmPFC activity in males but not on those in females.

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**I. KAWASAKI, T. FUJII, A. ITO, A. UENO, S. MUGIKURA, S. TAKAHASHI & E. MORI. Neural Correlates of Pleasant and Unpleasant Emotions Induced by Social Reputation from The Same and Opposite Genders.**

**Objective:** We used functional magnetic resonance imaging (fMRI) to identify the neural correlates of pleasant and unpleasant emotions induced by social reputation from the same and opposite genders.

**Participants and Methods:** Twenty-eight healthy volunteers (14 females, mean age 21.1 years) were paid for their participation. We prepared 72 face photographs (36 female and 36 male ones). We also prepared 108 comments (36 positive comments, e.g., “You are kind.”; 36 negative comments, e.g., “You are unkind.”; and 36 neutral comments, e.g., “Press a button with your index finger.”). The combination of two types of photographs with three types of comments yielded six experimental conditions. During fMRI scanning, the subjects were presented with the stimuli one by one. The subjects were asked to imagine that they were told the comment by a photographed person and to rate each stimulus based on how pleasant it was (1; the lowest, 4; the highest).

**Results:** The subjects rated more pleasant for positive comments than for negative comments. Imaging data showed that positive comments specifically activated bilateral ventromedial prefrontal cortex, the right posterior cingulate gyrus, and the left cerebellum. On the other hand, negative comments specifically activated the right superior temporal sulcus. Next, we extracted the signal changes of each activated region and conducted a ROI analysis using two-way ANOVAs with the gender of stimulus (the same and the opposite) and the emotional valence of comment (positive and negative) as factors. The ANOVAs for each region showed only a significant main effect of the emotional valence of comment.

**Conclusions:** The present analysis showed that different brain regions are associated with pleasant and unpleasant emotions induced by social reputation from others, but the activation patterns of these regions are not influenced by the gender of a person who gave social reputation.

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**E. LIEMBURG, H. KNECTERING, R. RENKEN, L. BAIS, J. DLABAC-DE LANGE & A. ALEMAN. Decreased frontoparietal activation related to apathy in patients with schizophrenia.**

**Objective:** Apathy is a disabling and difficult to treat symptom of schizophrenia. It is defined as a quantitative reduction of voluntary, goal-directed behaviors that impairs daily functioning. The neural basis of apathy in schizophrenia is still unclear. We hypothesized that patients with high levels of apathy would show decreased activation in brain regions involved in planning and goal-directed behavior. To test the hypothesis, we related levels of apathy with brain activation during a planning and working memory task.

**Participants and Methods:** 64 patients with schizophrenia and 17 healthy controls performed the Tower of London task in a 3 T Philips scanner (Best, The Netherlands). The acquired ASL images were preprocessed using SPM. Additionally nuisance factors were filtered and perfusion images were calculated. Brain activation was compared between healthy controls and patients. Apathy scores were derived from items of the Positive and Negative Syndrome Scale (N2, N4, N6, G13, G16) and regressed against the task related brain activation.

**Results:** Patients showed non-significant poorer performance on the task than controls. The task activated prefrontal, parietal and striatal brain regions. Compared to controls, patients showed decreased activation in lateral prefrontal regions. In contrast, patients showed increased activation in the anterior cingulate cortex and medial prefrontal regions. A negative linear association was observed between apathy and activation of inferior frontal gyrus and parietal lobule.

**Conclusions:** Patients showed decreased lateral prefrontal activation during planning. This fits the hypofrontality model of schizophrenia. In contrast, increased medial frontal activation in patients may be related to increased efforts to perform a task with conflicting task solutions. Apathy was related to lower activation in prefrontal and parietal regions. This supports our hypothesis that impaired function of brain regions involved in planning and goal directed behavior may underlie apathy in schizophrenia.

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**E.C. MIOTTO, M.C. BATISTUZZO, J.B. BALARDIN, M.M. MARTIN, C.R. SAVAGE, G.C. POLANCZYK, E.C. MIGUEL & E. AMARO JR. Neural Correlates of Episodic Verbal Memory in OCD Children after Semantic Strategy Training.**

**Objective:** We aimed to investigate the neural correlates of verbal memory encoding in children with OCD after a brief semantic strategy training using fMRI. In addition, we compared their performance with healthy controls to exam differences in behaviour and neural activity

**Participants and Methods:** We included 20 OCD children and 20 healthy controls matched for age, gender, and years of education. Images were collected in a 3Tesla Achieva Phillips in a AB block design paradigm with two different conditions: words semantically related (SR) and non-related (NR) and a fixation baseline. fMRI parameters included 41 slices, 3 mm thickness, 0.3 gap, TE 30 ms, TR 3000ms, matrix 80 x 78, FOV 240 mm<sup>2</sup>, voxels de 3 x 3 x 3 mm and 90 flip angle. Each condition (SR and NR) was presented 3 times and each one had 16 words. Subjects were instructed to memorize and later to recall as many words as they could. Then, they received a brief semantic strategy training outside the scanner. After that, they returned to the scanner and performed the same paradigm with novel words.

**Results:** OCD patients did not differ from controls for the total number of words recalled ( $p = 0.233$ ) before training on either the SR ( $p = 0.301$ ) or NR ( $p = 0.559$ ) conditions. After training, both groups improved their performance in the SR condition only, and did not differ from each other. For the OCD group, there was increased left inferior frontal gyrus (IFG) and bilateral parietal activation after training. In the control group, decreased activation was found after training in the IFG.

**Conclusions:** Both groups improved their memory performance after training in the SR condition. Nevertheless, only the OCD group showed increased activation in the left IFG related to this improvement, a key region for semantic categorization. These differences in brain activity are discussed in terms of the neurobiological model of this disease.

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**Y. MURAKAMI, A. ITO, I. KAWASAKI, A. UENO, Y. KAWACHI, S. MUGIKURA, Y. MATSUE, S. SAKAI, S. TAKAHASHI & T. FUJII. Effects of Cosmetics Use and Gaze Direction on Facial Attractiveness: An fMRI Study.**

**Objective:** Recent studies have shown that facial attractiveness is influenced by cosmetics use and gaze direction. However, the effects and the interaction of these two factors are not fully understood. The aim of this study was to investigate the effects of cosmetics use and gaze direction on facial attractiveness both from behavioral data and from brain activity measured by functional magnetic resonance imaging (fMRI).

**Participants and Methods:** Twenty-four healthy volunteers were paid for their participation in this study (12 males, mean age 22.4 years). During fMRI scanning, the subjects were presented with 180 face photographs (36 Make-up faces/Direct gaze, 36 Make-up faces/Averted gaze, 36 No make-up faces/Direct gaze, 36 No make-up faces/Averted gaze, and 36 scrambled photographs) one by one, and were asked to rate each stimulus for attractiveness. The imaging data were analyzed using SPM8 (Wellcome Department of Imaging Neuroscience, London, UK).

**Results:** Behavioral data revealed that, the face photographs with cosmetics were rated more attractive than those without cosmetics. Neuroimaging data showed that regardless of gaze direction, face photographs with cosmetics, compared with those without cosmetics, activated the bilateral orbitofrontal cortex, the right fusiform gyrus, the right thalamus, the right frontal pole, and the right cerebellum. On the other hand, regardless of cosmetics use, face photographs with direct gaze, compared with those with averted gaze, activated the bilateral inferior frontal gyrus, the right superior temporal gyrus, the left anterior cingulate gyrus, the bilateral orbitofrontal cortex, the right hippocampus, and the left cerebellum.

**Conclusions:** Facial attractiveness was increased by cosmetics use, but not by gaze direction in the present study. Our results indicate that facial attractiveness induced by cosmetics use is represented in multiple brain regions, including the reward value system such as the orbitofrontal cortex.

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**A. ORON, T. WOLAK & E. SZELAG. The Neuroanatomical Basis of Phonological Awareness - an fMRI Study.**

**Objective:** Phonological awareness refers to identification and discrimination of phonemes in fluent speech and underlies auditory comprehension. It reflects phonemic hearing, thus, an individual's capacity to differentiate words, syllables, rhymes in verbal utterances. The neuroanatomy of phonological awareness is still not clearly established in existing literature. The aim of our study was to identify brain regions involved in phonological processing in healthy volunteers, using fMRI method.

**Participants and Methods:** Forty four subjects (28 female, 16 male,  $\pm$  SD 47.3 years  $\pm$  18.6) participated in the block design study, performed in 3T MRI scanner (MAGNETOM TRIO, Siemens). Participants performed two visual and two auditory tasks during the scanning. For each modality both experimental and control tasks were applied. The visual tasks required rime detection (experimental task) and stimulus detection (control task). The auditory tasks required identification of words that started with a given letter (experimental task) and detection of a rising/ falling tone (control task). Subjects' answers were given by pressing one of two buttons after each stimulus presentation (responses: YES for congruent presentations or NO for incongruent ones). The fMRI procedure (BOLD fMRI:10 min) was proceeded by imaging of brain structures (structural MRI: 16 min). Two contrasts were considered: visual (experimental vs. control) task or auditory (experimental vs. control) task. Next, the conjunction analysis was used to map the common region activated in both visual and auditory experimental tasks, thus, to find the region involved in phonological processing, independently of the sensory modality.

**Results:** The results revealed BA 21 of the left hemisphere as the common region activated in both visual and auditory tasks.

**Conclusions:** These results indicate that phonological awareness is represented in the classical Wernicke's area involved in broad aspects of auditory comprehension.

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**R. SALAS, D. MOLFESE & P.R. BALDWIN. A Striatal Reward Learning Signal is Associated to Habenulo/striatal Resting State Functional Connectivity in Tobacco Smokers.**

**Objective:** Tobacco smoking is one of the largest public health issues in the world. The reward system in the brain is a major player in addiction development and relapse. The habenula is a small brain region that activates upon negative events, which in turn decreases dopaminergic activity eliciting negative affect. The habenula is hypothesized to have a major role in nicotine withdrawal symptoms.

**Participants and Methods:** We studied 12 overnight abstinent smokers and 12 non-smokers that were matched for age, sex and ethnicity. Subjects were scanned on 3T Trio Siemens MRI scanners under resting state (5 minutes, eyes open or closed) and a passive learning paradigm using repeated sweet juice as reward, 6 seconds after cue presentation. Resting state data was analyzed using the matlab toolbox Conn, and reward paradigm data was analyzed using AFNI (Analysis of Functional NeuroImages, NIH) with the habenula and the striatum as regions of interest.

**Results:** To construct a striatal reward learning signal, we studied the difference of the striatal response to the first 5 juice events and the striatal response to the last 5 juice events (of a total of 23 juice events). We found no statistically significant difference between smokers and non-smokers. However, the strength of the striatal learning signal was significantly correlated ( $r^2=.5$   $p=.01$ ) with the resting state functional connectivity between the habenula and the striatum, but only in smokers.

**Conclusions:** The habenula is hypothesized to be chronically affected by tobacco smoking. We show that the resting state functional connectivity between the habenula and the striatum is associated to the way

the striatum learns about reward. This can have important implications for tobacco smoking behaviors: when smokers are trying to quit, how robust is the connectivity between the habenula and the striatum may be a decisive factor in the way the brain process reward learning, thus affecting the ability to quit smoking.

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**J. VAN DER VELDE, M.N. SERVAAS, K.S. GOERLICH, R. BRUGGEMAN, P. HORTON, S.G. COSTAFREDA & A. ALEMAN. A meta-analysis on alexithymia related brain activity during emotion processing.**

**Objective:** Alexithymia ("no words for feelings") is a personality trait characterized by difficulties in identifying, analyzing and verbalizing feelings, restricted imaginal capacities and limited emotional experience (Sifneos, 1973). It is considered a risk factor for a range of psychiatric and neurological disorders (Taylor et al., 1997). Difficulties in emotion processing are at the core of alexithymia. Functional neuroimaging studies investigating the neural correlates of alexithymia during emotion processing have reported inconsistent results.

**Participants and Methods:** To integrate previous findings, we conducted a parametric coordinate-based meta-analysis including thirteen neuroimaging studies on emotion processing in alexithymia. The novel parametric coordinate-based meta-analysis (PCM) technique allowed the pooling of both ROI-based and coordinate based findings (Costafreda, 2012).

**Results:** The results revealed that during the processing of negative emotional stimuli, activity in the amygdala, fusiform gyrus and occipital cortex was negatively correlated with alexithymia. This may indicate that less visual attention is being directed towards negative stimuli. Furthermore, alexithymia was associated with lower activation in supplementary motor and premotor areas and the dorsomedial prefrontal cortex during the processing of negative stimuli. This is possibly underlying the poor empathic abilities and difficulties in emotion regulation associated with alexithymia. When confronted with positive stimuli alexithymia was associated with decreased activation in the insula and precuneus, presumably reflecting reduced emotional awareness of positive affect. Independent of valence, higher activation in the dorsal anterior cingulate was found, which may reflect higher cognitive demand and might serve as a compensatory mechanism.

**Conclusions:** Taken together, these results indicate that both valence-specific as well as valence-independent effects of alexithymia on neural correlates play a role during emotion processing.

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**J.M. DEBRABANT, F. GHEYSEN, K. CAEYENBERGHS, H. VAN WAEVELDE & G. VINGERHOETS. Neural underpinnings of impaired predictive motor timing in children with Developmental Coordination Disorder.**

**Objective:** Developmental Coordination Disorder (DCD) is a clinical label that describes an impaired acquisition and clumsy approach of motor activities including ball skills, writing, and sports. A dysfunction in predictive motor timing is put forward to underlie DCD-related motor problems. Predictive timing allows for the pre-selection of motor programs in order to decrease processing load and facilitate reactions.

**Participants and Methods:** Using functional magnetic resonance imaging (fMRI), this study investigated the neural correlates of motor timing in DCD ( $n=17$ , mean age  $9.4 \pm .6$  years) and typically developing children ( $n=17$ , mean age  $9.2 \pm .9$  years). The task involved motor responses to sequences of visual stimuli with predictive or unpredictable interstimulus intervals (ISIs).

**Results:** DCD children responded with a smaller reaction time (RT) advantage to predictive ISIs compared to typically developing children. Typically developing children exhibited higher activation in the right dorsolateral prefrontal cortex (DLPFC) and right inferior frontal gyrus (IFG) for responses at unpredictable as opposed to predictive ISIs, whereas activations in DCD children were non-differentiable. Moreover, DCD children showed less activation than typically developing children in the right DLPFC, the left posterior cerebellum (crus I) and the right temporo-parietal junction (TPJ) for this contrast. Notably, activation in the right temporo-parietal junction (TPJ) positively correlated with RT as an indicator of processing load in both groups.

**Conclusions:** These data indicate that motor performance in DCD children requires extra processing demands due to impaired predictive encoding.

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### Imaging (Structural)

**O.M. ALHASSOON, S.F. SORG, M.J. TAYLOR, S.C. BRIAN, N. STRICKER, M.J. STERN & I. GRANT. Relationship between Hepatic Function, Corpus Callosum Microstructural Integrity and Neuropsychological Performance in Recently Detoxified Alcoholics.**

**Objective:** Recent *in vitro* proteomic research has implicated liver dysfunction in abnormal brain protein expression among alcoholic patients. The corpus callosum (CC) is especially affected; with the genu showing most protein alterations. This study examines the association between *in vivo* microstructural white matter changes in CC, hepatic biomarkers, and neuropsychological testing (NP) in recently detoxified alcoholics (RDA).

**Participants and Methods:** NP, CC fractional anisotropy (FA), total bilirubin, and serum albumin data was collected on RDA males (N=27) two weeks after abstinence. Analysis consisted of Pearson correlations and multiple regression. The speeded score was the T-score average of Trail Making Test A and B, Grooved Pegboard, Paced Auditory Serial Addition Test, and Digit Symbol Coding. The non-speeded score was composed from the Halstead Category Test, Digit Span, Learning on the Story Memory and Figure Memory tests, and Tactual Performance Test learning and memory scores.

**Results:** Statistically significant correlations ( $p < 0.05$ ) were found between albumin levels and FA in the genu ( $r = 0.43$ ), body ( $r = 0.46$ ), and splenium ( $r = 0.40$ ) while total bilirubin was not significantly correlated with FA. In a full regression model predicting performance on time-sensitive tests, 36% of the variance was explained; with albumin ( $\beta = 0.62$ ,  $p = 0.003$ ) and FA in the genu ( $\beta = 0.67$ ,  $p = 0.037$ ) independently contributing to the model. Non-speeded tests yielded no statistically significant results for the overall model.

**Conclusions:** The current study is the first to demonstrate that albumin, one of the markers used in the Child-Pugh score of hepatic function, is associated with microstructural disruption in the CC of RDA. The ability of both albumin levels and genu FA to independently contribute to the prediction of performance on speeded NP tests highlights the role that subtle hepatic dysfunction and white matter disruption plays in information processing and psychomotor speed among RDA. (VA Merit Review SA-320)

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**S.J. BANKS, S. MAHMOUD & A. BONNER-JACKSON. Verbal and Nonverbal Memory and Hippocampal Volumes in a Memory Clinic Patient Population.**

**Objective:** The finding of material specific lateralization of memory function in the medial temporal lobes is central to classic neuropsychology. The left hippocampus is considered mainly responsible for verbal memory, the right hippocampus for visuospatial memory. Here we assess left and right hippocampal volume in relation to performance on two analogous tests of verbal and visuospatial memory.

**Participants and Methods:** Patients underwent neuropsychological testing and whole brain MRI in the course of their usual clinical work-up. The neuropsychological battery included the Hopkins Verbal Learning Test (HVLT) and the Brief Visuospatial Memory Test, Revised (BVMT-R). Neuroquant software was used to calculate the hippocampal volumes. Regression analyses were used to assess the relationship between performance on the memory measures (HVLT, BVMT) and volumes of left and right hippocampus.

**Results:** Initial results indicated a significant association between BVMT performance (both total learning and delayed recall) and right hippocampal volumes. Further analyses were also planned within diagnostic groups (e.g., AD, MCI, etc.), and to address the relationship between hippocampal asymmetry and memory performance.

**Conclusions:** Performance on a measure of visuospatial memory is sensitive to right hippocampal atrophy, suggesting that neuropsychological measures may serve as useful indicators to track brain changes in neurological patients over time.

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**C. SCHRETLEN, N. IBARRETXE-BILBAO, L. OLABARRIETA, O. RILO, M. VARVARIS & N. OJEDA. Altered White Matter Connectivity Relates to Executive Function Deficits in Schizophrenia.**

**Objective:** Executive dysfunction is common in schizophrenia. Attempts to identify the cerebral locus of this impairment with diffusion tensor imaging has yielded inconsistent results, pointing variously to white matter (WM) abnormalities in the uncinate fasciculus, superior longitudinal fasciculus, and cingulate bundle. We sought to elucidate the contribution of WM integrity in frontotemporal vs. frontoparietal regions to executive dysfunction in schizophrenia.

**Participants and Methods:** 73 stable outpatients with schizophrenia and 42 healthy adults underwent cognitive testing and diffusion tensor imaging on a Siemens 3T MRI scanner. Correct responses on the Modified Wisconsin Card Sorting Test (M-WCST) were tallied to assess executive function. Cerebral WM fractional anisotropy (FA) values were subjected to whole-brain voxel-wise regression analysis using Tract-Based Spatial Statistics and correlated with M-WCST performance.

**Results:** Groups differed in age, sex, and education. Healthy adults outperformed patients on the M-WCST ( $p < .01$ ). No correlations between FA values and M-WCST scores were found in controls. In schizophrenia, worse test performance correlated with reduced FA in a cluster of voxels spanning the frontal, parietal, and temporal lobes, including WM in the bilateral cingulum and the left anterior corona radiata, inferior fronto-occipital fasciculus, and uncinate fasciculus. Voxels in frontal regions correlated most strongly ( $p_{corr} = .02$ ) with test performance.

**Conclusions:** These results confirm that executive dysfunction is common in schizophrenia. Correlations between M-WCST performance and FA values were found in the left anterior corona radiata, inferior fronto-occipital fasciculus, and uncinate fasciculus. This study supports prior reports of involvement of both frontotemporal and frontoparietal WM, but suggests that degradation of frontal WM tracts correlates most highly with executive dysfunction.

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**J. KATARZYNA, G. WITKOWSKI, H. SIENKIEWICZ-JAROSZ, D. RYGLEWICZ & P. NAUMAN. The usefulness transcranial sonography in diagnosis of psychiatric symptoms in Huntington disease patients.**

**Objective:** Transcranial sonography (TCS) in recent years has become a method for the visualization of structural abnormalities of the brain parenchyma in movement disorders. Studies of TCS report changes of the echotexture of mesencephalic raphe in patients with major depression and depressive symptoms in some neurodegenerative disorders. The aim of this study was to test the usefulness of TCS in diagnosing of patients with genetically confirmed HD and concomitant psychiatric disorder.

**Participants and Methods:** TCS was performed in 69 patients with HD. Patients were allocated to the four groups: with the symptoms of depression (22 patients), with significant irritability (15 patients), obsessive-compulsive symptoms (12 patients) and patients without neither the presence, nor the history of these psychiatric signs in the past (20 patients). The psychiatric symptoms were assessed using the battery of tests: the Hamilton Rating Scale for Depression, the Beck Depression Inventory, UHDRS behavioral score, PBA-S and PBA-HD. All patient underwent complete neurological and psychiatric examination.

**Results:** Hypoechoogenicity of raphe nucleus was found in 72.7% of patients with depression (16/22), 13.3% of patients with irritability (2/15), 25% of patients with OCD (3/12 number) and 10% of patients without present or past history of psychiatric disturbances (2/20). Another finding, hyperechogenic substantia nigra was visualised in 51% of patients with genetically confirmed HD.



**Conclusions:** Our findings seem to confirm the relationship between changes in mesencephalic raphe echogenicity and the presence of depressive symptoms also in patients with HD.

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**T. LAZARUS, G.T. LAZARUS & J.T. LAZARUS. Occipital lobe hemangioma and Neuro-cognitive findings in recalcitrant substance abuse: A Case Study.**

**Objective:** The purposes of the assessment were to perform a brief neuropsychological screen on a patient who was unresponsive to psychiatric treatment for substance abuse and to further report pre- and post-surgical neuropsychological test scores before and after cognitive rehabilitation.

**Participants and Methods:** The patient was a 40-year-old male who practiced as a surgeon. He was under long-term opiate treatment for substance abuse. He underwent two, six-month periods of in-patient psychiatric rehabilitation which did not result in long-term benefits. Thus, a neuropsychological opinion was requested.

**Results:** Based on initial neuropsychological screen, patient was subjected to a MRI brain scan. A cavernous hemangioma identified in the occipital brain region. Although these lesions are treated conservatively with monitoring over time, mild compression of the fourth ventricle encouraged surgical removal due to significant morbidity concerns. Immediate post-surgical findings suggested improvement in visual functioning, visual attention and in the integration of visual-motor integration. Post-surgical neuropsychological assessment revealed significant improvement in patient's impulsive behaviours and his substance abuse patterns declined. However, persisting deficits in visual-motor integration, in tracking of visual information and fine motor integration skills were treated for a period of six months with a regimen of carefully selected cognitive rehabilitation programmes. Patient eventually returned to his vocation as a surgeon.

**Conclusions:** the purpose of this case study is to impress the critical value of brief neuropsychological screening, neuropsychological monitoring and cognitive rehabilitation in cases involving benign tumours. Correspondence: *Theophilus Lazarus, PhD, Independent Practice, P.O. Box 19660, Dormerton, Durban 4015, South Africa. E-mail: lazarus.theophilus@gmail.com*

**M. MATSUI, M.M. TANAKA, A. UEMATSU, C. TANAKA, S. UDA & K. MIURA. Normal developmental changes of the corpus callosum from infancy to early adulthood.**

**Objective:** Although some previous researches have reported development trajectory in the morphometric of the corpus callosum, there have been few studies that include infant data. The goal of this study was to examine the morphology of the corpus callosum in healthy subjects with both sexes from infancy to early adulthood. This study provides detailed information regarding the normal developmental patterns of the corpus callosum and their sex differences.

**Participants and Methods:** We performed a morphometric Magnetic Resonance Imaging (MRI) study of 114 healthy individuals (54 females and 60 males), aged 1 month to 25 years old. We measured the size of corpus callosum. The border of the corpus callosum was traced in midsagittal orientation. The segmentation of the corpus callosum into the seven subareas was performed by image processing software; the corpus callosum was segmented into rostrum, genu, rostral body, anterior midbody, posterior midbody, isthmus and splenium using the parcellation scheme. This study was reviewed and approved by the Research and Ethics Committee at the University of Toyama.

**Results:** Locally weighted regression analysis (LOESS) of morphometric findings of the corpus callosum indicated significant non-linear age-related changes, especially during the first few years of life, regardless of sex. After this increase, slopes of the curves gradually became flat in both sexes. The age of local maximum in each subarea of the corpus callosum differed between sexes.

**Conclusions:** The results have shown that the development trajectory of the corpus callosum during early life in healthy individual was non-linear and dynamic. It suggests that is similar with the developmental pattern of the cerebral cortex, especially frontal and temporal lobe, denoting that this period plays a very important role in neural and functional development. Furthermore, the results suggest that the development trajectory and growth change is different between sexes.

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**F.A. THIEL, S. FRISCH, A. VILLRINGER, A. HORSTMANN & M.L. SCHROETER. Gray matter atrophy and cognitive deficits in patients after Herpes Simplex Encephalitis.**

**Objective:** Herpes Simplex Encephalitis (HSE) is a severe neurological disease, that often leads to persistent cognitive deficits in survivors. Typically HSE patients exhibit memory and executive dysfunctions, naming deficits, as well as increased behavioral and emotional impairment. Regions such as the temporal lobes, the orbitofrontal cortex, the insulae, as well as the cingulate gyri are characteristically affected.

However, studies have not systematically reported cognitive deficits in accordance to the extent of atrophy in affected brain regions. In this work, we explore the pattern of structural gray matter changes following HSE and its direct correlation with neuropsychological deficits.

**Participants and Methods:** In this study, a voxel-based morphometry (VBM) analysis is conducted on the 3T MRI images of 13 HSE survivors and the patterns of gray matter atrophy are compared with a group of age- and sex-matched controls. Additionally, to ensure specificity of identified gray matter loss, whole brain gray matter values of each patient are correlated with memory and naming scores, obtained in a neuropsychological assessment.

**Results:** Analysis of the individual lesion patterns reveals a pattern of widespread gray matter loss, predominantly in the mesial temporal cortices, amygdalae and insulae. However, due to considerable regional inter-individual variability in lateralization, this is obscured in the group comparison. The neuropsychological data indicate that the verbal memory impairments correlates with atrophy especially in the left hippocampal region, whereas naming deficits are associated with gray matter loss in the lateral temporal lobe, the thalamus and the left insula.

**Conclusions:** The results obtained, being consistent with the well-known histopathology of this disease, contribute to the anatomical validity of VBM and to the understanding of neuropsychological impairments in patients after HSE.

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**M. TRIVIÑO, A. CORREA, J. LUPIAÑEZ, M. FUNES, A. CATENA, X. HE & G. HUMPHREYS. Mapping Temporal Preparation.**

**Objective:** Temporal preparation is a function relatively unexplored in the clinical setting. However, deficits in temporal preparation have been associated with brain damage and their consequences can include impaired motor coordination, impulsiveness or intolerance to delay. This study aimed to define the structures involved in two main mechanisms of temporal preparation described in the literature (Correa et al., 2006): controlled (temporal orienting and foreperiod effect) vs. automatic temporal preparation (sequential effects). This mapping will improve our characterization of patients' profiles and their associated deficits in basic timing functions.

**Participants and Methods:** A general linear model was used to conduct voxel-wise comparisons between 23 patients and controls to determine the GM lesion locations ( $p < 0.05$ ;  $p_{FWE} < 0.05$ ). Next, for each patient we counted the number of GM voxels within each cluster in which gray matter volume was significantly lower than that of controls. Finally, a multiple regression analysis was performed to measure the relationship between the lesion size in specific brain areas of the patients and their behavioral reaction time performance in a temporal preparation task, as measured by the three indexes mentioned above (Triviño et al., 2011).

**Results:** The main finding was that each temporal preparation effect was related to a differentiated neural network. In particular, the Temporal Orienting effect was significantly related to the left orbital, right superior temporal and right middle cingulum (Adj  $R^2 = 0.76$ ;  $F = 12.39$ ;  $p = 0.0001$ ). The Foreperiod effect involved mainly the right inferior orbital (Adj  $R = 0.68$ ;  $F = 16.60$ ;  $p = 0.0001$ ). Finally, the Sequential effects were related to the right superior temporal, the left parietal cortex and the right thalamus (Adj  $R^2 = 0.59$ ;  $F = 8.85$ ;  $p = 0.0001$ ).

**Conclusions:** The finding of differential regression models for each temporal preparation effect suggests the involvement of dissociable neural networks underlying independent mechanisms for temporal preparation.

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### Memory Functions

#### F. ANZAKI, S. YAMAMOTO & M. INOUE. Brain Regions Relevant to Letter Span and Digit Span using Functional Near-Infrared Spectroscopy.

**Objective:** Baddelley (2003) regarded Brodman's area 40 [the left (lt.) supramarginal gyrus (SMG)] as a phonological store. Leff et al. (2009) reported that the most relevant lesions were the lt. superior temporal gyrus (STG) and superior temporal sulcus (STS). Anzaki et al. (2012) presented that in patients with aphasia, the most relevant lesion for digit span (DS) disorder was the lt. angular gyrus (AG) and for letter span (LS) disorder was the lt. STG. Thus, our research objective is to identify the most relevant regions for DS and LS for normal persons.

**Participants and Methods:** Participants were 10 normal healthy persons. We made four different files, two each for LS and DS. Each LS file consisted of 5 sets. One set consisted of 5 s white noise (WN), 10 s rest, and 5 Japanese syllables. Each DS file consisted of 5 sets. One set consisted of 5 s WN, 10 s rest, and 5 Japanese digits. In the hearing task of the LS procedure, the participants were instructed to hear WN and 5 syllables. In the retaining task, they were instructed to retain 5 syllables for 5 s and then recall the syllables. The DS procedures were the same. Relative changes in oxyhemoglobin (OXY-Hb) during the DS and LS tests as well as the t-values were calculated using the FOIRE-3000 near-infrared brain imaging system (Shimadzu Corporation, Kyoto, Japan). We compared relative changes in OXY-Hb between retention and rest after hearing WN.

**Results:** During the retention performance of the DS tests, lt. SMG and AG activities were significantly observed. During the retention performance of the LS tests, bilateral middle and inferior Frontal gyrus activities were significantly observed.

**Conclusions:** The most relevant regions for DS were found to be the same for normal persons and aphasia patients. However, the most relevant regions for LS were not the same. Regarding the results, we examined each patient under different recovery stage. We considered that there are several phonological storages for each property.

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#### C. BOWMAN, D. SHUM & T. CUTMORE. Development of Prospective Memory (PM) Across Adolescence: the Effect of PM Target Numbers and the Role of Executive Functions.

**Objective:** Prospective memory (PM) is an important cognitive function vital for day to day functioning and little is known about its developmental trajectory throughout adolescence, a time of important brain maturation.

**Participants and Methods:** In the present study, the development of PM was examined in adolescents 12 to 13-year-olds ( $n = 22$ ), 14 to 15-year-olds ( $n = 23$ ), 16 to 17-year-olds ( $n = 20$ ) and young adults 18 to 19-year-olds ( $n = 28$ ). Two types of PM tasks were compared; 6-cue (10 minute) vs. 30-cue (30 minute) task. This comparison allowed us to examine whether varying PM target numbers would affect age-related PM performance. The Self-Ordered Pointing Task (SOPT), Stroop, and Trail Making Test (TMT) were administered to evaluate the role of executive functioning on PM performance. In addition, a retrospective memory (RM) test, the Hopkins Verbal Learning Test Revised (HVLT-R) was administered to see if RM and PM have a different developmental trajectory in adolescence.

**Results:** Results showed that there were no significant age differences on PM task for the 6-cue task. However for the 30-cue task, 12 to 13-year-olds performed significantly worse than 14 to 15-year-olds and young adults, when both accuracy and RT were taken into consideration. In regards to the role of executive functions on PM performance, only TMT (after controlling for age & RT) was a significant predictor of PM performance for the 30-cue task. Also, there were no significant age differences on the RM task.

**Conclusions:** These findings suggest that the role of task switching along with particular task demands may contribute to age-related PM differences across adolescence. In comparison, RM seems to be developed by early adolescence. The findings are discussed in relation to brain development in adolescence.

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#### P. CALUN-NADULSKA, M. WESIERSKA, A. SZYMASZEK, K. NOWAK, E. BIERWIAZONEK & E. SZELAG. The effect of cognitive distractors on real idiothetic memory in humans.

**Objective:** A number of experimental studies has indicated the involved of prefrontal cortex and hippocampal areas in cognitive function, specifically, the role of hippocampus in both visual (allothetic) and non-visual (idiothetic) spatial memory. The latter memory type is crucial for human navigation in space, where no distal and proximal visual cues are available, and spatial representation is built on a basis of vestibular and proprioception information. In our previous studies we showed that idiothetic memory examined with Real Idiothetic Memory (RIM) test was resistant to age-related declines in healthy elderly. We hypothesized that complex cognitive tasks (like turning and counting backwards) may affect such idiothetic memory.

**Participants and Methods:** Eighty young subjects were randomly assigned to one of two groups ( $n=40$ ; 20 males/20 females in each group; mean age=24 years). Half of them were examined using to the procedure without any distractors (non-DIS), whereas the others were tested using the procedure with distractors (DIS). RIM test was examined on a circular arena (300 cm in diameter) on which a subject walked in fully darkness. Experiment was conducted by computerized tracking system. The non-DIS task was to walk on arena starting from the Start Point (SP) placed on arena frame in order to find on arena physically nondescript circular Noise Place (NP, 45 cm in diameter), where noise was presented, and then, to return from NP to SP. The DIS procedure comprised an additional task of turning and, next, counting backwards in the NP. Accuracy of return (AR), i.e. an angle between SP, the middle of NP and return place (assessed in degrees) was analyzed.

**Results:** Subjects in DIS procedure performed worst ( $M=53,08\pm3,59$ ), with significantly higher AR values than in the non-DIS procedure ( $M=18,13\pm3,59$ ) (mixed model ANOVA,  $F(1,78)=47.47$ ;  $p<0.001$ ).

**Conclusions:** These results indicated that RIM was affected by cognitive distractors in young subjects.

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#### S. FRISCH, F. THIEL, M.L. SCHROETER & T. JENTZSCH. Cognitive Deficits in Transient Global Ischemia (TGI) – Memory and Beyond.

**Objective:** Transient global ischemia (TGI) frequently causes long-term cognitive impairments. Earlier studies have reported isolated memory deficits in these patients. However, a review of the literature reveals that TGI also leads to deficits in other domains, such as attention, executive functions, drive and emotional regulation, even though existing studies mostly rely on single cases or small samples (Caine & Watson, 2000).

**Participants and Methods:** We analyzed the data of 40 TGI survivors retrospectively who had been treated at the Day-Care Clinic of Cognitive Neurology in Leipzig between 1996 and 2009. The most frequent etiology was cardiac arrest (70%). In order to make results comparable, test results (attention, memory spans, learning/recall recognition, executive functions) were transformed into impairment scores ranging from '0' ('unimpaired') to '3' ('severely impaired') for attention, memory spans, long-term memory and executive functions (Horstmann et al., 2010). In addition, drive was rated with the same scale on the basis of the medical reports. On the basis of CT or MRI scans, patients with hypoxic basal ganglia lesions and microangiopathy were included, whereas those with other focal lesions were not.

**Results:** Memory problems were most frequent (92%). Generally, they were associated with varying deficits in other domains, and occurred in

isolation in only 10% of the cases. We found moderate correlations between the scores in the different domains (including drive). However, memory spans did not correlate with long-term memory, and executive functions did not correlate with drive. Hypoxic basal ganglia lesions were weakly associated with executive deficits.

**Conclusions:** In a comparatively large sample of TGI survivors, long-term memory deficits were most common, but occurred rarely in the absence of deficits in other cognitive domains. Thus, assessment and therapy of TGI survivors have to take the diversity and interdependence of deficits from different domains into account.

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### S. GEURTS & S. VAN DER WERF. Long term forgetting and memory complaints.

**Objective:** The associations between self-ratings of memory functioning and performances on memory tasks are generally small. Several studies have suggested that long term forgetting rates might be more sensitive to detect memory problems, especially in patients who obtain normal scores on standard memory tests. The goal of our study was therefore to assess whether long term forgetting rates might also be a better predictor for experienced memory problems compared to the standardly used forgetting intervals.

**Participants and Methods:** Long term forgetting rates were calculated for 44 outpatients who were referred for neuropsychological assessment and had obtained verbal memory scores (15 word-list learning test) within the normal range (T-scores total learning & 20 min. delayed recall  $\geq 35$ ). Prior to their standard assessment the patients were asked to rate their memory functioning with 1) the efficacy scale of the Multimodal Memory Questionnaire, and 2) an experimental rating scale (Accelerated Forgetting Questionnaire) that measured expected memory loss for a number of situations after respectively an hour, a day, and a week. Recall and recognition were tested again after a week during a regular second visit. Regression analyses were used to test whether long term forgetting percentages would predict memory self-ratings beyond the baseline standard memory measures.

**Results:** None of the regression models for predicting the MMQ effectiveness scores reached significance. In contrast, the models predicting forgetting expectations (AFQ-day, -hour, -week) were significant ( $p < .05$ , explained variances: 14 - 24%). However, the long term forgetting percentages did not add significantly to the models with only the standard baseline test scores.

**Conclusions:** Long term forgetting of previously learned verbal material did not explain differences in memory self-ratings beyond that of the standard baseline memory scores.

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### M. GOFER- LEVI, T. SILBERG, A. BREZNER & E. VAKIL. The Differential Effect of Age and Non-Verbal Intelligence on Different Skill Learning Types among Children with Spastic Cerebral Palsy.

**Objective:** Skill learning (SL) indicates the ability to learn incidentally, as a result of repeated exposure and practice. SL plays an important role in cognitive development, yet is reported to be unrelated to individual differences such as age and IQ. Relatively little is known about the effects of developmental disorders, such as Cerebral Palsy (CP), on SL abilities. In the current study we aimed to examine: (1) differences between children with spastic CP and typically developing (TD) controls in different SL tasks; (2) the effect of age on SL; and (3) the effect of non-verbal IQ and executive functions (EF) on the ability to acquire new skills.

**Participants and Methods:** Twenty four children with spastic CP, aged 9-20 years ( $M=13$ ,  $SD=3.5$ ) and 24 TD matched controls.

All children performed two SL tasks: (1) the Serial Reaction Time (SRT) task in which learning is studied via a repeated sequence of finger movements, and (2) a Probabilistic Classification Learning (PCL) task in which cue-outcome associations are learned gradually over many trials. All children were administered the Raven's Progressive Matrices test for non-verbal IQ and the Children's Category Test for the evaluation of EF.

**Results:** A different pattern of results was found for each SL task:

In the SRT task, a significant improvement in performance was found in both groups. Yet, introduction of a new sequence caused a decline in RT only in the TD group, indicating that improvement in the CP group was a result of general decrease in RT only. Performance was related to non-verbal IQ, but was not age dependent. In the PCL task, improvement in performance was observed for all children, with no relation to non-verbal IQ. An age effect was found only for the TD children. EF was not significantly related to performance on neither task.

**Conclusions:** SL seems to be qualitatively and quantitatively different between children with CP and TD controls. Understanding the unique aspects of SL among children with CP can help plan efficient rehabilitation interventions.

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### C. GOMEZ SEGOVIA, M. TURÓN, S. FERNANDEZ-GONZALO, C. FERNÁNDEZ & M. JÓDAR. Incomplete inversion of the hippocampus: study of 3 clinical cases in pediatric patients not associated with epilepsy.

**Objective:** The hippocampus (HC) completes its development about 21 gestation weeks. The fully inverted HC has an oval configuration in coronal MRI. The alteration in the HC formation has been designated like Incomplete Inversion of the Hippocampus (IIH). In most studies, IIH has been described in patients with epilepsy, severe midline malformations or other brain malformations. There are few studies about alterations in the HC formation during the gestational period and cognitive functioning in children. In the absence of a clear clinical significance, some researchers pointed out the need to establish the functional significance -if any- of IIH in relation to cognition, more specifically in relation to memory.

We report three clinical cases of children with IIH with not associated epilepsy.

**Participants and Methods:** 3 case studies of children (2 male and 1 female patients aged 11-12 years) diagnosed by MRI were fully assessed, including neurological exploration. All children completed a comprehensive neuropsychological assessment, which included measures of global cognitive level, verbal/visual memory, language, visuospatial/visuosperceptual/visuoconstructive abilities and attention and executive functions.

**Results:** Neuropsychological exploration of children with IIH left side did not reveal memory impairment nor in the other cognitive functions assessed. Results in working memory and dual attention tasks showed a below-average performance. In contrast, patient with bilateral IIH revealed impairment in verbal memory, even higher in visual memory.

**Conclusions:** IIH showed higher cognitive impairment when associated with epilepsy. As an independent entity, IIH left side was not associated with memory impairment. Bilateral IIH revealed impairment in memory functions, mainly in visual memory. This may be explained due the brain processes of reorganization, lateralization and crowding effect, which prioritizes the consolidation of language-related function, such as verbal memory ability.

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### P. LÓPEZ PINTO, C. GALISTEO, M. LARROSA, M. MASDEU, L. VIGIL & M. JÓDAR. Verbal memory performance in Fibromyalgia patients: self-report and objective measures.

**Objective:** Fibromyalgia (FM) is a chronic pain syndrome characterized by widespread musculoskeletal pain and tender points, tiredness, sleep disorders and mood disorders. FM patients have more self-reported cognitive problems than general people. Some authors found that objective measures of cognitive function have shown difference between FM patients and control group. The aim of this study was investigate memory beliefs and their relationship to actual verbal memory function in fibromyalgia patients and control group.

**Participants and Methods:** 30 fibromyalgia postmenopausal women (49 to 68 years old) and 30 control groups (46 to 64 years old) were assessed. Exclusion criteria for all subjects were: (a) history of neurological or cognitive dysfunction, (b) use of medication that could affect

the function of the autonomic nervous system, (c) consumption of toxics or stupeficient (d) and the presence of moderate or severe depressive syndrome. The assessment of objective verbal memory was performed with Auditory Verbal-learning test (AVLT) and we use the Metamemory in Adulthood Questionnaire (MIA) to evaluate subjective self-perception of memory.

**Results:** Fibromyalgia patients differed significantly from the control group on the AVLT learning score ( $p=0.03$ ), and AVLT delayed memory ( $p=0.02$ ). No significant results were found in MIA scores between FM patients and control group, except in subjective ratings of anxiety ( $p=0.01$ ) where FM patients were higher scores than control group.

**Conclusions:** Our findings could suggest that FM patients perform more poorly on an objective memory test than the control group; and that FM patients perceived more stress feelings about their memory, which was well correlated with objective memory performance. The results suggest that anxiety was an important component in the FM syndrome, but the relationship between cognitive function and anxiety may not be clear.

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**C. GONÇALVES, M.S. PINHO, V. CRUZ, H. GENS, F. OLIVEIRA, J. PAIS, J. RENTE, I. SANTANA & J.M. SANTOS. Memory Functioning: a Comparison Between Alzheimer's Dementia and Subcortical Vascular Disease.**

**Objective:** Neuropsychologists are often asked to differentiate between Alzheimer's disease (AD) and vascular dementia (VD), the two most frequent types of dementia, but this can be a very difficult task. Despite the heterogeneity of VD, the subcortical type is believed to represent a more homogeneous group. We hypothesise that due to the nature of the brain lesions the two pathologies may differ in some memory dimensions.

**Participants and Methods:** We explored the memory profile in mildly demented patients with AD ( $n=36$ ) and subcortical VD ( $n=16$ ) in comparison with 26 healthy controls. The Wechsler Memory Scale – 3rd edition (WMS-III), and a screening cognitive test (Addenbrooke Cognitive Test – Revised) were administered.

**Results:** Using the Kruskal-Wallis one-way analysis of variance by ranks we observed, as expected, that the control group performed significantly better than the two groups with dementia. Overall, AD patients have a worse performance in WMS-III than VD patients. In particular, AD subjects show better scores on working memory tests and VD patients have a better performance on recognition memory.

**Conclusions:** Although memory can not be an indicator of cerebrovascular disease, as it is for AD, dimensions of this cognitive function could help in the characterization of this clinical condition. This study was supported by a scholarship provided to the first author by 'Fundação para a Ciência e a Tecnologia'.

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**M. HENDRIKS, M. GROULS, A. COLON, J. SCHOMAKER & M. MEETER. Visual Novelty Processing in Patients with Unilateral Temporal Lobe Resection.**

**Objective:** The (mesio)temporal regions play an essential role in novelty processing. Damage to these regions causes abnormalities of the N2 and P3a, Event Related Potential (ERP) components associated with novelty processing. Whether novelty processing is bilaterally processed equally remains unclear. We investigated the contribution of the left and right hippocampus in novelty processing in patients who underwent medial temporal lobectomy.

**Participants and Methods:** Patients with a left ( $N=9$ ) or right ( $N=8$ ) MTL resection (8 females, mean age 41.5) completed a visual novelty-oddball task during EEG-recordings in which frequent standards, infrequent targets (requiring reaction time) and equally infrequent novels were presented both ipsilateral or contralateral to the resected hemisphere.

**Results:** Processing stimuli only differed between the non-resected MTL and the resected MTL for L- MTL patients, measured on Fz; novelty N2 was more negative when a novel stimulus was presented to the non-resected R-MTL compared to a novel stimulus presented to the resected left MTL,  $t(8) = -2.48$ ,  $p = .04$ . Although it was expected that the more positive novelty P3a peak would be observed when a novel was presented to the non-resected right MTL, compared to the resected left MTL, a reversed result was found,  $t(8) = -2.51$ ,  $p = .04$ . Furthermore, target P3b components were elicited by target presentation to both the non-resected and the resected MTL.

**Conclusions:** We conclude that visual novelty processing is more exclusively lateralized to the right MTL. The absence of the P3a peak is because: 1) patients did not allocate their attention to the deviant, novel stimuli after being distracted from their primary task (i.e. responding to the target). 2) flaws in average referencing led to weak observed novelty P3a. Finally, the hippocampus is not involved in processing target stimuli as no differences were found between processing target stimuli at the non-resected or resected hemisphere.

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**S.A. KOZLOVSKIY, A.V. VARTANOV, M.M. PYASIK & E.Y. NIKONOVA. Neuropsychological Visuo-Spatial Working Memory Tests Performance and Anatomical Characteristics of Hippocampi, Caudate Nuclei and Cingulate Cortex Regions.**

**Objective:** We studied possible relations between the sizes of several brain structures (hippocampus, caudate nucleus (CN), cingulate cortex) and different visual and visuo-spatial working memory (WM) characteristics.

**Participants and Methods:** 43 right-handed females (mean age – 60.4 years old) participated in the study. We measured hippocampus and CN volumes (in  $\text{mm}^3$ ) in both hemispheres with magnetic resonance morphometric analysis. We also calculated absolute square surfaces (in  $\text{mm}^2$ ) of three cingulate cortex regions – anterior (Brodmann area (BA) 24 and BA 33; ACC), posterior ventral (BA 23; vPCC), posterior dorsal (BA 31; dPCC) areas. Visual and visuo-spatial WM characteristics (memory capacity, permanency and the amount of different memory errors) were assessed by Luria's neuropsychological tests modified by J. Glzman (1999). We calculated non-parametric correlations (Spearman,  $p < .05$ ) between individual visuo-spatial WM characteristics and morphometrical data.

**Results:** Visual WM capacity correlates negatively with left vPCC ( $r = -.32$ ) and dPCC ( $r = -.30$ ) size. Increased size of right dPCC is related to the decreased amount of sequence errors in visuo-spatial WM tests ( $r = -.31$ ), while right ACC size correlates positively with the amount of contamination errors in visual WM tests ( $r = 0.33$ ). Right CN volume correlates positively with visual WM permanency ( $r = 0.31$ ) and negatively with the amount of visual contamination errors ( $r = -.33$ ). Increased left hippocampus volume is related to better visuo-spatial WM permanency ( $r = .40$ ).

**Conclusions:** According to the obtained data, increased volume of right CN is related to the decreased influence of the interfering stimuli on the visuo-spatial information maintenance in the WM. Increased volume of the left hippocampus correlates with increased permanency of visuo-spatial information maintenance. We can also hypothesize that cingulate cortex modulates the maintenance process by filtering out irrelevant visuo-spatial information and amplifying the relevant.

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**I. KULIKOVA, T. LERNER & V. DAMINOV. Using guided affective imagery in psychotherapy of patients with amnesic syndrome as a result of traumatic brain injury.**

**Objective:** Traumatic brain injury (TBI) and amnesic syndrome usually cause psychological trauma, anxiety and depression. The respective cognitive deficits lead to procedural difficulties in psychotherapy sessions and narrow the range of psychotherapy methods available. The aim of this study was to investigate the suitability of guided affective imagery (katathym imaginative psychotherapy) in psychotherapy for patients with amnesic syndrome.

**Participants and Methods:** Traumatic brain injury (TBI) and amnesic syndrome usually cause psychological trauma, anxiety and depression. The respective cognitive deficits lead to procedural difficulties in psychotherapy sessions and narrow the range of psychotherapy methods available. The aim of this study was to investigate the suitability of guided affective imagery (katathym imaginative psychotherapy) in psychotherapy for patients with amnesic syndrome.

**Results:** The described methods were shown to be effective, with patients reporting lower levels of depression and anxiety and improved use of coping resources. A key finding was that the effects of guided imagery were evident even for patients with significant memory deficit.

**Conclusions:** Guided affective imagery appears to be a suitable approach to use in psychotherapy for patients with amnesic syndrome.

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**J. DEL ANGEL, D. JUÁREZ, J. CORTEZ, A. GARCÍA, C. RAMÍREZ & P. VALDEZ. Effects of 24-h Sleep Deprivation on the Components of Working Memory.**

**Objective:** Sleep deprivation produces an increase in sleepiness and a reduction in several cognitive processes such as attention, executive functions and memory. The objective of this study was to analyze the effects of 24-h sleep deprivation on the phonological and visuospatial components of working memory.

**Participants and Methods:** Participants were 11 undergraduate students (age = 18.08 ± 1.16 years; 8 females, 3 males). Two computer tasks were used to assess the phonological and visuospatial memory components. The participants were recorded in the laboratory at 12:00 h in three conditions: after they slept 8 hours per night for 5 consecutive nights, after a 24-h sleep deprivation period and after one day of sleep recovery.

**Results:** A reduction in the percentage of correct responses in the phonological component was observed in the sleep deprivation condition (8-h Sleep = 86.45 ± 12.67 %, 24-h Sleep deprivation = 75.99 ± 15.51 %, Sleep recovery = 85.90 ± 9.82 %; Friedman = 8.90,  $p < 0.01$ ). The visuospatial component did not show changes during sleep deprivation.

**Conclusions:** A 24 h sleep deprivation reduces the efficiency of the phonological component of working memory, which is essential for oral and reading comprehension.

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**M. REUHKALA, L. HOKKANEN, P. TANI, S. LEPPAMAKI & M. LAASONEN. Verbal Recall in Adult Attention Deficit Hyperactivity Disorder and Dyslexia – the Role of Repetition.**

**Objective:** This study is part of Project DyAdd which investigates the cognitive profiles of adult dyslexia and attention deficit hyperactivity disorder (ADHD) in Finland. The symptoms of dyslexia and ADHD usually continue into adulthood, although they tend to change and remit to a degree. In both disorders, most research has focused on children and working memory functioning. The present study explored verbal recall. Both clinical groups have been associated with deficits in attention and working memory but it is unclear, whether deficits at encoding affect verbal recall and whether repetition of verbal material aids retrieval.

**Participants and Methods:** The participants (aged 18-55) consisted of 40 healthy controls, 40 adults diagnosed with dyslexia and 29 adults diagnosed with ADHD. Immediate and delayed verbal recall was assessed using the Wechsler Memory Scale III. In the subtest Logical Memory, immediate recall of the second story was assessed using the task following the repetition of the second story. In the subtest Word Lists, immediate recall of the word list was assessed using the task following the distractor list.

**Results:** Immediate recall was better than delayed recall in all the study groups on both Logical Memory story tasks. Further, the dyslexia group recalled fewer items in the second story than the control group, in both immediate and delayed conditions. In the Word List task, immediate recall did not differ between the dyslexia and control groups, and both groups performed worse after the delay. In contrast, delay did not affect the recall of the word list in the ADHD group.

**Conclusions:** Deficits in verbal recall are not necessarily part of adult ADHD. In adult dyslexia, difficulties with verbal recall may be confined to linguistically complicated material in which repetition is not particularly useful. In adult ADHD, there seems to be benefits from the repetition of verbal material.

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**S. SAITO. The left prefrontal cortex might relate to not memory recollection but recognition.**

**Objective:** Recent studies have shown that patients with the prefrontal cortex lesion deteriorated in the false memory. In addition, there are some studies that prefrontal cortex related to recognition but not recollection. However, there are few studies concerning the laterality of the lesion. In this study, we investigated the role of the left prefrontal cortex in recollection and recognition in two brain tumor patients between before and after surgery.

**Participants and Methods:** Patient 1 was a 69-year-old right-handed male and patient 2 was a 68-year-old right-handed male. Their lesion was located in the left prefrontal lobe. They showed mildly deterioration of verbal function and their memory function was near normal level. Before and after surgery, the neuropsychological tests were administered. In the memory test, we administered visual short-term memory and verbal short-term memory tests.

**Results:** In both patients, general verbal function was improved after surgery. In the memory test, both patients showed well preserved recollection function but they showed recognition disturbances in the verbal memory test not in the visual memory test. In addition, they could not recognize items that they could recall.

**Conclusions:** This finding suggest that the left prefrontal cortex might relate to not memory recollection but recognition. In addition, verbal and visual memory might be dissociable because the score of visual memory test is different from that of verbal memory test.

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**M. SURIYA PRAKASH, K. JOHN PREETHAM & R. SHARMA. Neural Correlates of Memory Load During Encoding in Visuo-Spatial Working Memory Task.**

**Objective:** Neural mechanisms underlying visuo-spatial working memory (WM) and its modulation by memory load are not well understood. The objective of this study is to investigate the neural correlates of visuo-spatial WM encoding and its modulation by memory load by quantitative EEG.

**Participants and Methods:** Healthy male volunteers (n=26) performed a visuo-spatial WM task with three memory loads (3, 6 and 8 pairs of identical abstract pictures). In each memory load, an array of pairs of identical abstract pictures (each unit of a pair in different spatial locations in the array) was presented for 10 seconds during which the spatial location of the pictures had to be encoded. After encoding, the pictures were hidden in the array. All pairs of pictures had to be matched correctly to complete the load. 128-channel EEG system was used for EEG acquisition. Wavelet transformation and standardized low-resolution electromagnetic tomography (sLORETA) were used to determine the power spectral changes in the frequency bands and to determine the brain regions involved, respectively.

**Results:** ANOVA measures were performed to examine the effect of memory load on various EEG parameters during encoding. P value of less than 0.05 was considered statistically significant. With increasing memory load, alpha power significantly increased at right frontal (F4, F8) region and decreased at central-parietal (Pz) region. We found a significant load-related decrease in the activity of right fusiform gyrus, right angular gyrus, insular cortex, cingulate cortex, left inferior occipital gyrus and left inferior parietal lobule.

**Conclusions:** With increasing visuo-spatial WM load, there is decrease in the activity of the neural substrates of visuo-spatial attention system while there is no change in the activity of visuo-spatial WM system during encoding. This emphasizes the key role of visuo-spatial attention system in limiting the working memory capacity.

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**G.T. VALLET, M. SIMARD, J. MACOIR, C. HUDON, N. BIER & R. VERSACE. All Errors Are not the Same: Different Memory Profiles between Aging, Alzheimer's Disease and Semantic Dementia from a New Memory Test.**

**Objective:** Memory errors might distinguish patients with memory disorders such as patients with Alzheimer's Disease (AD) from those with Semantic Dementia (SD). However, only few neuropsychological tests consider memory errors in their norms and scores. The objective of the present study was to test the clinical validity in aging and dementia of an adapted version of the Pyramids and Palm Trees Test (PPTT) created to simultaneously assess episodic and semantic memory and to differentiate error types.

**Participants and Methods:** 55 young adults, 36 HE, 16 AD patients and 3 SD patients were included. The visual part of the PPTT was adapted to test episodic memory in addition to semantic matching. 32 pages of three line drawings were presented in triangle. Participants had to decide which one of the two drawings at the bottom of the page matched the one on top. In addition, they were explicitly instructed to learn the correct answer. After a distraction task, participants performed a free recall task followed by a recognition task. Finally, a delayed free recall task was completed. The procedure allowed differentiating confusion errors [items previously seen but not target of learning] from intrusions [items never seen].

**Results:** HE showed poor memory and some confusion errors compared with young adults. However, they had no intrusion. AD patients had poorer memory performances than HE and they demonstrated intrusion as confusion errors. Finally, SD patients showed a matching deficit and poorer free recall than HE. They also demonstrated some confusion errors, but yet no intrusion errors.

**Conclusions:** Qualitative analysis of memory is useful to distinct memory profiles and patients. Confusion errors might be an unspecific symptom of memory decline associated with aging. Intrusion errors differentiated AD from SD patients and HE, whereas SD patients were selectively impaired on matching compared to HE and AD.

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**E. VAN DEN BERG & I.M. BRANDS. Meta-analysis of Prospective Memory in Parkinson's Disease.**

**Objective:** Prospective memory (PM) refers to the ability to implement intended actions in the future. Patients with Parkinson's disease (PD) show impaired PM, but the nature and extent of these deficits remain to be evaluated.

**Participants and Methods:** We performed a meta-analysis of nine case-control studies published between 1990 and July 2012. In total, 248 patients and 235 control participants were included. Analysis of potential differences between time- and event-based PM was performed. Moreover, differences between measures of prospective and retrospective memory were investigated, as well as the relation with other cognitive domains and with disease severity.

**Results:** The overall weighted effect size (Hedges' *d*) for patients vs. control participant was -0.52 (95% confidence interval -0.71 to -0.33,  $p < .0001$ ). There was no difference in effect size for event-based and time-based PM ( $d$  -0.45 vs. -0.70,  $p > .05$ ). The effect sizes for prospective, retrospective and working memory were also similar in size ( $d$  -0.60 vs. -0.28 vs. -0.46,  $p > .05$ ). PM was modestly related to measures of retrospective memory (median  $r = 0.17$ ), working memory (median  $r = 0.13$ ) and executive functioning (median  $r = 0.11$ ). There was a strong negative correlation with disease severity ( $r = -0.86$ ).

**Conclusions:** Patients with PD have moderate deficits in PM. PM is a promising construct in neuropsychological examination of patients with PD, but more insight is needed in the cognitive correlates and the distinct phases of PM that are impaired.

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**B. VAN GELDORP, M. PARRA & R. KESSELS. Relational and Conjunctive Working Memory Binding across Age.**

**Objective:** The ability to form associations (i.e. binding) is critical for memory formation. Recent studies suggest that aging specifically affects some types of binding: relational binding (associating separate features, e.g. object and location) declines with age, whereas conjunctive binding (integrating features within an object) is insensitive to age. One possible explanation is that functional integrity of the hippocampus is required for relational binding, but not for conjunctive binding. However, hippocampal involvement may be explained by the use of spatial information in most studies. Alternatively, relational binding may simply require more attentional resources than conjunctive binding. We expected that aging would affect relational binding more than conjunctive binding. If attentional resources are the mediating factor, relational binding would be more affected by an interfering task than conjunctive binding.

**Participants and Methods:** Both types of binding were examined in a working memory (WM) task using the same (non-spatial) features: shape and color. We used an articulatory suppression task during encoding and maintenance to study the effect of attentional resources. Thirty-one young adults (mean age 22.4), 30 middle-aged adults (mean age 54.8) and 30 older adults (mean age 70.3) performed the task.

**Results:** Results show an effect of age group ( $F(2,88)=14.7$ ,  $p < .001$ ) and type of binding ( $F(1,88)=16.5$ ,  $p < .01$ ), but no interaction between type of binding and age ( $F(2,88)=1.4$ ,  $p = .25$ ). The interaction between type of binding and interference was significant ( $F(1,88)=4.71$ ,  $p = .03$ ).

**Conclusions:** These results indicate that aging did not affect relational binding differently than conjunctive binding. However, relational binding is more vulnerable to interference than conjunctive binding, which suggests that relational binding requires more attentional resources than conjunctive binding. We suggest that a general decline in WM resources associated with frontal dysfunction underlies deficits in WM binding. Correspondence: *Bonnie van Geldorp, MSc, Donders Centre for Cognition, Radboud University Nijmegen, Montessorilaan 3, Room B.02.0S, Nijmegen 6525 HR, Netherlands. E-mail: b.vangeldorp@donders.ru.nl*

**M.A. WITKOWSKA. Functioning Of Prospective Memory And Mnemonics Used By Pulmonary Patients.**

**Objective:** The efficiency of the respiratory system limits a good fitness and proper functioning of the brain. Respiratory failure is linked to processes of physiological ageing or chronic diseases such as asthma or chronic obstructive pulmonary disease. Decreased transportation of oxygen to the brain directly reduces mental efficiency, including memory and attention.

Prospective memory, PM, is a set of processes or abilities to formulate, store and implement the purposes and intents in a set time frame. It is said that worse functioning of PM is a result of the lack of mnemonics. A person with a well functioning PM effectively uses a set of methods that leads him/her to success in the execution of its intent.

**Participants and Methods:** Several memory tests were administered to adult patients with allergy AL,  $n=27$ , asthma, AS,  $n=27$ , chronic obstructive pulmonary disease, COPD,  $n=32$  and controls, C,  $n=30$ .

**Results:** The results show that majority of COPD patients don't use any mnemonics, 65.62%;  $\chi^2_1, n=32, =10.24; p < 0.001$ , at the same time most patients who use mnemonics has better PM  $F(1,108) = 41.99; p < 0.001; \eta^2 = 0.28$ .

**Conclusions:** From COPD and AS patients active participation in the treatment is required. This includes the ability to anticipate situations which may lead to exacerbations. This kind of ability, requiring the good functioning of the PM, directly affects improving patients quality of life and the reduction of the health care costs incurred by them. However, the results lead to the conclusion that COPD patients may not deal with the prescribed therapeutic requirements.

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## Stroke/Aneurysm

**J.C. ARANGO LASPRILLA, J.A. CALDERÓN CHAGUALÁ, H. CHACÓN PERALTA, G. VERGARA TORRES, I. PANYAVIN, H.L. ROGERS & P. PERRIN. Neuropsychological Findings and Recovery in a Group of Spanish Speaking Individuals Six Months Post Stroke.**

**Objective:** To describe the cognitive functioning and examine the neuropsychological recovery in patients across the first six months after a stroke.

**Participants and Methods:** 28 individuals who had sustained a stroke and 28 healthy controls from Ibagué, Colombia were administered a comprehensive neuropsychological evaluation at three and six months post-event. The battery included the Mini-mental state exam (general cognitive function), Trail Making Test (TMT) Parts A and B (executive functioning), Stroop Test (attention), Digit Symbol Test (speed of information processing), Phonological and Semantic Verbal Fluency Test (executive functioning), Verbal Memory Test (verbal memory), Wisconsin Card Sorting Test (executive functioning), Rey Figure Test (visual-spatial skills).

**Results:** 2 x 2 within and between groups repeated-measures ANOVAs showed a main effect for group with controls scoring higher than individuals with stroke independent of time on: the Mini-mental, TMT A and B, the Stroop, Digit Symbol modalities, Wisconsin number of categories, Phonological and Semantic Verbal Fluency, Verbal Memory, and Rey Figure copy and recall ( $p < 0.01$ ). The Digit Symbol modalities, Wisconsin number of categories, Phonological and Semantic Verbal Fluency, Verbal Memory, and Rey Figure copy and recall ANOVAs also showed a main effect for time with improved performance from three months to six months independent of group.

**Conclusions:** Despite cognitive recovery in individuals with stroke from three to six months post-event in executive functioning, speed of information processing, verbal fluency, verbal memory, and visual-spatial skills, they still showed deficits compared to controls in these areas, as well as in attention, and general cognitive functioning (which did not improve). Early neuropsychological rehabilitation should be implemented to help this population optimize their recovery.

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**W. BOERBOOM, M.H. HEIJENBROK-KAL, L. KHAJEH, F. VAN KOOTEN & G.M. RIBBERS. Differences in cognitive and emotional outcomes between patients with perimesencephalic and aneurysmal subarachnoid hemorrhage.**

**Objective:** To compare cognitive and emotional outcomes between patients with aneurysmal subarachnoid hemorrhage (A-SAH) and perimesencephalic subarachnoid hemorrhage (PM-SAH).

**Participants and Methods:** Patients hospitalized between 2006 and 2009 at the neurology or neurosurgery department of an academic hospital in the Netherlands were included if diagnosed with PM-SAH or A-SAH. The main outcome measures were Glasgow Coma Scale scores (GCS), depression measured with the Center for Epidemiologic Studies Depression scale, fatigue measured with the Fatigue Severity Scale and objective cognitive functioning tested with the Trail Making Test (TMT-A and TMT-B).

**Results:** In total, 67 patients participated, of which 8 with PM-SAH and 59 with A-SAH. PM-SAH patients had higher GCS scores ( $p = 0.000$ ) and lower depression ( $p = 0.002$ ) and fatigue scores ( $p = 0.016$ ) than A-SAH patients. PM-SAH patients were faster on the simple cognitive functioning task TMT-A ( $p = 0.002$ ), but no significant differences were found on the more complex TMT-B task ( $p = 0.112$ ). Both groups scored significantly worse on the TMT-B compared to a norm population ( $p < 0.008$ ). Furthermore, the proportion of patients with fatigue was not significantly different between the PM- and A-SAH groups ( $p = 0.105$ ). Compared to the norm population, fatigue score ( $p = 0.073$ ) and the presence of fatigue ( $p = 0.058$ ) in PM-SAH patients were borderline significant.

**Conclusions:** Contrary to the assumed favorable outcome, PM-SAH patients experience impaired complex cognitive functioning and fatigue. In this respect PM-SAH patients have similar sequelae as A-SAH, that may interfere with daily activities and social participation. These findings are of clinical relevance as PM-SAH patients often are discharged from hospital without long-term follow-up.

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**A.M. BUUNK, W.S. VEENSTRA, R.J. GROEN & J.M. SPIKMAN. Nonaneurysmal Subarachnoid Hemorrhage compared to Aneurysmal Subarachnoid Hemorrhage: Long-term Cognitive, Emotional and Behavioral Consequences Related to Vocational Outcome.**

**Objective:** In 15% of all patients with subarachnoid hemorrhage (SAH) no aneurysms can be demonstrated on cerebral angiograms (Besoglu et al., 2010). Nonaneurysmal SAH (N SAH) has been frequently reported as a benign pathology with a better outcome than aneurysmal SAH (Ildan et al., 2002). However, exact differences remain unclear. The aim of this study is to investigate possible differences in long-term vocational outcome and cognitive, emotional and behavioral consequences of SAH with different etiology.

**Participants and Methods:** 526 patients (437 SAH and 89 N SAH) were admitted to the UMCG between 2002 and 2009. Of the 389 survivors 30 were excluded because of comorbidity. Of the remaining 359 patients 272 participated; 203 SAH (63.5% female, mean age 58.8 years) and 69 N SAH (33.3% female, mean age 60.5 years). All patients completed questionnaires on complaints (HISC), anxiety and depression (HADS) and executive functioning in everyday life (DEX). Furthermore, role resumption and work status was investigated by means of a semi-structured telephone interview (RRL).

**Results:** 47.5% of N SAH patients and 34.3% of aneurysmal SAH patients who were employed before the SAH returned to their former occupation. 89.4% N SAH and 92.6% SAH patients reported at least two long term complaints. 17.4% of the N SAH patients versus 32.5% of the SAH patients reported possible anxiety and 21.7% of the N SAH versus 25.1% of the SAH patients suffered from possible depression. On average SAH patients reported more emotional, cognitive and behavioral complaints than N SAH patients, however this difference was not significant.

**Conclusions:** Nonaneurysmal SAH is often regarded as a benign entity. However, in this study most patients reported long-term changes following N SAH and more than half of the patients failed to return to their previous occupation. No significant differences were found with respect to cognitive, emotional and behavioral consequences in patients with nonaneurysmal versus aneurysmal SAH.

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**J.A. CALDERON CHAGUALA, J.C. ARANGO LASPRILLA, H. CHACÓN PERALTA, G.P. VERGARA TORRES, I. PANYAVIN, H.L. ROGERS & P. PERRIN. Longitudinal Changes in Quality of Life in Individuals with Stroke from Ibagué, Colombia.**

**Objective:** To estimate changes in quality of life over the first six months post-stroke in patients from Ibagué, Colombia.

**Participants and Methods:** A sample of 28 individuals with stroke and 28 healthy controls were recruited from hospitals in the city of Ibagué, Colombia. A self-report measure of quality of life (SF-36) composed of eight sub-scales (physical health problems, pain, role limitations due to physical problems, role limitations due to emotional problems, emotional well-being, social functioning, energy/fatigue, and general health perceptions) was administered at three months and six months post-event.

**Results:** 2 x 2 within and between groups repeated measures ANOVAs identified significant time x group interactions on all SF-36 sub-scales ( $p < 0.001$ ). Analyses of main effects showed that healthy controls, compared to individuals with stroke, had significantly higher scores on all of the SF-36 sub-scales at 3 and 6 months ( $p < 0.001$ ). Furthermore, the SF-36 scores of individuals with stroke improved over time ( $p < 0.05$ ), while the healthy controls' generally did not ( $p = NS$ ), except for improvement in the energy/fatigue sub-scale ( $p < 0.05$ ).

**Conclusions:** Although individuals with stroke improved their quality of life across all sub-scales, even at 6 month post-event, their quality of life was still lower than controls. Rehabilitation professionals should use these results to develop and implement culturally-appropriate interventions to improve quality of life in Colombian individuals with stroke in the first year post-event.

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**S.L. CARTER, R. GALE & G. GUBITZ. Down the Rabbit Hole: Neuropsychological Findings in a Case of Alice-in-Wonderland Syndrome.**

**Objective:** The objective of this case study was to investigate neuropsychological changes in rare diagnoses of Alice-in-Wonderland syndrome and transient Cotard's syndrome associated with laminar necrosis and cerebral infarct following migraine. We expected the neuropsychological profile to show visuo-perceptual dysfunction in keeping with the unusual presenting visuo-perceptual symptoms.

**Participants and Methods:** A 59-year-old, right handed woman presented with self-reported perception of people appearing as "aliens", perceptual distortions in size of facial features, clothing, and movement. Imaging showed a right temporal-parietal-occipital infarct with laminar necrosis. She completed a neuropsychological assessment approximately 3 months post event. A broad range of cognitive domains was evaluated, including intellectual functioning, language, visuo-perceptual/spatial skills, attention, processing speed, memory, executive functioning, manual motor skills, as well as mood/psychological status.

**Results:** Results revealed average to high average intellectual (WAIS-IV) and cognitive functioning in most domains, consistent with premorbid estimates. Visuo-perceptual dysfunction was evident in facial recognition (Benton), perceptual organization of parts into a meaningful whole (HVOT), and distortion in figure copy (RCFT). Other types of visuo-spatial skills were preserved (e.g., Judgment of Line Orientation, WAIS-IV Block Design). Visual memory for spatial content was more affected than memory for spatial location (WMS-IV). Grooved pegboard was slowed. Responses on the BDI-II, BAI, and SCL-90-R showed elevated symptoms suggestive of emotional distress associated with her recent perceptual experience.

**Conclusions:** Neuropsychological results revealed residual visuo-perceptual dysfunction several months following the initial unusual presenting perceptual symptoms. These findings implicated more ventral rather than dorsal stream involvement of visuo-perceptual processing, consistent with EEG findings of focal right temporal changes.

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**M. GERRITSEN, A. VISSER, R. HUITEMA & J. SPIKMAN. How Minor Is Minor Stroke With Respect To Cognitive Functioning?**

**Objective:** Patients with minor stroke are often discharged from hospital without rehabilitation care. Despite so-called good recovery, recent studies showed a negative impact of minor stroke on life satisfaction and return to work. So far most stroke studies focussing on cognitive functioning examined a broad variety of stroke patients. In the present study minor and severe stroke patients are compared in order to gain more insight in the cognitive impact of minor stroke.

**Participants and Methods:** In a community based ischemic stroke group (n=75) patients were classified based on their Rankin-score as minor (Rankin <= 2) or moderate to severe (Rankin >2). Three cognitive domains: 1) reasoning and problem-solving, 2) speed of information processing and 3) verbal memory, were studied at 3 and 15 months post-stroke. A healthy control group (n= 64) was tested with the same time interval.

**Results:** Based on the Rankin outcome scores most patients had suffered a minor stroke: n=61. ANOVA at T1 showed significant group differences in the three cognitive domains. Post-hoc analyses revealed that minor stroke patients performed worse than the control group on problem-solving. The moderate to severe stroke group performed worse than the minor group on all measures, except problem solving. The moderate to severe group was impaired compared to the control group in all domains. At T2 largely the same profiles were seen.

**Conclusions:** Minor stroke patients, who are considered to have a good outcome, show similar chronic cognitive disorders in problem solving as a more severe stroke group. Problem solving is considered an important aspect of executive functioning, and further research studying underlying cerebral and metabolic factors for these specific disorders in minor stroke are needed. This study stresses the importance of neuropsychological examination in mild stroke patients, a group that is still often neglected.

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**I. HUENGES WAJER, A. VISSER-MEILY, P. GREEBE, M. POST, G. RINKEL & M. VAN ZANDVOORT. Participation after Aneurysmal Subarachnoid Hemorrhage.**

**Objective:** Survivors of a Subarachnoid Hemorrhage (SAH), who have a relatively good functional outcome, report consistently problems in (complex) daily life activities and in regaining their pre-morbid level of functioning. This study focuses on the level of participation after SAH and the influence of cognitive and psychological factors on experienced participation.

**Participants and Methods:** In 73 patients who visited our outpatient clinic 10 weeks after SAH, experienced participation and satisfaction with participation were assessed by the Restrictions scale and the Satisfaction scale of the Utrecht Scale for Evaluation of Rehabilitation Participation (USER-P). The impact of cognitive functioning, cognitive and emotional complaints, and symptoms of depression and anxiety on the level of participation were examined using linear regression analysis.

**Results:** Despite independent ADL, 48 patients (65.8%) reported participation restrictions and 45 patients (61.6%) were dissatisfied with their level of participation. Most common experienced restrictions concerned housekeeping, chores in and around the house and physical exercise. Dissatisfaction was most frequently reported with outdoor activities, mobility, work/housekeeping and cognition. Cognitive complaints turned out to be the main predictor of the participation restrictions ( $R^2=.23$ ). Satisfaction with participation was besides cognitive complaints also predicted by the level of anxiety (total  $R^2=.41$ ).

**Conclusions:** Rehabilitation of SAH patients is aimed at minimizing its consequences and to improve social participation. Cognitive complaints and anxiety symptoms emerged as important and strong predictors for (social) participation. We conclude therefore, that focus on these (neuro-)psychological factors in rehabilitation of SAH patients can be helpful to enhance outcome.

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**K.M. MICHIELS, K. BEECKMANS, R. CLUYDTS, B. DOM, C. KIEKENS, H. BEYENS, P. VANCOILLIE & R. BRUFFAERTS. Measuring Quality of Life before and after a Multidisciplinary Rehabilitation Program in Stroke Patients by means of the Stroke-specific Quality of Life Scale.**

**Objective:** Stroke patients show frequently a reduced quality of life (QOL). In this study the effect of a multidisciplinary rehabilitation program on QOL was evaluated by means of the Stroke-specific Quality of Life Scale (SS-QOL).

**Participants and Methods:** The QOL of 25 patients in the post-acute or chronic phase after first-ever stroke was assessed before and after a multidisciplinary rehabilitation program with the SS-QOL. Besides this, an evaluation of mood (with the subscale 'vigor' of the Profile of Mood States) and self-awareness (with the Patient Competency Rating Scale) was also carried out before and after treatment. The treatment program consisted of motor and cognitive rehabilitation, occupational therapy, neuropsychotherapy and/or language therapy. The mean duration of the program was 13 weeks.

**Results:** A significant improvement after treatment was detected for the overall score and 4 domains (mobility, language, vision and work/productivity) of the SS-QOL. However, no significant treatment effect could be noticed for the other 8 SS-QOL domains (energy, upper extremity functions, mood, self-care, social roles, family roles, thinking and personality). With regard to the overall SS-QOL score, most patients (n= 19) reported their QOL as better after treatment. So, only a small group considered their QOL as worse (n= 5) or the same (n= 1). Besides this, a significant improvement after treatment was also noticed for self-awareness (concerning activities of daily living, interpersonal/emotional functioning and cognitive abilities). Nevertheless, no significant treatment effect could be documented for mood (concerning vigor). Finally, no significant correlation could be found between (1) improvement of mood (vigor) and improvement of QOL and (2) improvement of self-awareness and reduced QOL.



**Conclusions:** In conclusion we can state that a multidisciplinary rehabilitation program has a positive effect on several domains of QOL in stroke patients. The SS-QOL seems to be a useful instrument to evaluate QOL after stroke.

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**L. MORENO, V. VIÑAS, I. RICO, A. GABARRÓS & M. JUNCADELLA. Cognitive Outcome After Surgical Repair Of Unruptured Aneurysm.**

**Objective:** Intracranial aneurysms are acquired lesions frequently located at the branch-points of cerebral arteries. The increase and improvement in noninvasive neuroimaging techniques have led to the detection of a growing number of unruptured intracranial aneurysms (UIA) which are commonly found incidentally. The management of UIA is controversial because of the risk of rupture if they remain untreated. Until now, few studies have assessed cognitive function in patients with incidental aneurysms, and those who have didn't obtain conclusive results. The aim of this study is to examine cognitive function in asymptomatic patients surgically treated for UIA.

**Participants and Methods:** Cognitive function was assessed in a sample of 10 right-handed patients who underwent repair of one or multiple intracerebral aneurysms. A standardized neuropsychological battery was administered 6 months after surgery. Performance of UIA patients was compared to a control group matched by sex, age and level of education.

**Results:** Group comparisons did not reveal a significant difference in cognitive performance.

**Conclusions:** In conclusion, data obtained could be used to predict the outcome in patients with good neuropsychological, medical and neurological status, showing that the choice of surgical treatment is reasonable and does not cause cognitive deficits.

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**P. SCHAAPMEERDERS, N. MAAIJWEE, L. RUTTEN-JACOBS, R. ARNTZ, E. VAN DIJK, F. DE LEEUW & R. KESSELS. Episodic Memory Profile in First-Ever Ischemic Stroke in Young Adults: Separating Vascular from Ageing-Related Memory Components.**

**Objective:** Follow-up studies on memory function after a single stroke in the elderly are confounded by the interaction with aging, such as (pre-clinical) Alzheimer's disease or other age-related brain changes. Investigating stroke in young adults (<50yrs), with presumed absence of age-related brain changes, in different follow-up age strata gives the unique opportunity to investigate the memory profile of a single stroke, but also whether older age (>55years) might exhibit a memory profile that suggests a progressive neurodegenerative process.

**Participants and Methods:** All consecutive patients between 1/1/1980 and 11/1/2010 with a first-ever young ischemic stroke (no recurrent stroke/TIA), aged 18-50, were included and cognitive assessment was conducted between November 2009 and end 2011. Matched controls were also enrolled. Z-scores were calculated for different episodic memory processes using the Rey-Auditory Verbal Learning Task: immediate memory, delayed memory, retention (information decay over time), and recognition. Patients and controls were divided into three equal age groups (tertiles: 19-47yr, 47-54yr, 54-74yr). ANCOVA was used to compare patients and controls, adjusting for age, sex, level of education, depressive symptoms, and fatigue.

**Results:** 234 stroke patients (mean age:50.8yrs, SD:10.2; mean follow-up:10.9, SD:8.3) and 146 controls (age:48.6yrs, SD:11.7) participated. Only patients aged 54+ showed a significant worse encoding ability compared with controls ( $F(1,117)=14.9$ ,  $p<0.0001$ ,  $\eta^2=0.08$ ). None of the age categories exhibited as faster decay of information over time (all  $p>0.05$ ). Recognition memory was significantly worse in all age groups, however only with a large effect size in the 54+ group ( $F(1,115)=25.5$ ,  $p<0.0001$ ,  $\eta^2=0.15$ ).

**Conclusions:** Older stroke patients (54+) exhibit the most severe memory performance, affecting multiple memory processes. However, this profile and it's severity does not resemble the memory profile seen in (early) AD or vascular dementia.

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**R.J. STOLWYK, E. O'CONNELL, A.G. THRIFT, C. REDPATH, E. BYRNE & P. NEW. Characterising Neurobehavioural Change Following Stroke: Preliminary Findings.**

**Objective:** While numerous investigators have assessed challenging behaviour following acquired brain injury, relatively few have explored the broader construct of neurobehavioural function specifically following stroke. Aim: To (i) characterise the incidence of neurobehavioural change during subacute inpatient stroke recovery, (ii) identify demographic and disease variables associated with neurobehavioural changes, and (ii) investigate the impact of neurobehavioural change on nursing staff care.

**Participants and Methods:** To date, 36 people who suffered either ischaemic or haemorrhagic stroke have been consecutively recruited from a subacute inpatient stroke rehabilitation ward. Nursing staff completed the St Andrews-Swansea Neurobehavioural Outcome Scale (SASNOS) in addition to a measure of nursing burden for each patient.

**Results:** Nurses reported 41% of stroke patients exhibited behavioural difficulties relating to interpersonal relationships; 47% relating to cognition; 3% with inhibition; 6% with aggression; and 3% with communication. Haemorrhagic stroke was more closely associated with cognitive, inhibition and communication behavioural disturbance compared to ischaemic stroke (Pearson  $r = -.540, -.455, -.403$  respectively, all  $p < .05$ ). Nursing care burden was significantly associated with inhibition, aggression and communication neurobehavioural change (Pearson  $r = -.456, -.669, -.639$  respectively, all  $p < .05$ ), but not interpersonal relationships or cognition. No significant associations were found between age, gender, lesion location or stroke severity with neurobehavioural change.

**Conclusions:** We have preliminary evidence that interpersonal and cognitive neurobehavioural difficulties are most common early after stroke but, despite being less common, inhibition, aggression and communication changes are causing more concern for nursing staff. This study is ongoing and will include additional self-report, report from "close others" and longitudinal data to further investigate stroke-related neurobehavioural disturbance.

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**A. DUMBRAVA, C. BALUT, M. TOBA & R. TIMOIANU. Faith as a possible preventive coping mechanism in post-stroke depression.**

**Objective:** Faith is probably commonly employed as a coping mechanism in old age, especially in persons confronting with such irreparably pathology as stroke. However, it is often neglected when we try to better understand the psychological problems of these people and the way in which they deal with them.

**Participants and Methods:** In an attempt to verify the assumption that faith and religious behavior can protect somehow from developing depression following stroke, we examined, using parts of or full instruments available (including the Scales for Religious Dimensions [King, 1967], the Royal Free Interview for Religious and Spiritual Beliefs [King, Speck, Thomas, 1995], the Using Private Prayer for Coping [Ai et al., 2002] etc.), the level of these parameters in equivalent (in respect to relevant psycho-demographic and clinical variables) groups of non-aphasic post-stroke patients with ( $n=79$ ) or without ( $n=97$ ) depression (based on DSM-IV criteria and commonly employed cut off scores of the severity measures of depression) as well as aged controls without either stroke or depression ( $n=89$ ).

**Results:** No significant difference between the post-stroke depressives and any of the two other groups of aged subjects was observed in any global scores reflecting the pre-stroke or post-stroke levels of faith and religious behavior. The only significant correlations between the levels of religious behavior and depressive symptomatology were obtained for the late-onset depressives who proved to become more religious since their stroke.

**Conclusions:** Further research is required in order to clarify the possible psychological protective effect of faith and religious behavior in people confronting with stroke.

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#### **A. DUMBRAVA, M. TOBA, C. BALUT & R. TIMOIANU. Self-esteem in post-stroke depression.**

**Objective:** Self-esteem is affected in depression as well as in stroke. Beyond any possible relation of causality, it might prove that it is most affected in post-stroke depression, in which both conditions meet.

**Participants and Methods:** The levels of self-esteem were assessed using different psychometrical instruments in equivalent (in respect to the main relevant psycho-demographical and clinical parameters) groups of non-aphasic post-stroke non-depressives ( $n=83$ ) and depressives, both with early onset (during the first three months after the stroke) ( $n=42$ ) and late onset (beyond the sixth month post-stroke) ( $n=31$ ), as well as in seniors without either stroke or depression ( $n=89$ ). [All the diagnoses were based on the DSM-IV criteria and the accepted cut off scores of the widely used depression severity instruments.]

**Results:** At discharge from the hospital (approximately one month post-stroke) the levels of self-esteem were not significantly different in depressives as compared with non-depressives stroke patients but significantly lower when compared with healthy controls. A non-significant difference in the "incidence" or the level of depression between low- and high- self-esteem patients has been noticed. On the contrary, at follow up (circa twelve months after the stroke), late onset depressives showed a much more affected level of self-esteem when compared with either non-depressive or early-onset depressive patients.

**Conclusions:** Such data suggest that a (somehow predictable) lowered self-esteem in post-stroke patients is not the key factor in the occurrence of early onset, but could prove more relevant for the late onset post-stroke depression.

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#### **A. DUMBRAVA, M. TOBA, C. BALUT & R. TIMOIANU. Meaning in life in post-stroke depression.**

**Objective:** A sense of meaninglessness in life is common in both old age and chronic illness.

**Participants and Methods:** As part of a larger battery envisioned to assess the psychological condition of post-stroke patients, a couple of instruments for the assessment of meaning in life ["Life Regard Index" and "Purpose in Life Test"] was comparatively administered to equivalent (in respect to relevant psycho-demographic and clinical variables) groups of non-aphasic post-stroke patients with ( $n=79$ ) or without ( $n=97$ ) depression (based on DSM-IV criteria and commonly employed cut off scores of the severity measures of depression) as well as aged controls without either stroke or depression but with ( $n=23$ ) or without ( $n=39$ ) a hip fracture as an invalidating somatic condition.

**Results:** A significant larger meaninglessness in life has been observed in patients with post-stroke depression as compared with any other group of subjects; this observation was mainly due to the levels of meaninglessness in late onset as opposed to early onset post-stroke depressives. The level of meaninglessness in life was higher but less larger in non-depressive stroke patients and hip fracture patients as compared with aged "healthy" controls.

**Conclusions:** These data suggest that a degree of "noogenic neuroses" may accompany the depression following stroke.

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### **Visuospatial Functions/Neglect/Agnosia**

#### **R. TIMOIANU, A. DUMBRAVA & M. TOBA. Line bisection performances in professional musicians.**

**Objective:** The musicians' brain seems to show special organization due to plastic changes induced by the intensive practice of their art.

**Participants and Methods:** In the present study, we comparatively examined, independently for each hand, the performances in a line bisection task of two equivalent (in respect to relevant demographic parameters) groups of professional musicians ( $n=27$ ) and music naïve control subjects ( $n=27$ ), as well as undergraduate students in performing ( $n=30$ ) or teaching ( $n=30$ ) music.

**Results:** Using either the right or the left hand, the professional musicians show a clear left pseudo-hemineglect, compared with the subjects of the control groups. The performances of both groups of undergraduate students are closer to those of the professional musicians and different from those of the music naïve controls.

**Conclusions:** These results are similar to those obtained in some other professionals (namely skilled sportsmen) and could be interpreted in the frame of the "Group Cortical Organisation and Activation Theory". Correspondence: *Monica Toba, ICM, 47, Bd. de l'Hopital, Paris 75013, France. E-mail: monica.n.toba@gmail.com*

#### **W.H. BROUWER, R.B. BUSSCHER & M.L. TANT. On-Road Driving In Homonymous Hemianopia After Stroke: The Importance Of Attention And Perceptual Speed.**

**Objective:** To describe and understand limitations in on-road functioning of drivers with homonymous hemianopia

**Participants and Methods:** On-road driving performance (practical fitness to drive) was assessed in 17 experienced drivers with homonymous hemianopia (7 R, 10 L) following stroke and related to visual and cognitive impairments. On two different days practical fitness to drive was assessed by an examiner of the Dutch licensing authority (CBR) in a 45 minute drive in varying road and traffic conditions. A second observer sitting in the back of the car scored driving performance in more detail and also gave an independent global rating.

**Results:** Large individual differences were found: Four drivers were declared fit to drive, 10 were unfit, and 3 were doubtful. These differences were not related to the side of hemianopia or to the extent of the field loss. Moderately high correlations were found, however, between test-drive performance and scores on paper and pencil tests of attention and visual search (Hidden Figures Test, the Trail Making Test, the Bells test and the Grey Scales). Drivers passing the on-road test generally performed in the average range of these neuropsychological test in spite of their field defects. A moderately strong negative correlation was found between test drive performance and age but this correlation dropped to zero when test performance was partialled out.

**Conclusions:** For the current situation this implies that a positive outcome of an on-road test of practical fitness to drive in HH is probable only for subjects with average or better (for older subjects) performance on tests of visual attention and visual search. For the future it implies that rehabilitation methods for driving with HH should find ways to compensate for limitations of visual attention, working memory and visual search.

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#### **G.A. DE HAAN, J. HEUTINK, B. MELIS-DANKERS, O. TUCHA & W. BROUWER. The Effect of Compensatory Scanning Training on Mobility in Hemianopia Patients.**

**Objective:** Homonymous hemianopia, the most common form of Homonymous Visual Field Defects (HVFD), refers to a loss of perception for half the visual field, affecting both eyes, due to acquired post-chiasmatic brain injury. Because of a disorganized visual search strategy, patients with HVFD have particular difficulties with visual exploration and mobility.

**Participants and Methods:** A new Compensatory Scanning Training protocol has been developed, which aims to improve awareness, scanning and mobility in daily life. The effect of this training protocol has been examined in 57 hemianopia patients. A wide range of effect measurements has been applied, covering all levels of the ICF. These measurements include visual search tasks including eye tracking, reading tasks, obstacle courses, rides in a driving simulator, and questionnaires to examine self-reported visual disabilities, mobility and quality of life. The examinations were done in the week before and the week after training and a subgroup of these patients, the so-called control group, was examined three months before the start of the training as well, resulting in a Randomized Controlled Trial.

**Results:** Data collection has recently been completed. The final results will be discussed in terms of within-subject effects (pre- vs. postmeasurement, and associations between different parameters), and between-subject effects (comparison with the results of the control group).

**Conclusions:** Compensatory Scanning Training has a beneficial effect on scanning and mobility in hemianopia patients, but interesting inconsistencies have been found in the results of the different tests.

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#### **B.B. ERSHOV. Executive dysfunction and visual memory impairments in major depressive disorder.**

**Objective:** The purpose of this study was to compare visual memory performances between subjects with major depressive disorder (MDD) and subjects with major depression following traumatic brain injury (MDTBI) and to determine to what degree memory deficits were mediated by impaired executive function. This study examined the hypothesis that memory deficits would be greater in MDTBI than in MDD and that the effect of executive dysfunction on memory deficits would be more pronounced in MDD.

**Participants and Methods:** The group of subjects with MDD included 41 middle-age (25-40), right-handed outpatients (19 male and 22 women). The group of subjects with MDTBI included 35 outpatients (24 male and 11 women) with depressive symptoms and others consequences of brain injury. Participants were screened for Beck Depression Inventory (BDI), diagnosed for major depression by ISD-10 criteria, and administered the Rey-Osterrieth Complex Figure test (ROCF). The ROCF performances was scored, using the Boston Qualitative Scoring System (BQSS).

**Results:** There were no significant differences between groups in progress performances of immediate recall. In contrast, group differences in 25 min-delayed recall were statistically significant - subjects with MDD perform this trial better than subjects with MDTBI. However, the between-group differences were small. Visual memory impairment was partly determined by difficulties in executive function in both groups, as that the effects of deficit of organization and planning were present in the both groups.

**Conclusions:** The findings suggest that true visual memory impairment may be one of the core feature of cognitive deficits in MDD as well as in MDTBI. The main finding of this study is that visual memory was impaired in both MDD and MDTBI groups in a similar way. The executive dysfunction had only a partial mediating effect on memory deficits in MDD and MDTBI. This study was supported by Grant 8.37.126.2011 from St. Petersburg State University, Russian Federation.

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#### **M. HISCOCK & B.G. BREITMEYER. Categorical and Coordinate Spatial Judgments Differ According to Visual Quadrant and Subjects' Handedness.**

**Objective:** Right and upper visual field (VF) superiority on perceptual tasks can be attributed to preferential use of high spatial-frequency parvocellular (P) pathways of the left hemisphere, whereas left and lower visual field superiority can be attributed to preferential use of low-frequency magnocellular (M) pathways of the right hemisphere (Previc, 1990). Accordingly, we predicted a diagonal difference (lower left versus upper right quadrant) between categorical judgment tasks that entail P-channel activation and coordinate judgment tasks that entail M-channel activation. Moreover, left-hand preference should favor performance in the near field (i.e., lower field) on the left side.

**Participants and Methods:** Participants were 56 right-handed and 24 left-handed university students. Two dots and a horizontal bar were presented in one quadrant for 130 ms. A categorical task (144 trials) required deciding whether the dots fell above or below the bar; a coordinate task (144 trials) required deciding whether the bar would fit between the dots. Participants responded by pressing keys.

**Results:** As predicted, categorical responses were faster to right VF stimuli ( $p < .05$ ) and coordinate responses were faster to left VF stimuli ( $p < .05$ ). Categorical responses were faster to upper VF stimuli ( $p < .05$ ) and coordinate responses were faster to lower VF stimuli ( $p < .005$ ). Categorical reaction time (RT) was especially short for stimuli in the upper right quadrant ( $p < .01$ ), and coordinate RT was especially short for stimuli in the lower left quadrant ( $p < .05$ ). For coordinate judgments only, the predicted diagonal pattern was stronger for left-handers than right-handers ( $p < .05$ ).

**Conclusions:** Both of the the obtained lateral and vertical asymmetries in spatial judgment are consistent with differential P- and M-activity of the left and right hemispheres. An augmented quadrant effect in left-handers may reflect their stronger near-space representation on the left side, which is related to preferential use of the left hand.

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#### **R. HUITEMA, M. GERRITSEN, J. WOUDEMA & W. BROUWER. Effect of Prism Adaptation as a Treatment for Unilateral Spatial Neglect on Lane Tracking Performance.**

**Objective:** Patients with unilateral spatial neglect (USN) experience many problems in daily life including impaired fitness to drive. They may be unaware of traffic occurrences in the neglected field and during lane tracking they often demonstrate a contralesional deviation and a large variability in lane position. A promising, relatively new treatment for USN is prism adaptation (PA). PA is a treatment that acts on the alignment between proprioceptive and visual reference frames, which is skewed in neglect patients. This mis-alignment may be the basis for the inadequate heading control in neglect patients and we expected that PA may therefore improve heading control and lane tracking in these patients. Objective of this study was to evaluate the effectiveness of PA on lane tracking performance of neglect patients in a driving simulator.

**Participants and Methods:** In a randomized controlled study 14 patients were included and treated (8 experimental PA, 6 placebo) in the first week post stroke. Patients were followed up and assessed in a driving simulator half a year post stroke.

**Results:** Due to drop-out 6 patients from the experimental and 2 from the placebo group were assessed in the driving simulator. 4 out of 6 patients in the experimental group showed normal lane tracking performance after 6 months, whereas both patients in the control group showed an abnormal performance: they demonstrated a larger than average variability in lane position.

**Conclusions:** Although the results are inconclusive because of the large amount of drop-out a trend appeared to exist in which only neglect patients from the experimental group showed normal lane tracking performance, which suggests that PA may be an effective treatment for driving ability in neglect patients.

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#### **F. LUCHELLI & E. MARTINI. Visuo-Spatial Impairment and Apraxia in Posterior Cortical Atrophy: a Possible Relationship.**

**Objective:** Studies of apraxia in patients with Posterior Cortical Atrophy (PCA), a degenerative condition affecting the right parietal regions of the brain, may provide valuable insight into the nature and the neural substrate of limb praxis.

**Participants and Methods:** AL, a 69-year-old, right-handed male and former high school headmaster, presented with a 3-year long history of progressive visuo-spatial impairment diagnosed as PCA. Neuropsychological assessment confirmed severe and pervasive visuo-spatial deficits; language, verbal memory and executive functions were disproportionately spared. Recognition and naming of objects were normal. Brain MRI and 18F-FDG PET showed evidence of pathological changes in the right parietal cortex. Limb praxis was extensively assessed by tests of gesture imitation, pantomimes, single object use and multiple objects actions.

**Results:** AL showed moderate impairment in gesture imitation and mild impairment in pantomimes. Clumsiness and repeated attempts to perform the correct gesture were observed throughout all tests. On imitation, apraxia was more severe on the left than on the right hand; meaningless gestures, arm/hand movements and motor sequences were more impaired than meaningful, finger movements and static postures, respectively. Errors consisted mostly of spatial errors (i.e., wrong orientation or spatial position) even in motor sequences. On the pantomime test, errors consisted of amorphous or rather stereotyped movements (in most instances, keeping thumb and index finger juxtaposed as in a precision grip) to the correct location of action; body-part-as-object errors were few. Real object use was good both with single and multiple objects. Face praxis was fully preserved.

**Conclusions:** The pattern of apraxic errors is consistent with a parietal locus of lesion, congruent with MRI and PET findings. We surmise that predominantly spatial errors may be related to AL's visuo-spatial impairment.

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**INS Presidential Address:  
It's Not Only the Injury that Matters, but the Kind of Head**

**4:00–5:00 p.m.**

**J. PONSFORD.** *It's not only the injury that matters, but the kind of head.* Much neuropsychological research has focused on the effects of injury to various parts of the brain. Increasingly sophisticated neuropatholog-

ical and neuroimaging studies have identified the nature and common sites of diffuse axonal injury associated with traumatic brain injury (TBI) and neuropsychological studies have elucidated the common cognitive and behavioural changes associated with these injuries. Despite this, it remains very difficult to predict outcome in any individual case. There is a growing body of research which has identified that significance of the make-up of the injured person in determining their recovery trajectory from TBI across the spectrum of injury severity. In this address I will discuss studies which have identified the influence of factors such as pre-injury ability, education, psychiatric history, social support, cultural background and other factors on outcome following TBI. In order to improve outcomes, it is vital that clinicians understand and embrace these influences and address them as part of the rehabilitation process. Correspondence: *Jennie Ponsford., NSW, Australia. E-mail: jennie.ponsford@monash.edu*

**SATURDAY MORNING, JULY 13, 2013**

**Invited Address:  
Divided Attention and Working Memory after Severe Traumatic Brain Injury: From Assessment to Rehabilitation**

**Presenter: Philippe Azouvi**

**8:45–9:45 a.m.**

**P. AZOUVI.** *Divided attention and working memory after severe traumatic brain injury : from assessment to rehabilitation.*

Patients who survived a severe traumatic brain injury (TBI) often complain of a difficulty in doing two things at the same time, that is often referred to as a divided attention deficit. This impairment may have disabling consequences in patients' everyday life. This presentation will focus on three issues related to divided attention deficits:

- First, we will address the underlying cognitive impairments, particularly the relationships between divided attention, speed of processing, and working memory. Experimental data suggest that divided attention and working memory deficits are closely related, although they may dissociate one from each other, suggesting that they rely (at least in part) on distinct mechanisms (Asloun et al., 2008).

- Secondly, we will address ecological assessment of divided attention / working memory. We present recent data with behavioural scales or complaint lists. These questionnaires showed significant correlations with global measures of disability, but were less strongly related with cognitive testing.

- The third issue is rehabilitation. A randomised group study (Couillet et al., 2010) showed that intensive, hierarchized training improved divided attention in patients with brain injury. The partial generalisation of training effects to other cognitive domains, and particularly to working memory, again suggested that divided attention and working memory are closely related but independent processes that should be trained separately.

We conclude with suggestions for future research on rehabilitation of executive aspects of attention and working memory in brain-injured patients.

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**Symposium 10:  
Neurocognitive Development in Adolescence: Normal and Subnormal**

**Chair: Mariette Huizinga**

**Discussant: Peter Isquith**

**8:45–10:15 a.m.**

**A. VAN DUIJVENVOORDE, H. HUIZENGA, L.H. SOMERVILLE, A. POWERS, W.D. WEEDA, M.R. DELGADO, B.J. CASEY, E.U. WEBER & B. FIGNER.** *Neural Correlates of Expected Risks and Returns in Children's, Adolescents', and Adults' Risky Choice.*

**Objective:** It is known that risky behaviors like harmful substance use and dangerous behavior in traffic start and/or peak during adolescence. This increase in risk-taking has been explained by an imbalance between affective-motivational versus cognitive-control processes, caused by the differential subcortical versus prefrontal maturational trajectories. To investigate the processes that underlie and drive individual and age differences in overt risk-taking levels, we decomposed risky choices by use of the 'risk-return model'.

**Participants and Methods:** In an fMRI-scanner, 23 children (M=10 years), 25 adolescents (M=17.9 years) and 24 adults (M=28.3 years) played an fMRI-adjusted version of a dynamic risky-choice task, the Columbia Card Task. For each decision a player faced—to either turn over a card or move on to the next round—we calculated the expected value (overall value of possible choice outcomes: greater EV=greater return) and the expected risks (standard deviation of possible choice outcomes: greater SD=greater risk).

**Results:** Behavioral results showed that greater returns increased the probability to take a card—all ages liked greater returns—and this sensitivity increased linearly with age. fMRI analyses showed a similar age-related increase in neural activation to returns in reward-related brain regions. Further, greater risk decreased the probability to take a card—all ages disliked greater risk—however, this sensitivity was absent in children and highest in adolescents. fMRI analyses showed a similar age-related increase in neural activation to risk that tended to peak in adolescence.

**Conclusions:** These results illustrate the importance of decomposing influences in risky choice and are discussed in relation to neurodevelopmental models of adolescent risk-taking.

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**P. DE ZEEUW, J. WEUSTEN, S. VAN DIJK, J. VAN BELLE & S. DURSTON.** *Neuropsychological Heterogeneity in ADHD: Implications for Theory and Practice.*

**Objective:** Recent neurobiological models of ADHD suggest that deficits in different neurobiological pathways may independently lead to symptoms of this disorder. At least three independent pathways may be in-

volved: a dorsal frontostriatal pathway involved in cognitive control, a ventral frontostriatal pathway involved in reward processing and a frontocerebellar pathway related to temporal processing. Importantly, we and others have suggested that disruptions in these three pathways should lead to separable deficits at the cognitive level. Furthermore, if these truly represent separate biological pathways to ADHD, these cognitive deficits should segregate between individuals with ADHD. The present study tests these hypotheses in a sample of children, adolescents and young adults with ADHD and controls.

**Participants and Methods:** We recently performed a study where we examined all three domains using a short battery of computerized tasks. 149 Subjects (mean age 12.8 years) participated in a short computerized battery assessing cognitive control, timing and reward sensitivity.

**Results:** We used Principal Component Analysis to find independent components underlying the variance in the data. The segregation of deficits between individuals was tested using Loglinear Analysis. We found four components, three of which were predicted by the model: Cognitive control, reward sensitivity and timing. Furthermore, 80% of subjects with ADHD that had a deficit were deficient on only one component. Loglinear Analysis statistically confirmed the independent segregation of deficits between individuals.

**Conclusions:** We therefore conclude that cognitive control, timing and reward sensitivity were separable at a cognitive level and that deficits on these components segregated between individuals with ADHD. These results support a neurobiological framework of separate biological pathways to ADHD with separable cognitive deficits.

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**S. DEKKER, L. KRABBENDAM, N.C. LEE, A. BOSCHLOO, R. DE GROOT & J. JOLLES. Dominant Goal Orientations Predict Differences in Academic Achievement During Adolescence Through Metacognitive Self-Regulation.**

**Objective:** Developmental changes take place in motivation for learning during adolescence. Motivation for learning has often been conceptualized as the striving to reach goals. This study investigated whether academic achievement was predicted by the goal which generally drives a student's learning behavior. Secondly, the role of metacognitive self-regulation was examined.

**Participants and Methods:** Goals were assessed using vignettes of students that reflect four goal orientations. 735 adolescents aged 10-19 years indicated which student they resembled most. Age, sex and level of parental education were controlled for.

**Results:** Results showed that students with motivation goals of the intrinsic and performance-approach types obtained higher grades than students characterized by the learning-avoidant goal type. Intrinsically motivated students showed the best metacognitive self-regulation skills of all students. Better self-regulation skills predicted higher achievement. This shows that motivational goals explained achievement differences.

**Conclusions:** The results suggest that teachers should stimulate students' intrinsic motivation and self-regulation skills.

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**M. HUIZINGA, W.D. WEEDA & L.L. VAN DER HEIJDEN. The Struggle Between Socio-Emotional Impulses and Cognitive Control Among Adolescents: The Relationship with School Performance.**

**Objective:** Goal-directed behavior includes, for example, planning of homework, showing up on time, or prepare for a presentation. Many adults experience difficulties in this area, but for adolescents, reaching goals is even more complicated. In daily life, they are exposed to many impulses (such as social media, mobile phones, and the internet), possibly leading to distraction. In addition, their friends are very important, and some adolescents even take risks in order to belong to a peer group. So-called cognitive control helps us to show goal-directed, adaptive, behavior. In most children, the cognitive control system and the socio-emotional system get into balance during adolescence. Great differences in this 'balancing process' between children however exist. In this presentation, I will focus on these differences, and their underlying factors – in relation to school performance.

**Participants and Methods:** The first wave of this longitudinal project comprised 600 young adolescents from the last year of primary education ('Groep 8'), and the first and second years of secondary education ('VMBO', 'HAVO', 'VWO'). The participants performed on experimental neuropsychological tasks to measure cognitive flexibility, working memory capacity, inhibition, and risk taking. In addition, we indexed school performance, and collected survey data on e.g., pubertal status, need for arousal, substance use, social networks, and media use.

**Results:** The results will be discussed in terms of a network model that departs from the classical psychometric view, in which differences between individuals reflect a function of an underlying ('latent') variable. Instead, these individual differences are taken to be part of a causal system.

**Conclusions:** Individual differences in school performance seems to be influenced by the balancing process of socio-emotional and cognitive development, as indicated by different networks of factors related through functional, causal, and homeostatic mechanisms.

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**M. HUIZINGA, P. ISQUITH, A. VAN DUJVENVOORDE, P. DE ZEEUW, S. DEKKER & M. HUIZINGA. Neurocognitive Development in Adolescence: Normal and Subnormal.**

**Symposium Description:** Recent neurocognitive theories on adolescent development focus on the interplay between socio-emotional factors and cognitive control in determining developmental outcome. It is assumed that context may explain all these diverse and sometimes conflicting aspects of development: adolescents are under unique social and emotional pressures, such as peer expectations and increased desires and motivations. It is therefore suggested that their reasoning and decision making is not simply a reflection of their cognitive ability, but also of their emotional, social and physical state.

Presentation 1 will focus on risk-taking behavior in normal children, adolescents and adults. The neural processes that underlie and drive individual and age differences in overt risk-taking levels were investigated. Results are discussed vis-à-vis neurodevelopmental models of adolescent risk-taking.

Presentation 2 will focus on the neuropsychological heterogeneity in adolescents with ADHD and how this may be of use for etiological research and clinical practice. The multifactorial nature of ADHD is discussed in terms of multipathway theoretical accounts.

Presentation 3 will focus on goal orientation in normal developing adolescents. Academic achievement and the goal that drives learning behavior were investigated as well as the role of metacognitive self-regulation in this process. Results will be related to intervention strategies for teachers.

Presentation 4 will focus on individual differences in the balancing of the cognitive control system and the socio-emotional system during early adolescence, and their underlying factors – in relation to school performance. Results are discussed in terms of a network model that takes individual differences as part of a causal system.

Discussion. The issues raised by the presenters are discussed in terms of neurocognitive theories on adolescent development.

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**Symposium 11:  
Neuropsychology of Navigation**

**Chair: Ineke van der Ham**

**8:45–10:15 a.m.**

**I. VAN DER HAM, J. WEGMAN, J. VAN EKERT, J. WIENER, I. VAN DER HAM & S. HERINGA. Neuropsychology of navigation.**

**Symposium Description:** Many times a day, we use our ability to find our way in the world. This allows us to interact with our environment,

to realize where we are, and where to go next. Navigation ability is one of our most essential but also most complex cognitive skills. Without it, we cannot go anywhere by ourselves without getting lost. Recent advances of research techniques like neuroanatomical density measures and the use of virtual reality environments make navigation a very contemporary research topic, in particular with regard to neuropsychology.

In this symposium navigation ability is discussed from different neuropsychological perspectives. The presentations cover various approaches to the topic, moving from more fundamental studies to applied clinical work, dealing with natural variation, development, and impairment in navigation.

First, the large variation in ability that is typical for navigation will be considered. Neuroimaging data is used to show that volumetric as well as density measures in specific brain areas differ between good and bad navigators. The second presentation will deal with the maturation of the medial temporal lobe; this correlates with navigation ability throughout childhood and adolescence. Effects of aging will also be discussed; the ageing brain is suggested to affect strategy use. Then, navigation in a clinical setting is examined. Both subjective and objective measures of navigation ability in mild stroke patients highlight the importance of navigation ability in neuropsychological assessment in this group. Lastly, navigation measures in mild cognitive impairment and early Alzheimer's disease indicate that these clinical populations show navigation specific impairment, in addition to typically found general memory impairment.

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#### **I. VAN DER HAM, M. BRASPENNING & A. VISSER-MEILY. Navigation impairment in mild stroke patients.**

**Objective:** Navigation is a complex and multi-faceted cognitive ability we use in many everyday activities. However, impairment in navigation ability has received relatively little attention in neuropsychology and neurorehabilitation. Moreover, standardized neuropsychological tools have shown to be insufficient to correctly identify this type of impairment. This leads to the question how often such problems occur in this population and what its impact is.

**Participants and Methods:** We assessed the prevalence of navigation problems in a sample of mild stroke patients (N=62) with a navigation questionnaire (WQ). In addition, the relation between WQ scores and quality of life measures and neuropsychological test scores were studied.

In a second study navigation ability was measured at an objective level by means of a neuropsychological task battery including virtual reality route learning. This task battery was designed to assess landmark recognition, route knowledge, survey knowledge, perspective taking, order memory, distance estimation, and mental transformation. 43 Mild stroke patients were tested.

**Results:** Self-reported navigation impairment occurred in a substantial proportion of patients (29.0%), as compared to a large control group (N=384). Moreover, these ratings were closely linked to quality of life and negatively correlated to spatial anxiety.

In the second study, 65.1% of patients showed impaired scores in at least one of these components of navigation, in comparison to healthy controls (N=32). The highest level of impairment was found for route knowledge (34.9%), survey knowledge (30.9%), and perspective taking (30.9%).

**Conclusions:** Our data indicate that navigation impairment is common among mild stroke patients, subjectively, as well as objectively. Therefore, more attention should be paid to potential navigation impairment in this population. Particularly its multi-faceted nature is of importance, as considerable differences in performance between the separate components were found.

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#### **J. WEGMAN, H.M. FONTEIJN, J. VAN EKERT, A. TYBOROWSKA, C. JANSEN & G. JANZEN. Gray and White Matter Correlates of Navigational Ability in Humans.**

**Objective:** Humans differ widely in their navigational abilities. Studies have shown that self-reports on navigational abilities are good pre-

dictors of performance on navigation tasks in real and virtual environments. The caudate nucleus and medial temporal lobe regions have been suggested to subserve different navigational strategies. The ability to use different strategies might underlie navigational ability differences. This study examines the anatomical correlates of self-reported navigational ability in both gray and white matter.

**Participants and Methods:** Gray matter density was compared between a group (N=134) of good and bad navigators using voxel-based morphometry (VBM), as well as regional volumes. To compare between good and bad navigators, we also measured white matter anatomy using diffusion tensor imaging (DTI) and looked at fractional anisotropy (FA) values.

**Results:** We observed a trend towards higher GM density in right anterior parahippocampal / rhinal cortex for good versus bad navigators. Good male navigators showed significantly higher GM in right hippocampus than bad male navigators. Conversely, bad navigators showed increased FA values in the internal capsule, the white matter bundle closest to the caudate nucleus and a trend towards higher GM in the caudate nucleus. Furthermore, caudate nucleus volume correlated negatively with navigational ability.

**Conclusions:** These convergent findings across imaging modalities are in line with findings showing that the caudate nucleus and the medial temporal lobes are involved in different wayfinding strategies. Our study is the first to show a link between self-reported large-scale navigational abilities and different measures of brain anatomy.

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#### **J.M. WIENER, O. DE CONDAPPA, M.A. HARRIS & T. WOLBERS. Maladaptive bias for extrahippocampal navigation strategies in aging humans.**

**Objective:** Efficient spatial navigation not only requires accurate spatial knowledge but also the selection of appropriate strategies. Using a novel paradigm that allowed us to distinguish between beacon, associative cue, and place strategies, we investigated the effects of cognitive aging on the selection and adoption of navigation strategies in humans.

**Participants and Methods:** Participants were required to rejoin a previously learned route encountered from an unfamiliar direction. Successful performance required the use of an allocentric place strategy.

**Results:** Use of the allocentric strategy was increasingly observed in young participants over six experimental sessions. In contrast, older participants, who were able to recall the route when approaching intersections from the same direction as during encoding, failed to employ the correct place strategy when approaching intersections from novel directions. Instead, they continuously employed a beacon strategy and showed no evidence of changing their behavior across the six sessions. Given that this bias that was already apparent in the first experimental session, the inability to adopt the correct place strategy is not related to an inability to switch from a firmly established response strategy to an allocentric place strategy. Rather, and in line with earlier research, age-related deficits in allocentric processing result in shifts in preferred navigation strategies and an overall bias for response strategies.

**Conclusions:** The specific preference for a beacon strategy is discussed in context of a possible dissociation between beacon-based and associative cue-based response learning in the striatum, with the latter being more sensitive to age-related changes.

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#### **S.M. HERINGA, E. VAN DEN BERG, L.E. WISSE, G.J. BIESELS & I.J. VAN DER HAM. Spatial Navigation in Patients with Mild Cognitive Impairment or Early Alzheimer Disease.**

**Objective:** Patients with amnesic mild cognitive impairment (aMCI) or Alzheimer disease (AD) often have problems with navigation, such as getting lost. We explored whether three elemental aspects of navigation are affected in these patients and how navigation performance is related to other cognitive functions.

**Participants and Methods:** We recruited 68 patients with aMCI or AD (age 76±9 years, MMSE 25±4) via a memory clinic and 21 healthy volunteers (age 77±4 years, MMSE 28±2) via their general practitioners. Using a novel navigation task, the Virtual Reality Tübingen task, we measured scene recognition, route continuation and route ordering.

All participants also underwent cognitive testing. Test scores were converted into z-scores. Navigation performance was compared between patients and controls. Next, within each group, we correlated navigation performance to functioning on the cognitive domains memory, executive functioning and processing speed.

**Results:** Age, sex and education-adjusted analyses showed similar performance of patients and controls for scene recognition (mean difference in z-scores  $-0.34$  (95% confidence interval (CI)  $-0.80;0.13$ ),  $p=0.15$ ), but patients performed worse than controls on route continuation (mean difference  $-0.64$  (CI  $-1.10;-0.18$ ),  $p<0.01$ ) and route ordering (mean difference  $-0.84$  (CI  $-1.31;-0.38$ ),  $p<0.01$ ). Within patients, all navigation aspects were correlated with memory function (scene recognition: Pearson's  $r=0.32$ ,  $p<0.01$ ; route continuation:  $r=0.29$ ,  $p<0.05$ ; route ordering:  $r=0.44$ ,  $p<0.01$ ). Within controls, only scene recognition ( $r=0.45$ ,  $p<0.05$ ) was correlated with memory function. In both groups, executive functioning and processing speed were unrelated to navigation performance (all  $p>0.05$ ).

**Conclusions:** This study shows a spatial, route-specific, navigation deficit in patients with aMCI or early AD relative to controls, while recognition is intact. Furthermore, findings suggest that patients apply a less efficient strategy during navigation that is more dependent on memory functioning.

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### J. VAN EKERT, J. WEGMAN & G. JANZEN. The Development of a Neural Wayfinding Mechanism.

**Objective:** Navigating through space is central to human nature and requires the ability to retrieve relevant information from memory. Imaging studies on navigation in adults commonly point to the involvement of the parahippocampal gyrus (PHG). More specifically, retrieval of landmarks placed at locations relevant for navigation recruits the PHG. The retrieval of irrelevant or ambiguous landmarks, however, does not evoke increased responses in this region. The present study sought to test whether functional maturation of the PHG contributes to the development of long-term memory for landmarks.

**Participants and Methods:** To accomplish this goal, 30 participants (aged 8-18) watched a route through a large-scale virtual environment. The environment had 120 objects at its disposal all of which served as landmarks. The location of each landmark, as well of the number of occurrences, was manipulated. This resulted in four conditions: In condition 1D the object appeared once at a location relevant for navigation (decision point), in condition 1ND the object appeared once at a location irrelevant for navigation (non decision point), in condition 2D the object appeared twice at a decision point (ambiguous landmark) and in condition 2ND, the object appeared twice at a non decision point (non ambiguous landmark). Participants were instructed to attend to the route and the objects along the route. Subsequently, they performed a recognition task of the objects during which we acquired event related fMRI data.

**Results:** fMRI data showed that the PHG selectively responds to landmarks previously located at a decision point and that this response increases significantly with age. Moreover, the response to ambiguous landmarks in this region did not increase with age.

**Conclusions:** The results imply that the automatic storage of relevant information continuously develops with age. It suggests that maturation of MTL function contributes to the development of a neural network that subserves successful navigation.

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### Poster Session 6:

#### Epilepsy / Medical / Schizophrenia / TBI (Adult)

9:45–11:15 a.m.

#### Epilepsy/Seizures

**C. SCHMIDT, H. SAUERWEIN, M. LASSONDE, L. CARMANT, P. MAJOR & A. GALLAGHER. Are there modality-specific memory impairments following hippocampal asymmetry in children with temporal lobe epilepsy?**

**Objective:** Extensive research has been focused on memory impairments in children and adolescents with temporal lobe epilepsy (TLE). How-

ever, unlike the results in the adult population with TLE, no specific memory impairment pattern has been confirmed in children in regards to the hemispheric laterality of the epileptic disorder. Therefore, this study aims to clarify the specific nature of cognitive impairments in children with TLE by comparing neuropsychological and clinical data of patients with left and right temporal lobe epilepsy with unilateral hippocampal asymmetry (HA).

**Participants and Methods:** Eleven patients, aged between 9 and 19 years, who presented unilateral HA (left: 8; right: 3) and seizure onset during childhood or adolescence (age at onset: 2-14) were submitted to a battery of neuropsychological tests, including intellectual (WISC-IV or WAIS-III scales) and memory (CMS or WMS-III, CVLT and Rey complex figure) assessments. Results were divided into specific index: verbal and nonverbal intellectual functioning, attention and working memory index, and verbal and visual memory.

**Results:** Patients with left HA tended to have lower verbal memory compared to visual memory, but results were not significant. Patients with right HA showed no difference between verbal and visual memory index. Therefore, no modality specific memory profile was found. Moreover, no difference between intellectual quotient (IQ) and memory quotient (MQ) has been measured in both groups suggesting that there was no memory impairment in these children with TLE. Interestingly, almost all patients (10/11) presented significantly lower attention and working memory index than the global IQ.

**Conclusions:** This preliminary study suggests that TLE with HA is associated with attention and working memory problems rather than memory impairment. In a clinical perspective, it would therefore be important to further investigate attention and executive functioning in children with TLE in order to identify appropriate interventions.

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### K. HIROMITSU, C. ITOI, S. SAITO, R. YAMADA, N. SHINOURA & A. MIDORIKAWA. Religious experiences and out-of-body experiences during awake surgery.

**Objective:** It has been suggested that patients with temporal lobe epilepsy have ictal religious experiences or out-of-body experiences (Lukas, 2010; Francesco, 2005). In this study, the patient with brain tumors who has no prior history of epileptic seizure showed religious experiences and out-of-body experiences during awake surgery.

**Participants and Methods:** The patient was 59 year-old, left-handed male suffering from brain tumors which were primarily located in the left temporal lobe and included the cingulate gyrus. In order to remove the brain tumors surgically, he underwent awake surgery.

**Results:** During awake surgery, the patient reported that there was the dazzling light in the operating room and in that light he saw the vision of God. Moreover, when the operation was conducted near the cingulate gyrus, he also reported that he was located in another place not in the operating room for a few seconds. After surgery, he did not remember what he had seen and said during surgery. However, he remembered the sense of out-of-body experiences vaguely and never felt such a sense since the surgery.

**Conclusions:** Cingulate gyrus function was associated with religious experiences and out-of-body experiences.

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### L. KRAMSKA, H. MALIKOVA, Z. VOJTECH, J. LUKAVSKY, T. PROCHAZKA, I. MARECKOVA, R. LISCAK & M. KALINA. Memory performance two years after stereotactic radiofrequency amygdalohippocampectomy.

**Objective:** To assess memory performance and effect of stereotactic radiofrequency amygdalohippocampectomy (SAHE) in the treatment of mesial temporal lobe epilepsy (MTLE) due to mesial temporal sclerosis (MTS).

**Participants and Methods:** We included 37 MTLE patients who were treated by SAHE (26 in the left, 11 in the right side). We compared Global, Verbal and Visual Memory Quotients (MQ), Attention/Concentration, Delayed Recall by WMS-R and Working Memory and Long-term semantic Memory (Digit Span and Information from WAIS-R) before the SAHE and one and two years after intervention. All patients underwent standard preoperative neurological and neuropsychological evaluation.

**Results:** Whole group significantly improved after two years since operation in Global MQ ( $p=0.0001$ ), Verbal MQ ( $p=0.0002$ ), Visual MQ ( $p=0.0084$ ), Attention ( $p=0.0012$ ), Delayed Recall ( $p=0.0020$ ), Long-term semantic Memory (LTM) (subtest Information from WAIS-R,  $p=0.0016$ ) and Working Memory (subtest Digit Span from WAIS-R,  $p=0.0052$ ). Right-sided patients benefitted more than left-sided in verbal memory and delay recall tests. Two years after SAHE 28 (75.5%) patients were assessed as Engel Class I; 7 (18.9%) patients as Engel Class II. In 2 patients (5.4%) treatment failed; 1 of them was classified as Class III and 1 patient as Class IV.

**Conclusions:** This study shows good neuropsychological outcomes after SAHE in our patients. We hypothesize that good neuropsychological results were achieved by incomplete destruction of target structures, sparing the lateral temporal neocortex and also partially by the practice effect. Treatment failures in seizure control could be attributed to larger epileptogenic zones.

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### M. LECHOWICZ, L. MILLER, M. IRISH, D. ADDIS & S. LAH. **Recollection of Past and Construction of Future Events in Patients with Unilateral Medial Temporal Lobe Epilepsy.**

**Objective:** Autobiographical thinking involves vivid recollection of past and construction of future events, which contain episodic and non-episodic information. Bilateral hippocampal damage has typically been associated with impaired recall of episodic but not non-episodic event details from both temporal directions: past and future. Unilateral hippocampal damage impairs recall of past episodic details, but whether it also impacts generation of future episodic details is unknown.

**Participants and Methods:** Patients with a history of unilateral temporal lobe epilepsy (TLE) and structural hippocampal damage ( $n=10$ ), and normal control (NC) subjects ( $n=10$ ) participated. We assessed autobiographical thinking using the Adapted Autobiographical Interview (AI), which required recall of past and generation of future events, and distinguished episodic (internal) from non-episodic (external) details.

**Results:** First, a Group by Temporal Direction repeated measure ANOVA of internal AI details revealed main effects of Group ( $F=8.15$ ,  $p<.05$ ) and Direction ( $F=19.15$ ,  $p<.01$ ) as well as a significant interaction ( $F=5.88$ ,  $p<.05$ ). Overall, significantly fewer internal details were generated (i) by the TLE relative to NC participants and (ii) for future relative to past events ( $p<.05$ ). The between group difference was greater for the past relative to future events. Second, a Group by Temporal Direction ANOVA of external AI details found no significant interaction or main effects. Third, a Group by Type of Detail ANOVA revealed a significant interaction ( $F=8.77$ ,  $p<.01$ ), with TLE participants providing significantly fewer internal but not external details than NCs.

**Conclusions:** Our study provides initial evidence that unilateral hippocampal damage is associated not only with impaired recall of past, but also future episodic (but not non-episodic) details.

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### M. LEVAV, A. BORD, Y. FELDMANN & B. BEN-ZEEV. **Neuropsychological Short Assessment Battery for Children Presenting with Epileptic Disorders (SNACE).**

**Objective:** Test the efficiency of SNACE as an alternative approach to target the cognitive areas affected in epileptic disorders.

**Participants and Methods:** Three hundred children (age 4-18) were referred for neuropsychological assessment after being diagnosed with epilepsy. The SNACE battery was administered to assess: attention, memory, verbal and motor skills. Statistical analyses were performed on background variables: age at onset [ $<6y/>6y$ ]; antiepileptic drugs [monotherapy/polytherapy/no medication]; time since diagnosis [ $<1.8y/>1.8y$ ]; age and gender.

**Results:** All children performed below the expected level as compared to norms among healthy children. Children with early onset of illness (as per age of diagnosis) showed a deficit in visual attention [ $t=2.74$ ,

$p<0.01$ ] and fine motor [ $t=4.95$ ,  $p<0.01$ ] tasks. Children who waited longer periods between the medical diagnosis and the neuropsychological assessment performed poorly in auditory attention [ $t=3.04$ ,  $p<0.01$ ]; visual attention [ $t=2.11$ ,  $p<0.05$ ]; visual search [ $t=4.4$ ,  $p<0.01$ ]; fine motor [ $t=4.67$ ,  $p<0.01$ ]; visuomotor [ $t=6.88$ ,  $p<0.01$ ]; verbal memory [ $t=4.72$ ,  $p<0.01$ ] and verbal fluency [ $t=4.27$ ,  $p<0.01$ ] tasks. Children receiving polytherapy scored lower than those receiving a single antiepileptic drug or none, in auditory attention [ $F=7.25$ ,  $p<0.01$ ]; visual attention [ $F=3.86$ ,  $p<0.05$ ]; visual search [ $F=6.61$ ,  $p<0.01$ ]; fine motor [ $F=9.67$ ,  $p<0.01$ ]; visuomotor [ $F=8.85$ ,  $p<0.01$ ]; verbal memory [ $F=5.28$ ,  $p<0.01$ ] and semantic verbal fluency [ $F=6.53$ ,  $p<0.01$ ] tasks.

**Conclusions:** Seizure disorders affect neuropsychological function in children. Early onset, long duration of illness and polytherapy (that could also relate to disease severity) have a deleterious effect on neuropsychological function. The SNACE battery, administered early as possible, enables a short and efficient neuropsychological assessment, and provides a guide for further educational, psychosocial and medical interventions.

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### K. RANTANEN, K. ERIKSSON & P. NIEMINEN. **Academic Competence of School-Aged Children with Early-Onset Epilepsy.**

**Objective:** Children with epilepsy are at risk for lower academic competence. About 20-50 % of children with epilepsy are reported to have learning difficulties which are associated with epilepsy related factors, e.g. high seizure frequency. However, problems have been reported also in idiopathic epilepsies with well-controlled seizures. The aims of this study were to assess academic competence, and to investigate the associations between epilepsy related factors and academic competence among children with early onset epilepsy.

**Participants and Methods:** Participants were 43 children aged 9-14 (mean 11.2 years) children from a population-based cohort ( $N=64$ ) from the Pediatric Neurology Unit at Tampere University Hospital. Participants were divided into uncomplicated epilepsy (UE,  $n=17$ ) and complicated epilepsy (CE, i.e. those with underlying central nervous system pathology or additional neurologic conditions,  $n=26$ ) groups. Mean age at the onset of epilepsy was 2.3 years. Medical data and results of psychological assessment were reviewed from children's medical records. Academic competence were assessed by teachers with the Teacher's Report Form and Social Skills Rating System.

**Results:** In the UE group, teachers reported significantly below average reading skills in 18 % and significantly below average mathematical skills in 12 %. Similarly percentages for the CE group were 33 and 41. About 24 % of the UE group needed special educational support (either part-time or full time), and total of 81 % of the CE group needed special education. Academic competence was negatively associated with age at onset of seizures ( $p<.05$ ), and present seizure frequency ( $p<.01$ ).

**Conclusions:** As expected academic competence was lower and learning difficulties more frequently reported in the children with CE. However, almost fourth of the children with UE had special educational needs. Especially age at the onset of seizures seem to be of special importance for lower academic competence.

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### V. VIÑAS DÍEZ, L. MORENO CORDÓN, I. RICO PONS, M. FALIP CENTELLAS & M. JUNCADILLA PUIG. **A Preliminary Study: Cognitive Impairment In Frontal Lobe Epilepsy.**

**Objective:** Frontal lobe epilepsy (FLE) is the second type of epilepsy that more commonly presents seizures which origin is a partial focus and represents about a 20-30% of partial epilepsies. However, FLE has not been as widely studied as the temporal lobe epilepsy (TLE). Our study aims to identify the neuropsychological disorders associated with this type of epilepsy. The main cognitive deficits that have been reported until now are motor coordination and several executive functions, although a memory impairment has also been described.



**Participants and Methods:** Subjects with FLE (n=10) were compared to a control group (n=10). Both groups were matched for sex, age, education level and handedness. An exhaustive neuropsychological battery was administered to all of the participants, including the ability of decision-making with the Iowa Gambling Task. This test consisted in an ecological task based on reinforced learning.

**Results:** Patients with FLE performed significantly worse than control group in different components of executive functions (working memory, phonemic verbal fluency, cognitive flexibility, and ability of decision-making), processing speed and memory.

**Conclusions:** In conclusion, these findings provide an important knowledge about the pattern of deficits on these patients for the development of a diagnosis and highlights the importance of using ecological tests for their neuropsychological assessment.

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### Medical/Neurological Disorders/Other (Adult)

**L. KHANCHANDANI, X. BONILLA & S. BINKS. Neurosyphilis - A Case Study of the Nexus of Severe and Persisting Mental Illness, Addiction, Homelessness, and Ignorance.**

**Objective:** This case study presented SY, a 60 year-old African-American male, with a distinct progression of neurosyphilis. Specific characteristics included history of homelessness, severe mental illness (SMI), chronic substance abuse, and syphilis. Data were obtained through clinical interviews, behavioral observations, reviewing legal records, neuropsychological measures, blood work, and a neurological examination. This study aimed to highlight clinical characteristics of neurosyphilis and unique displays of symptomatology. This case study focused on discussing implications of neurosyphilis and highlighting preventative strategies that could be implemented with the SMI population.

**Participants and Methods:** SY was selected due to his unique presentation of neurosyphilis and potential benefit to the field of neuropsychology. The research design was characterized by a neuropsychological battery, examination of data findings, neurological consultation, and literature review.

**Results:** SY's history was obtained during a clinical interview with him and his interdisciplinary treatment team. Neuropsychological results revealed that SY had a significant discrepancy between his premorbid functioning level and level of cognitive functioning. Atypical neuropsychological findings included deficits in visual/verbal learning and memory system, attention/processing speed, motor coordination, and executive functioning. Progressive decline in overall adaptive functioning and personality changes were also observed.

**Conclusions:** Relevant findings unique to this case included undiagnosed and untreated syphilis due to the nexus of SMI, addiction, chronic homelessness, and lack of preventative measures. Findings also concluded evidence of memory loss and personality changes resulting from syphilis progression. Future research should focus on better understanding how this nexus contributes to progression from syphilis to neurosyphilis and preventative measures for the SMI population.

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**P. BRUMMELMAN, J. KOERTS, R.P. DULLAART, G. VAN DEN BERG, O. TUCHA, B.H. WOLFFENBUTTEL & A.P. VAN BEEK. Cognitive Functioning in Patients with Secondary Adrenal Insufficiency.**

**Objective:** Previous research demonstrated that patients with secondary adrenal insufficiency display impairments of memory and executive functioning. However, these domains of cognition have not been examined in detail. Furthermore, other domains of cognition, such as social cognition and attention have hardly been considered. The present study focused on the effects of secondary adrenal insufficiency on cognition by applying a comprehensive neuropsychological battery consisting of tests measuring various aspects of memory, attention, executive functions as well as social cognition.

**Participants and Methods:** Sixty patients (mean (SD) age, 52.3 (13.9) years) with secondary adrenal insufficiency were included. Patients were treated with hydrocortisone at the time of assessment (mean (SD) dose, 25.5 (5.4) mg hydrocortisone). Patients' performances on standardized neuropsychological tests were compared to age-, sex- and education-matched normative data collected on the healthy population.

**Results:** Data analysis revealed significant impairments of patients in the domains of verbal memory, attention, executive functions and social cognition, while no dysfunctions were found with regard to visual memory.

**Conclusions:** The neuropsychological profile indicates that patients with secondary adrenal insufficiency do not show a general cognitive impairment but rather a pattern of selective deficits with some cognitive domains being impaired while others remains preserved. These results are of importance for patient management, since cognitive impairments frequently adversely affect everyday functioning.

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**R.S. BUCKS, M. OLAITHE, P.R. EASTWOOD, D. HILLMAN & T.C. SKINNER. Impact of Sleep Disordered Breathing on Self-reported Memory Function: It's More Than Just Being Old and Sad.**

**Objective:** Memory dysfunction and depression are common consequences of sleep disordered breathing (SDB). Less well known, is whether individuals with SDB are aware of memory changes, and whether this can be explained by depression. This study explored sleep symptoms, depression and memory function in a community cohort.

**Participants and Methods:** 422 (139: 32% male) participants, mean age 42.6±20.9 years completed self-report questionnaires describing medical history, sleepiness (ESS), snoring (Berlin), sleep quality (PSQI), functional outcomes of sleep (FOSQ), memory ability (MMQ) memory contentment (MMQ), and depression (DASS-21). Using an algorithm (Marshall, Dawson & Bucks, 2009), participants were identified as low-risk (few sleep symptoms, no history; 86%), or high-risk (marked symptoms; 14%) of having SDB.

**Results:** Hierarchical multiple regression analysis was used to investigate memory contentment scores and memory ability, in a community sample. In step 1, age and depression were entered. These were significantly associated with memory contentment  $F(2, 419) = 29.86, p < .001, R_{sq} = .13$  and memory ability  $F(2, 419) = 32.01, p < .001, R_{sq} = .13$ . At step 2, SDB-risk was added, resulting in a significant increase in  $R_{sq}$  for memory contentment,  $R_{sq}$  change = .02,  $p = .004$ , and memory ability,  $R_{sq}$  change = .05,  $p < .001$ .

**Conclusions:** Memory complaints (ability) and dissatisfaction with memory (contentment) appear to be more common in individuals at risk of SDB. However, this is not explained by age or depression. That is, changes in memory ability and memory contentment may be independent consequences of sleep disordered breathing. This warrants exploration in individuals with diagnosed sleep disorders and case-matched controls. Such work is underway in our lab.

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**H. DIJKSTRA. Attention in Parkinson's disease: traditional versus ecologically valid and subjective measures.**

**Objective:** In studies aimed at exploring attentional functioning in patients with Parkinson's disease, mainly 'traditional' tasks are used (like the Stroop or Trailmaking task). In recent years not only more ecologically valid attention tasks, but also more subjective measures of attentional functioning were developed. To date however, it is unclear whether these different kinds of tasks are correlated and whether there is a difference in performance between healthy subjects and patients with Parkinson's disease. In order to gain more insight in the usefulness of ecologically valid and subjective measures of attentional functioning in Parkinson's disease, we investigated these questions.

**Participants and Methods:** First, correlations between traditional, ecologically valid and subjective measures of attentional functioning in the group as a whole were calculated, by analyzing the following measures:

performance on Trailmaking form A and B, the subtasks 'map search' and 'visual elevator' of the Test of Everyday Attention (TEA), and the attentional subscale of the Brock Adaptive Functioning Questionnaire (BAFQ). Then the difference in performance between healthy subjects and Parkinson patients was analyzed.

**Results:** The results show significant correlations between the traditional and ecologically valid tasks. However, when objective measures are compared to a subjective measure, not all correlations are significant. When healthy controls and patients with Parkinson's disease are compared, the results show significant differences on all measures.

**Conclusions:** The results show that both traditional and ecologically valid tasks are useful in the assessment of attentional functioning. However, subjective complaints are not always related to objective attentional dysfunction. In Parkinson patients, not only objective attentional deficits, but also subjective attentional complaints are more present than in healthy subjects.

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**G.J. GEURTSSEN, B.A. SCHMAND, R.M. DE BIE, V.J. ODEKERKEN & R.P. SCHURMAN. Is mild cognitive impairment in Parkinson's disease predictive for further cognitive decline after deep brain stimulation?**

**Objective:** The issue of patient selection for Deep Brain Stimulation (DBS) remains an area of discussion. Dementia is considered an absolute exclusion criterion for DBS, but Parkinson patients with mild cognitive impairment (PD-MCI) are often included. However, a study from our group found that patients, who had impairments of attention before the operation, showed further cognitive decline after DBS (Smeding et al., 2011). Whether PD-MCI predicts cognitive decline after DBS needs to be elucidated.

**Participants and Methods:** Data from two studies on the cognitive effects of DBS will be combined (Smeding et al. 2011; Odekerken et al. 2013). As part of the patient selection for DBS we administered the Mattis Dementia Rating Scale (MDRS) and a series neuropsychological tests. Using the proposed diagnostic criteria for PD-MCI (Litvan et al. 2012), the presence of PD-MCI will be scored based on the MDRS (level I scoring of PD-MCI) and on the neuropsychological evaluation (level II scoring). We will reanalyze the data to determine whether level I and/or level II PD-MCI predict cognitive decline after DBS.

**Results:** Study one contains 105 subthalamic nucleus patients (Smeding et al., 2011), and study two 63 subthalamic nucleus and 65 globus pallidus patients (Odekerken et al., 2013). The data on cognitive decline after DBS and the prediction of this decline will be presented.

**Conclusions:** References

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**D.J. JONES, L.T. BUTLER, J.P. HARRIS & E. VAUX. Evidence from a Latent Learning Task for Temporal Lobe Impairment in End Stage Renal Disease.**

**Objective:** Cognition is known to be impaired in End Stage Renal Disease (ESRD); however, sites of the neural changes are uncertain. One distinction is cortical and subcortical structures, as examined using a latent learning task; exposure to an irrelevant cue during initial learning results in slower learning during a subsequent phase of learning in which that cue is now relevant (learned irrelevance). Myers et al. (2003) found a dissociation between medial temporal (MT) patients and those with basal ganglia damage (PD); by examining ESRD patients on the latent task we can begin to draw on similarities with other disorders and infer sites of damage.

**Participants and Methods:** 24 ESRD patients and 24 matched controls were randomly assigned to either Exposed or Unexposed groups. In 'Phase 1' participants learned that a cue (word) on the back of a schematic head predicted that the subsequently seen face would be smiling. For the Exposed (but not Unexposed) group, an additional (irrelevant) colour cue was shown during presentation. In 'Phase 2' a different association, between colour and facial expression, was learnt. Instructions were the same for each phase: participants had to predict whether the face was going to be happy or sad; the number of errors made measured performance.

**Results:** No difference was found in Phase 1, suggesting patients and controls performed similarly. However, in 'Phase 2' a significant interaction was found between group and condition; Phase 2 revealed Unexposed controls to be performing significantly better than Exposed. In contrast, Exposed patients made a similar number of errors to Unexposed; condition did not affect patient performance.

**Conclusions:** Controls showed learned irrelevance, with Exposed participants learning more slowly in Phase 2 than Unexposed. In contrast, patients did not show an exposure effect with performance in Phase 2 being similar in both groups. This pattern is similar to that observed in MT patients, suggesting the impairment may be similar in nature: cortical hippocampal.

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**A. COSTA, F. TIFFIN-RICHARDS, B. HOLSCHBACH, R.D. FRANK, A. VASSILIADOU, Z. ABBAS, T. KRÜGER, F. EITNER, T. GROSS, J.N. SHAH, J.B. SCHULZ, J. FLÖGE & K. REETZ. Reliability of Intra-individual Cognitive Fluctuations in Haemodialysis Patients.**

**Objective:** The prevalence of cognitive impairment in haemodialysis (HD) patients is more than double that of the general population, and there is evidence on the modulation effect of HD on cognition. We aimed to better characterize fluctuations of cognitive functioning around the dialysis cycle by investigating intra-individual changes.

**Participants and Methods:** We assessed several cognitive functions – verbal and nonverbal memory (CVLT, Complex Figure), executive functions (TMT, Stroop, word fluency) and attention (TAP Alertness) - in 45 chronic HD patients, a day before and just after a dialysis session, as well as in 33 healthy controls within the same time-interval, using alternate-versions and contra-balancing test version. We calculated a general linear model for determining time effects at the group level. For intra-individual changes we calculated three reliable change (RC) indexes, controlling for practice effects, regression to the mean and healthy control group variability, for each patient per measure.

**Results:** We found a significant interaction between time and group for attention (intrinsic and phasic alertness), and timed executive functions (Stroop, TMT B), where the patients were significantly slower after HD. Except for the verbal memory recognition task, the patient group was significantly worse than the control group. At the individual level, independent of RC analysis, the majority of patients showed no significant change in performance before and after HD. The highest frequency of reliable change in HD patients was observed in the executive and attention domains.

**Conclusions:** Although primarily presenting with a subcortical pattern of cognitive impairment, applying RC analyses to assess intra-individual fluctuation around the dialysis cycle, only a minority of patients showed reliable decline after HD in attention and executive functions. This appears to reflect the results at the group level and leaves the question of the susceptibility of the frontostriatal system in certain patients undergoing HD.  
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**T. VAESSEN, M.M. SITSKOORN, H.H. HASSING & S. OVEREEM. Cognitive Complaints In Obstructive Sleep Apnea Syndrome.**

**Objective:** Patients with obstructive sleep apnea syndrome (OSAS) often express daytime complaints related to their cognitive functioning. So far subjective cognitive functioning is hardly studied in OSAS patients and the relation between subjective and objective measures of cognition is still unclear. The aim of this study is to compare subjective cognitive functioning in OSAS patients to healthy controls and explore its relation to objective cognitive functioning.

**Participants and Methods:** We compared 36 newly diagnosed OSAS patients without any medical comorbidity to 33 healthy controls on self-report measures of cognitive dysfunction. Additionally all participants completed a test battery of neuropsychological tests.

**Results:** Overall OSAS patients had significant higher scores on self-report measures of cognitive dysfunction compared to healthy controls. Specifically OSAS patients had significant higher scores on subscales evaluating problems related to distractibility, remembering names and words and executive functioning. On objective measures, OSAS patients only showed a significant poorer performance on a word-learning task. However this poorer performance showed no correlation to any of the subjective measures of cognitive dysfunction.

**Conclusions:** OSAS patients showed more cognitive complaints compared to healthy controls and consistent with previous studies diminished objective cognitive functioning on a word-learning task. Cognitive complaints and objective cognitive functioning showed no correlation. These findings validate the cognitive complaints often expressed by OSAS patients and are in accordance with the low or absence of correlations often found between subjective and objective functioning in other patient populations.

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#### **S.D. VAN DER LINDEN, I. MESKAL, M.E. SALDEN, G. RUTTEN & M.M. SITSKOORN. Cognitive Deficits in Meningioma Patients in Preoperative and Postoperative Stage.**

**Objective:** Cognitive dysfunction is common in patients with primary brain tumors and it is now recognized as an independent prognostic factor in survival. In addition, cognitive functioning has a major impact on quality of life and the ability to perform activities of daily living. Previous studies have mainly focused on glioma patients. This prospective follow-up study focuses on cognitive functioning in meningioma patients before and after surgery.

**Participants and Methods:** Sixty-one meningioma patients, who underwent an intracranial neurosurgical procedure in the St. Elisabeth Hospital, were assessed one day before surgery and 3 months after surgery. To identify the impaired domains of cognitive function, all patients were assessed with a computerized neuropsychological test, CNS Vital Signs. The standard scores of the patients on seven cognitive domains were compared with the normative healthy American control group from CNS VS by means of one-tailed one-sample t-tests.

**Results:** Meningioma patients showed significantly lower scores on all cognitive domains preoperatively, in comparison with healthy controls ( $p < 0.05$ ). After surgery, the performance of the patients was significantly lower on the domains of memory, psychomotor speed, reaction time and complex attention. Their scores on the three other domains (cognitive flexibility, processing speed and executive functioning) did not deviate from the controls.

**Conclusions:** Based on these results, we can conclude that meningioma patients are faced with substantial cognitive dysfunction in several cognitive domains both pre- and postoperatively. This study emphasizes the importance of the use of neuropsychological tests to identify cognitive deficits in meningioma patients, so that appropriate treatment can be provided.

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#### **Medical/Neurological Disorders/Other (Child)**

#### **J. EBBINK, F. AARSEN, C. VAN GELDER, H. VAN DEN HOUT, N. WEISGLAS-KUPERUS, J. JAEKEN, M. LEQUIN, W. ARTS & A. VAN DER PLOEG. Cognitive Outcome Of Patients With Classic Infantile Pompe Disease Receiving Enzyme Therapy.**

**Objective:** Classic infantile Pompe disease affects many tissues, including the brain. Untreated infants die within their first year. Although enzyme-replacement therapy (ERT) significantly increases survival, its potential limitation is that the drug cannot cross the blood-brain barrier. We therefore investigated long-term cognitive development in patients treated with ERT.

**Participants and Methods:** We prospectively assessed cognitive functioning in 10 children with classic infantile

Pompe disease who had been treated with ERT since 1999. Brain imaging was performed in 6 children.

**Results:** During the first 4 years of life, developmental scores in 10 children ranged from above average development to severe developmental delay; they were influenced by the type of intelligence test used, severity of motor problems, speech/language difficulties, and age at start of therapy. Five of the children were also tested from 5 years onward. Among them were 2 tetraplegic children whose earlier scores had indicated severe developmental delay. These scores now ranged between normal and mild developmental delay and indicated that at young age poor motor functioning may interfere with proper assessment of cognition. We found delayed processing speed in 2 children. Brain imaging revealed periventricular white matter abnormalities in 4 children.

**Conclusions:** Cognitive development at school age ranged between normal and mildly delayed in our long-term survivors with classic infantile Pompe disease treated with ERT. The oldest was 12-years. We found that cognition is easily underestimated in children younger than 5 years with poor motor functioning

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#### **H. HOCHMAN COHEN, T. SILBERG, Y. GALIN, M. LEVAV, J. AHONNISKA-ASSA, T. SHANI-UR, J. LANDA & A. BREZNER. The Effect of Cerebellar Mutism on Neuropsychological Functions Among Children With Posterior Fossa Tumors.**

**Objective:** Long term cognitive outcome of pediatric Posterior Fossa (PF) tumors include deficits in executive functions, visual-spatial perception, expressive language and affect modulation. Cognitive outcomes vary due to numerous factors related to type of diagnosis, treatment protocols and background variables. However, these findings are not always consistent among studies. Cerebellar mutism (CM), a condition characterized by diminished speech as a result of the removal of PF tumors, is specifically associated with verbal deficits.

In the current study we aimed to investigate the relationship between diagnosis related factors, treatment and background variables and the neuropsychological profile, among children at the chronic stage following removal of PF tumors.

**Participants and Methods:** Thirty three children (age range 5-18, M=10.5 yrs; SD=3.6, 15 girls) diagnosed with PF tumors, (14 medulloblastoma; 5 ependimoma; 14 astrocytoma and glioma) participated in the study. Among them 11 with CM post surgery, 16 diagnosed before age 5, 19 treated with radiotherapy. Verbal expression and comprehension, visual perception, visuo-motor functions, verbal and visual memory, executive functions and attention were assessed.

**Results:** Children with CM showed significantly lower scores not only on verbal functions but also in visuo-motor functions, attention, and processing speed. Children affected with medulloblastoma had lower IQ scores than the ones with astrocytomas and gliomas. Treatment protocol, time since the beginning of treatment and age at diagnosis were not related to the neuropsychological functions.

**Conclusions:** CM post-surgery was the most evident symptom of pathology severity related to PF tumors. Our results indicate that CM is associated with a wider range of cognitive deficits added to the lower performance in language. These results suggest that the consequences of CM should be considered in the assessment as well as in the planning of rehabilitation. Correspondence: *Hila Hochman Cohen, PhD, Pediatric Rehabilitation, Edmond and Lili Safra Children Hospital, Sheba Medical Center, Tel Ha-Shomer, Ramat Gan 52621, Israel. E-mail: hochmanh@gmail.com*

#### **A. MARYNIAK & A. SEDEK. Huge Arachnoid Cyst Discovered Accidentally. Exemplary Student with "Underdeveloped Brain".**

**Objective:** We describe the case of teenage girl with a huge arachnoid cyst and psychological consequences of the diagnosis.

**Participants and Methods:** During computed tomography of paranasal sinuses in the fourteen year old girl was found a huge arachnoid cyst of Sylvian fissure and ambient cistern in the right hemisphere. Due to the absence of any symptoms, neurosurgical treatment was not taken and only systematic controls were recommended.

**Results:** Patient's parents asked for a neuropsychological consultation, because they were worried about the mental state of their daughter. Since the diagnosis of the cyst, the girl presented increasingly depressed mood, limitation of activity, avoidance of contact with peers. The teenager claimed that she had "underdeveloped brain", doubted her intellectual ability, and began to deny her achievements (she was an exemplary student). Also, the patient's parents reported cognitive dissonance - knowing the CT image of the daughter's brain they "could not understand" how she can function normally.

In the neuropsychological examination there was found above average intellectual development (IQ = 121), with a small predominance of verbal scale (IQ<sub>ver</sub> = 123) over performance scale (IQ<sub>per</sub> = 114). In other tests carried out in the patient, there were no noted deficits in memory, verbal and visual - spatial functioning. Only in the reproduction of the Rey Complex Figure Test (RCFT) score was significantly reduced.

**Conclusions:** The question is, whether the result of RCFT, as well as the difference between the level of verbal and performance scales of WISC-R, should be interpreted as a symptom associated with the presence of arachnoid cysts in the right hemisphere. Perhaps, without knowing the CT image, these results were interpreted as a natural variation of abilities, and fatigue or reduction of concentration during the performance of RCFT.

Case of the girl also shows the importance of appropriate information given to the patient about the results of the incidental findings in neuroimaging.

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#### **E. BENNETT, E. TALBOT, S. THOMAS & A. STARZA-SMITH. Paediatric brain tumour parent/carer support and information group: An evaluation.**

**Objective:** The study aimed to explore the impact and utility of a newly-developed support and information group for parents/carers of children with brain tumours at a regional neuro-oncology centre in the UK. Childhood brain tumours and their treatments can result in a range of neuropsychological consequences, and this can have a significant psychological impact on parents/carers. Providing support and information can help to empower families in managing these difficulties.

**Participants and Methods:** The group was developed for parents/carers of children with brain tumours. It aimed to provide an opportunity for parents/carers to develop their understanding of key neuropsychological issues and to access additional peer support. Six evening sessions included presentations and discussions on neuropsychological and psychological issues associated with childhood brain tumours (e.g. memory/executive functions/emotions/behaviour). Following the group parents/carers completed questionnaires on overall satisfaction, content and format of the group. They were also asked whether their expectations were met and if they would recommend the group to others.

**Results:** Session-by-session and overall satisfaction ratings indicated parents/carers found the group supportive, helpful and relevant. Parents/carers indicated that they valued opportunities to discuss concerns with professionals and other parents/carers and all said they would recommend it to others. Many parents commented they would like additional or longer sessions including more time for discussion. Some had already made changes in light of the information provided.

**Conclusions:** The pilot study demonstrated the positive value of a support and information group for parents/carers of children with brain tumours. Feedback received from parents/carers was positive and indicates the need and scope for this support in all paediatric neuro-oncology services.

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#### **E. TALBOT, A. STARZA-SMITH & A. HART. Encephalitis-Related Sleep Difficulties in the Developing Brain.**

**Objective:** Following encephalitis, children can experience a number of neuropsychological, psychological and medical consequences. A commonly reported problem is sleep difficulties post-illness. Following our

study of parent/carer reported HRQL, which identified frequent reports of sleep difficulties for children post-encephalitis and a significant correlation between sleep difficulties and parent/carer reported HRQL, we aimed to review existing literature within this topic area and identify key areas of future research.

**Participants and Methods:** We review findings of our study exploring parent/carer reported HRQL. 38 parents/carers of children/adolescents, aged 8 – 15 years old, who had a history of encephalitis responded to an invitation to take part. Participants were recruited through the Encephalitis Society and each parent/carer completed a Pediatric Quality of Life Inventory™ (PedsQL™), proxy measures of memory and executive function, as well as demographic/illness specific questions which included asking whether their child experienced sleep difficulties. A literature review into sleep difficulties post-encephalitis in childhood and proposals for areas of future research are presented.

**Results:** Of the study sample, 64% of children/adolescents were reported by their parents/carers to have difficulties with sleep post-encephalitis. Sleep difficulties were also found to significantly correlate with parent/carer reported HRQL. There is a dearth of literature specifically exploring sleep difficulties post-encephalitis in childhood.

**Conclusions:** Sleep difficulties following childhood encephalitis are frequently reported and are found to relate significantly to parent/carer reported HRQL. With few existing studies exploring encephalitis-related sleep problems in children we propose further research to explore this topic area, including investigation into sleep disorders related to organic encephalitis-related brain injury, and implications for rehabilitation at different stages of the child's brain development.

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#### **E. TALBOT, M. WILSON & A. STARZA-SMITH. Dancing Eye Syndrome (Myoclonus Opsoclonus Syndrome) in Children: A Case Study.**

**Objective:** Dancing Eye Syndrome (Opsoclonus-Myoclonus Syndrome) (DES/OMS) in children is a rare condition characterised by opsoclonus (rapid, involuntary, multidirectional eye movements), ataxia with myoclonus, irritability, sleep disturbance and mutism, sometimes associated with neuroblastoma. There are approximately 0.18 new cases per million total population of DES/OMS in children in the UK each year (Pang, de Sousa, Lang & Pike, 2010). Age at onset is typically reported in the literature to be approximately 18 months old. The condition is no more prevalent in any specific ethnic group and of the limited research available regarding outcome it is identified that there is the possibility of intellectual impairment, speech, motor and behavioural difficulties.

**Participants and Methods:** Chloe is a nine-year-old female diagnosed with DES/OMS without neuroblastoma at the age of two-years. We present the neuropsychological and psychological assessment compiled for this case assessing cognitive domains including memory (CMS), general intellectual abilities (WNV & WISC-IV) and emotion and behaviour (SDQ). The particular case we present is complicated by cultural and language issues and we discuss the challenges of differentiating these factors from condition specific deficits.

**Results:** Chloe demonstrates significant difficulties in learning, memory, and behaviour, with performance on certain cognitive domains such as verbal memory being below the 1st percentile. Complex cultural and language considerations were evident throughout the assessment, speaking three languages and having recently entered the UK education system.

**Conclusions:** A review of the literature on this condition, neuropsychological assessment findings and recommendations for rehabilitation are presented. The importance of understanding this rare condition and informing educational provision and community based support in this case is highlighted, particularly due to complex cultural and language concerns.

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## Psychopathology/Neuropsychiatry (Schizophrenia)

**E. ANDRÉS, S. FERNANDEZ-GONZALO, M. TURON, E. POUSA, D.J. PALAO & M. JODAR. Neuropsychological profile of first-episode schizophrenia patients.**

**Objective:** In recent years cognitive deficits have become a core symptom of schizophrenia, fact that has influenced the process of diagnosis and treatment of the illness. As in chronic patients with schizophrenia, it is known that patients with first episode may also exhibit impairment in different cognitive domains (attention, working memory, learning, memory and executive functions). Although some authors have described a specific cognitive profile in patients in the early stages of schizophrenia compared to chronic patients, others studies have shown controversial results. In order to observe whether early stages are associated to specific cognitive profile compared to chronic patients, the aim of this study is describe the cognitive profile of a first-episode schizophrenia sample.

**Participants and Methods:** 30 patients with first-episode schizophrenia were assessed through a comprehensive neuropsychological battery including measures of Verbal and Visual Memory, Attention, Executive Function and Speed of Processing. At the moment of the study 89.3% of the patients were receiving atypical antipsychotic medication, 7.1% typical antipsychotic and 3.6% anticholinergic drugs.

**Results:** Patients sample showed a mean age of 31, a mean education years of 12 and a mean duration of illness of 3.7 years as descriptive characteristics. Raw scores of each measure were converted on z-scores. Z-scores means were grouped on the five cognitive domains assessed. All cognitive domains were below the mean: Attention ( $z = -0.2$ ), Verbal Memory ( $z = -0.86$ ), Visual Memory ( $z = -0.74$ ), Executive Function ( $z = -0.94$ ) and Speed Processing ( $z = -1.5$ ).

**Conclusions:** Although most cognitive domains were preserved, all of them were slightly below average. Only speed of processing was found to be more impaired with 1.5 standard deviation below average. The neuropsychological profile of first-episode schizophrenia patients seems to be similar to chronic schizophrenia patients but with lower severity.

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**L. BAIS, A. VERCAMMEN, F. VAN ES, B. VISSER, A. ALEMAN & H. KNEGTERING. Efficacy and Durability of Left and Bilateral repetitive Transcranial Magnetic Stimulation (rTMS) for Auditory Verbal Hallucinations in Schizophrenia.**

**Objective:** Various repetitive Transcranial Magnetic Stimulation (rTMS) studies have been performed to reduce auditory verbal hallucinations (AVH). Although neuroimaging findings point to the bilateral involvement in the genesis of AVH, most studies have restricted stimulation to the left temporo-parietal junction (TPJ) area. Furthermore, little is known about the durability of rTMS treatment effects. As an extension of the trial by Vercammen et al. (2009), we examined the efficacy and durability of 1 Hz rTMS treatment delivered to the left or bilateral TPJ area, compared to sham treatment.

**Participants and Methods:** 47 schizophrenia patients with persistent AVH were randomly allocated to rTMS treatment of the left or bilateral TPJ area or sham treatment. Patients were treated for 6 days, twice daily for 20 minutes at 90% of their motor threshold. Efficacy was measured with Positive and Negative Syndrome Scale (PANSS), Auditory Hallucinations Rating Scale (AHRS), and Positive and Negative Affect Scale (PANAS). We included follow-up measures with AHRS and PANAS at 1 week, 4 weeks and 3 months. Data were analyzed with repeated measures ANOVA.

**Results:** Mean scores of Hallucination item of the PANSS decreased during the treatment period ( $F(2, 44) = 2.55, p = .09$ ), without interaction between treatment and time. Mean scores on the Hallucination Frequency item of the AHRS, and negative and positive subscales of the PANAS decreased most during the treatment period, and these reduced scores remained on the same level for three months ( $F(2.55, 112.27) = 5.30, p = .003$ ;  $F(2.83, 96.22) = 8.53, p < .001$ ;  $F(2.48, 81.98) = 4.00, p = .015$ , resp.). Again, there was no effect of treatment.

**Conclusions:** In this study, the hypothesized superior effect of bilateral rTMS in the treatment of AVH was not supported. Although the reduction in hallucination scores was not specific for any treatment condition, the scores did not return to baseline. For future research, investigating treatment parameters and factors predicting individual response, may be considered.

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**H.E. BARDER, K.S. SUNDET, B.R. RUND, J. EVENSEN, U. HAAHR, W. HEGELSTAD, I. JOA, J. JOHANNESSEN, H. LANGEVELD, T. LARSEN, I. MELLE, S. OPJORDSMOEN, J. RØSSBERG, E. SIMONSEN, P. VAGLUM, T. MCGLASHAN & S. FRIIS. Ten year neurocognitive trajectories in first-episode psychosis.**

**Objective:** Neurocognitive impairment is commonly reported in psychotic disorders. However, long-term neurocognitive course remains largely uninvestigated in first episode psychosis (FEP) and its relationship to clinically significant subgroups even more so. We report 10 year longitudinal neurocognitive development in a sample of FEP patients, and explore whether the trajectories of cognitive development are related to presence of relapses within in the first year, with a special focus on the course of verbal memory.

**Participants and Methods:** Forty-three FEP subjects (51% male,  $28 \pm 9$  years) were followed-up neurocognitively over five assessments spanning 10 years. The test battery was divided into four neurocognitive indices; Executive Function, Verbal Learning, Motor Speed, and Working Memory. The sample was divided into those relapsing or not within the first year.

**Results:** The four neurocognitive indices showed overall stability over the ten year period. Significant relapse x index interactions were found for all indices except the Executive Function. Follow-up analyses showed a significant decrease over time for the encoding stage within the Verbal Memory index for patients relapsing in the first year ( $F(1, 41) = 5.0, p = 0.031, \eta^2 = 0.11$ ).

**Conclusions:** Main findings are long term stability in neurocognitive development in first episode patients, except for poor verbal memory in patients with one or more (1-3) psychotic relapses early in the course of illness. We conclude that worsening of cognitive function may be expected for subgroups with repeated episodes of psychosis, but that most patients should expect no change in cognitive performance during the first 10 years after being diagnosed.

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**H. CHAN, R. STOLWYK, J. NEATH, W. KELSO, M. WALTERFANG, R. MOCELLIN & D. VELAKOULIS. Profiling Neurocognition and Social Cognition in Frontotemporal Dementia (FTD) and Chronic Schizophrenia.**

**Objective:** FTD and schizophrenia have historically been considered two very different disorders. However, recent research has revealed important similarities between the two in terms of clinical presentation, neurocognition, and neuropathology. The main aim of this research is to compare and contrast neurocognition and social cognition in FTD and chronic schizophrenia on retrospective and prospective data. The hypothesis is that the two groups will be very similar in their profiles.

**Participants and Methods:** Retrospective neuropsychological data of patients with FTD and chronic schizophrenia ( $n = 38$  per group) was obtained from a clinical database. Tests were categorised into cognitive domains and an average z-score derived for each domain. Prospective neuropsychological data and social cognition data were collected (using a fixed test battery and The Awareness of Social Inference Test, TASIT, respectively) from participants with FTD ( $n = 12$ ) and chronic schizophrenia ( $n = 19$ ) as well as healthy controls ( $n = 19$ ).

**Results:** Statistical analyses were conducted using "traditional" difference of means analyses and equivalence testing. The two patient groups were found to be very similar on the retrospective data, differing significantly only in the Switching domain. Analysis of the prospective data revealed further similarities as well as differences. For social cognition, the patient groups were significantly different only in the recognition of the emotion "anger".

**Conclusions:** The current analyses of neurocognitive and social cognition data in FTD and chronic schizophrenia revealed similar performances across most domains. Interesting differences were also uncovered. These findings contribute to a growing body of literature showing that FTD and chronic schizophrenia may not be as dissimilar as previously suggested and that in some patients may be two sides of the same coin. Correspondence: *Hui-Minn Chan, School of Psychology and Psychiatry, Monash University, Department of Psychology, Clayton, VIC 3800, Australia. E-mail: huiminn@gmail.com*

**R. DEL PINO SÁEZ, C. SCHRETLEN, J. PEÑA, E. ARETOULI, N. OJEDA DEL POZO, A. DE LA CRUZ & M. ASPIUNZA. Clinical Symptoms Moderate the Association Between Nicotine Dependence and Cognition.**

**Objective:** The self-medication hypothesis suggests that increased nicotine consumption improves cognitive performance in the domains of attention, working memory, and executive function and diminishes clinical symptoms in patients with schizophrenia. However, it is unclear whether clinical symptoms affect the association between nicotine dependence (ND) and cognition.

**Participants and Methods:** We investigated the potential interaction effect of clinical symptoms and ND on cognitive performance in 30 patients with schizophrenia who reported smoking habitually. Level of ND, clinical symptoms, and cognitive performance on tasks of attention, memory, working memory, executive functions, and processing speed were evaluated. We used hierarchical regression to analyze the potential moderator effect of clinical symptoms on the relationship between ND and cognitive performance.

**Results:** Severity of total positive symptoms moderated the relationships between ND and both attention ( $p=.046$ ) and executive function ( $p=.043$ ). Severity of total negative symptoms moderated the relationships between ND and both attention ( $p=.007$ ) and processing speed ( $p=.008$ ). Among negative symptoms, poor social contact influenced the relationships between ND and attention ( $p=.005$ ), processing speed ( $p=.007$ ), and executive function ( $p=.013$ ). Social isolation influenced the relationships between ND and memory ( $p=.001$ ), processing speed ( $p=.003$ ), and executive function ( $p=.000$ ).

**Conclusions:** Both positive and negative clinical symptoms moderated the relationship between ND and cognitive performance in patients with schizophrenia. Interestingly, in patients with fewer clinical symptoms, high levels of ND contributed to higher cognitive performance. However, in patients with more severe clinical symptoms, high levels of ND were associated with worse performance. Our results suggest a significant interplay between the severity of clinical symptoms and ND in the determination of cognitive function in patients with schizophrenia.

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**S. FERNANDEZ-GONZALO, M. TURON, E. POUSA, D. PALAO & M. JODAR. Preliminary Efficacy Findings of a New Social and Non-Social Cognitive Rehabilitation Computerized Program for Schizophrenia/Schizoaffective Disorders in Early Stages.**

**Objective:** People with schizophrenia and schizoaffective disorders present neuropsychological deficits in almost every cognitive domain. These deficits are observed before illness onset and they present a significant decline on the first episode. Neuropsychological deficits are linked with the daily-living functioning, but recently, authors have demonstrated that social cognitive impairments have a greater impact in functional outcomes. Cognitive rehabilitation has demonstrated consistent effects improving cognitive performance as well as ameliorating symptoms and psychosocial functioning. However, the active key of these interventions for generalization remains unknown.

The aim of this study is to present the preliminary efficacy results of a new social and non-social cognitive computerized program for people with schizophrenia/schizoaffective disorder in early stages of the illness.

**Participants and Methods:** 13 patients that met inclusion criteria were randomized between treatment and control groups. A comprehensive assessment of social and non-social neuropsychological and functional variables was carried out before and after treatment.

**Results:** Mann-Whitney test showed significant differences between groups in Digits Span Backward ( $p=0.002$ ), Spatial Span Forward

( $p=0.04$ ), Logical Memory Immediate Recall ( $p=0.04$ ), Logical Memory Learning Curve ( $p=0.02$ ), and in processing of sadness in the Pictures of Facial Affect ( $p=0.04$ ). A tendency to significant was observed in Spatial Span Backwards ( $p=0.06$ ), RAVLT Learning Curve ( $p=0.07$ ), 2nd Order ToM Task ( $p=0.06$ ), and Social Functioning Scale ( $p=0.06$ ).

**Conclusions:** This new intervention showed preliminary efficacy results for visual attention, logical and verbal learning, working memory and emotional processing as well as a tendency to improve theory of mind and functional outcome. The importance of social and non-social cognitive rehabilitation as a preventive tool in early phases of psychosis is discussed. Project funded by Fundació la Marató TV3

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**O. RILO CANO, N. IBARRETXE-BILBAO, L. OLABARRIETA LANDA, C. SCHRETLEN, M. VARVARIS, J. PEÑA LASA & N. OJEDA DEL POZO. Altered White Matter Connectivity Relates to Processing Speed Deficits in Schizophrenia.**

**Objective:** Schizophrenia is associated with impairments in many cognitive functions, but processing speed (PS) may be considered the most prevalent deficit in this disorder. This cognitive function has been related to white matter (WM) integrity in other pathologies and in healthy aging in several brain areas. Our aim is to investigate the relationship between performance on tasks of PS and whole brain WM fractional anisotropy (FA) in schizophrenia.

**Participants and Methods:** We recruited 73 stable outpatients with schizophrenia (mean age=37) and 42 healthy controls (mean age=44). Participants were given an extensive battery of neuropsychological tests and a diffusion tensor MRI on a Siemens 3T scanner. Total correct responses on the letter portion of the Salthouse Perceptual Comparison Test (PCT) were considered indicative of PS and was correlated with WM FA values. Whole-brain voxel-wise regression analysis of PS and cerebral WM FA data was performed using TBSS (Tract-Based Spatial Statistics) as implemented in FSL.

**Results:** Participants with schizophrenia performed significantly worse than controls on the PCT ( $p<.01$ ). In participants with schizophrenia the strongest positive correlation between performance and FA was found in a cluster of voxels ( $n=9309$ ) in the forceps minor and genu of the corpus callosum bilaterally ( $p_{corrected}=.016$ ). PS also correlated significantly with FA in the bilateral superior corona radiata, bilateral corticospinal tract and with WM adjacent to the primary somatosensory area. No correlations surviving correction existed between processing speed and FA in the control group.

**Conclusions:** Our results reinforce the previously documented impairment on tasks of PS in participants with schizophrenia as well as the relationship between decreased FA in fronto-parietal regions and the corpus callosum and deficits in PS. Finally, we conclude that there exists a contribution of specific WM tracts to impairments in PS in schizophrenia.

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**M. KIM, D. JUNG, B. KANG & K. JANG. Deficits of decision making in patients with schizophrenia.**

**Objective:** Schizophrenia patients show deficits in real-life decision making, but the nature of these deficits is not fully understood. This study investigated deficits of decision making in schizophrenia patients with Iowa Gambling Task (IGT) and Prospect Valence Learning (PVL) Model.

**Participants and Methods:** Twelve schizophrenia patients and age-matched 10 normal controls participated.

IGT was administered to evaluate the decision-making. Participants were required to select one card from four decks in each trial. Each selection resulted in monetary gain or loss. There were 2 advantageous decks with long-term gains (C' & D') and two disadvantageous decks with long-term losses (A' & B'). Participants needed to learn from experience which decks were advantageous for monetary gains. PVL model was applied to evaluate the participants' decision-making process. This model estimates four parameters; utility shape (subjective evaluation for selection outcome based on gains & losses), loss aversion (sensitivity

ity to losses), recency (selection based on feedback of previous trials), and consistency (consistent selection of cards which individual prefers) parameters. PVL parameters were estimated with Markov Chain Monte Carlo (MCMC) sampling scheme in OpenBUGS and BRUGS, its interface to R.

**Results:** The two groups differed in total net score,  $t(20)=-2.88$ ,  $p<.01$  with significantly lower score in schizophrenia than control group. For deck selection, schizophrenia group selected D' deck significantly less than control group,  $t(20)=-2.83$ ,  $p<.05$ . In terms of PVL analysis, schizophrenia group exhibited lower value for loss aversion parameter,  $U=9.00$ ,  $p<.001$ , than control group

**Conclusions:** The schizophrenia patients showed significantly lower net score and less selection of advantageous deck (D') than did control group. In addition, patients were less sensitive to loss than controls. These results indicate that schizophrenia patients have deficits of decision-making, which may be resulted from gain-biased tendency.

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**N.G. KLAASEN, J. VAN DER VELDE, P.M. GROMANN, M. SWART, E.M. OPMEER, D. WIERSMA, R. BRUGGEMAN, L. DE HAAN, L. KRABBENDAM & A. ALEMAN. Brain Activation in Unaffected Relatives of Patients with Schizophrenia During Emotional Perception.**

**Objective:** Patients with schizophrenia have been shown to attribute salience to nonsalient information. Recent insights suggest that patients often show more activation in emotional attention areas than healthy controls when viewing neutral pictures. Activation during negative pictures does not differ (Anticevic et al., 2010). This has also been found in individuals clinically at risk for schizophrenia (Seiferth et al., 2007). In this study we examined whether unaffected first-degree relatives of patients with schizophrenia show more activation while viewing neutral pictures and similar activation while viewing negative pictures, compared to healthy controls.

**Participants and Methods:** 50 relatives and 50 matched healthy controls (HC) viewed and rated neutral and negative images during functional Magnetic Resonance Imaging (fMRI). Ratings were analyzed non-parametrically. Brain activation was compared between groups for the contrasts negative > fixation, neutral > fixation, and negative > neutral. An initial threshold was set at  $p<.001$  and statistical significance was defined as  $p<0.05$  FWE corrected on cluster level.

**Results:** Relatives rated neutral pictures more negative than HC ( $p=.006$ ). There was no difference in the ratings of negative pictures ( $p=.139$ ).

In HC, while viewing neutral pictures, occipital and parietal activation related to visual processing was found. Furthermore, while viewing negative pictures, activation was found in frontal emotional processing areas and emotional attention areas like the precuneus and the amygdala. Relatives showed the same activation pattern. Thus, there were no significant differences between the groups in activation for neutral or negative stimuli, or their comparison.

**Conclusions:** Although behavioral measures suggest that neutral pictures may be more salient to relatives, measures of brain activation did not reveal any differences. Therefore, our results do not support the hypothesis of a difference between relatives and controls regarding brain activation during emotion perception.

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**C. KOS, J. DLABAC-DE LANGE, L. BAIS, H. KNEGTERING & A. ALEMAN. Cognitive Performance in Schizophrenia Patients Before and After rTMS Treatment over the Prefrontal Cortex.**

**Objective:** Repetitive Transcranial Magnetic Stimulation (rTMS) is a relatively new technique in the treatment of various neuropsychiatric conditions. In schizophrenia rTMS is investigated as an "add-on" therapy for both positive and negative symptoms (Biswa et al., 2011). It has been suggested that rTMS treatment could also beneficially influence cognitive functioning (Mogg et al., 2007). The purpose of the present study was to investigate possible cognitive effects of a longitudinal rTMS treatment for negative symptoms in schizophrenia patients.

**Participants and Methods:** In this randomized controlled trial, 26 schizophrenia patients with moderate to severe negative symptoms (PANSS negative subscale  $\geq 15$ ) were included. Patients received either a three-week active rTMS treatment targeting the bilateral dorsolateral prefrontal cortex (DLPFC), or a sham rTMS treatment. The treatment was provided twice daily in the local institution for mental health care. Cognitive functioning was measured by means of the Digit Symbol Substitution Test (DSST), the Trailmaking Test (TMT), the Verbal Fluency Test (VFT), and the Rey's auditory verbal learning Task (RAVLT) prior to treatment, directly after treatment, and at a four-week follow-up.

**Results:** ANCOVA analysis, including pre-treatment scores, age, sex, and level of education as covariates, did not reveal any effects of treatment on cognitive processing, on any of the tasks. Analysis were performed for pre- and post-treatment comparisons, and pre-treatment and follow-up comparisons.

**Conclusions:** In the present study, a wide range of highly sensitive cognitive tasks are used that target separate cognitive domains. The results may imply that even though rTMS does not affect cognition beneficially, it neither has a potentially adverse effect on cognitive functioning.

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**E. OPMEER, E. LIEMBURG, J. VAN DER VELDE, R. NIEBOER, L. WUNDERINK & A. ALEMAN. Neural correlates of self-reflection in individuals with an ultra-high risk for psychosis.**

**Objective:** Disturbances in the basic sense of the self have been associated with vulnerability for psychosis. The cortical midline structures (CMS) of the brain, the inferior frontal gyrus (IFG), and inferior parietal lobule (IPL) play an important role in self-reflective processing. Previously, our group has reported abnormal activations in these regions in patients with schizophrenia (van der Meer et al., 2012) and in people with high psychosis proneness (Modinos et al., 2011). The aim of the current study was to investigate brain activation during self-reflection in a sample with an ultra-high risk (UHR) for psychosis.

**Participants and Methods:** Twelve UHR-subjects were included in addition to twelve age-, sex- and education-matched healthy controls (HC). All participants performed a self-reflection task during functional MRI scanning. The task comprised a self-reflection, other-reflection and semantic (baseline) condition. Both reflection conditions contained positive and negative related traits.

**Results:** UHR-subjects attributed more negative ( $U=26$ ,  $p<.05$ ) and less positive traits ( $U=14.5$ ,  $p<.05$ ) to themselves than HC. There were no differences for other-related traits. Functional MRI analyses showed that both groups robustly activated the CMS during reflection of the traits to self and others compared to judging semantic baseline sentences. Only during reflection of positive traits to the self, between group differences were present: UHR-subjects showed more activation in the right IFG and left IPL ( $p<.001$  unc.).

**Conclusions:** UHR-subjects attributed less positive traits to them selves, which on a neural level was reflected by more activation in areas relevant for self-reflective processing. This could imply a less efficient processing of positive traits and might be associated with low self-esteem and depression symptoms, which have both been described in UHR-individuals. Replication in a larger sample is necessary, in addition to the investigation of predictive value for transition to clinical psychotic disorders. Correspondence: *Esther Opmeer, University Medical Center Groningen, A. Deusinglaan 2, Groningen 9713 AW, Netherlands. E-mail: e.m.opmeer@umcg.nl*

**S. TSOTSI, M.H. KOSMIDIS, K. FOKAS & V.P. BOZIKAS. The role of attention in emotion perception in schizophrenia: training attention to facial features.**

**Objective:** Previous studies have suggested that emotion perception deficits in schizophrenia cannot be attributed solely to dysfunctional affective processing, but also reflect impairments in attention. Specifically, Combs and colleagues (2008) reported that attention-shaping may improve facial emotion perception recognition in these patients. In the present study, we explored the effect of a brief intervention to enhance emotion perception in schizophrenia, involving training participants to attend to crucial facial features.

**Participants and Methods:** Twenty four outpatients with schizophrenia were randomly assigned to the intervention (IP) or no intervention control (CP) groups. Twelve healthy adults also completed the same intervention protocol (IH). We assessed all participants' ability to attend to details in facial features and match them based on identity (AF), and to recognize the emotion expressed in photographs of faces (FER) at baseline and immediately after the intervention.

**Results:** Repeated-measures ANOVAs (within subject variable: time of assessment) showed improved AF accuracy from pre- to post-intervention in both IP and IH groups, but not on emotion recognition. Additionally, post-intervention between groups comparisons showed greater AF accuracy in the IP relative to the CP group, but no patient group difference on FER accuracy; the IH group had the highest accuracy on both conditions.

**Conclusions:** Thus, training patients with schizophrenia to attend to critical facial features yielded improvement specifically in this process, but did not improve emotional expression recognition accuracy. Our results contradict previous suggestions regarding the impact of an attention intervention alone in enhancing facial emotion recognition accuracy in schizophrenia. Instead, affective processing deficits appear to play the primary role, with an aggravating contribution of the attention component.

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**V.P. BOZIKAS, A. DARDAGANI, S. TSOTSI, A. LAGOUDIS, P. ATHANASIS, C. MAMALIS & K. FOKAS. A differential deficit in executive function in 1st psychotic episode patients: a six months and 1 year follow-up.**

**Objective:** Many researchers have focused on executive ability in 1st psychotic episode patients as a unified function. However, more detailed research is needed to identify the role of specific sub-components of executive function, their possible change over time and their involvement in the course of the illness.

**Participants and Methods:** We administered alternative forms of a battery to 23 patients (13 men) at the time of diagnosis and at 6 months follow-up; 12 (4 men) of them were also reassessed after 1 year. Specific non-verbal tests of the Cambridge Neuropsychological Automated Battery (CANTAB) were used, in order to measure the cognitive domains of memory, attention, planning, inhibition, shifting ability, mental flexibility, working memory, and visuospatial ability. In addition, a paper and pencil test assessing verbal learning and recall – adapted for the Greek language – was administered.

**Results:** Repeated-measures ANOVA was used on performance with time of administration as a within-subject factor. Overall neuropsychological performance remained stable after 6 months, whereas improvement was noticed on the 1-year follow up. Specifically, there was an improvement in attention and planning on the 6-month evaluation, but deterioration in mental shifting and flexibility; these functions remained stable on the 1-year assessment. Visual retention, inhibition and visual working memory remained stable over time and so has verbal learning and long-term recall.

**Conclusions:** Our data suggest that distinct aspects of executive function have a different course over time. It seems that early on, specific cognitive areas of executive function, such as mental shifting and flexibility, deteriorate rapidly. Considering the role these areas have been suggested to play in psychosocial functioning, our results highlight the importance of intervention early in the course of the illness.

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**M. TURON, S. FERNANDEZ-GONZALO, E. POUSA, D.J. PALAO & M. JODAR. Improving Jumping To Conclusions Bias After Social and Non-Social Cognitive Computer-based Intervention in First-episode Schizophrenia and Schizoaffective Patients.**

**Objective:** Individuals with schizophrenia present specific cognitive biases that may play a role in the development and exacerbation of symptoms and may impair overall functioning. These cognitive biases precede the psychotic first-episode and represent thinking distortions and

unconscious processing preferences rather than impairment in neuropsychological functions. Nowadays, it is known that cognitive rehabilitation is effective in ameliorating symptoms and improve cognitive performance and social functioning. However, there are few interventions for the treatment of these cognitive biases.

**aim:** To present the preliminary findings of the efficacy of a social and non-social cognitive computer-based intervention for first-episode schizophrenia/schizoaffective patients, that includes an specific module to treat cognitive biases such as jumping to conclusions (JTC) and bias against disconfirmatory evidence (BADE).

**Participants and Methods:** 13 patients that met inclusion criteria were randomized between treatment and control groups. Treatment group received a social and non-social cognitive intervention whereas control group received a non-specific computer-based intervention. Groups were compared before and after on two cognitive biases measures (JTC and BADE).

**Results:** Groups did not differ in age, diagnosis, illness duration, pharmacological treatment and severity of symptoms nor JTC and BADE measures at baseline. After treatment, Mann-Whitney test showed significant differences between groups in JTC measure ( $p=0.04$ ).

**Conclusions:** After social and non-social cognitive intervention, treatment group showed a decrease on JTC behavior compared with control group. These results could suggest that metacognitive interventions focused on cognitive biases, bringing these biases to the awareness of patients, could be beneficial in the treatment of these patients.

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**K. VERWEIJ, E. DERKS, W. CAHN & G. INVESTIGATORS. The association between intelligence scores and family history of psychiatric disorder in schizophrenia patients, their siblings and healthy controls.**

**Objective:** The degree of intellectual impairment in schizophrenia patients and their relatives has been suggested to be associated with the degree of familial loading for schizophrenia. These studies have not taken into account the fact that other psychiatric disorders are also more present in relatives of schizophrenia patients. Therefore, the definition of family history should be broadened. The association between family history for psychiatric disorder and intelligence scores was investigated in patients with non-affective psychosis, their unaffected siblings and healthy controls

**Participants and Methods:** A sample of 712 schizophrenia proband families (696 patients and 766 siblings) and 427 healthy control families (517 subjects) participated in this study. Family history of psychiatric disorder was determined while excluding the data of the participating schizophrenia patient. A dichotomous division was made between families with no first- or second degree relative with psychiatric disorder and families with one or more affected relatives. Total intelligence scores were estimated by admission of the short form of the Wechsler Adult Intelligence Scale III

**Results:** A significant interaction was found between family history for psychiatric disorder and clinical status. Patients with a positive family history of psychiatric disorder obtained higher intelligence scores compared to patients with no family history with an opposite effect in controls. No significant difference was found between siblings of schizophrenia patients with or without a positive family history

**Conclusions:** In patients with schizophrenia, a negative family history for psychiatric disorder was associated with relatively low IQ suggesting that the etiology in these patients may involve environmental or genetic factors which are unique to the patient and are not observed in other members of the pedigree. Possible factors include severe environmental stressors including premature birth or brain injury and genetic factors (e.g de novo Copy Number Variants)

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**C.T. VISSERS, S. KOOLEN, D.J. CHWILLA & J.I. EGGER. Attention in Schizophrenia and Autism Spectrum Disorders: Evidence from P300.**

**Objective:** Autism spectrum disorders (ASD) and schizophrenia show phenomenological overlap and have been proposed to share a common underlying pathogenesis. We investigate whether both psychopathological conditions can be conceptualized as disorders of attention.



**Participants and Methods:** To examine attentional processing, event-related potentials (ERPs) were recorded in an oddball paradigm. Previously, infrequent stimuli in this paradigm elicit a large positivity (P300). P300 has been proposed as the neural signature of the working memory update of changes in the environment. Specifically, variations in P300 latency and amplitude have been taken to reflect differences in the degree and quality of attentional mechanisms required to change the mental model of the environment. In the present ERP experiment, 10 patients with ASD, 10 patients with schizophrenia, and 10 healthy controls were exposed to a visual oddball task (frequent stimulus: large circle; odd stimulus: small circle). All participants were asked to silently count the odd stimuli.

**Results:** A centroparietally distributed P300 effect was elicited for both controls, patients with ASD and schizophrenia. For controls, the P300 effect was more broadly distributed compared to the P300 in ASD patients and schizophrenia patients and was also present at bilateral occipital sites.

**Conclusions:** The smaller scalp distribution of P300 in ASD and schizophrenia could reflect differences in the amount of attentional resources allocated in processing target stimuli. These differences can both be associated with hypervigilance and inattention observed in patients with ASD and schizophrenia.

The present ERP findings suggest that both ASD and schizophrenia can be conceptualized as disorders of attention and speak in favor of a common pathogenesis. Future research should reveal whether similar attentional mechanisms also play a role in higher-order cognitive disturbances in both ASD and schizophrenia.

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### TBI (Adult)

**S.L. BARKER-COLLO, A. THEADOM, V. FEIGIN, S. AMERATUNGA, K. JONES, N. STARKEY & K. MCPHERSON. Prevalence and Predictors of Posttraumatic Stress Disorder in Adults 1 Year Following Traumatic Brain Injury: A Population Based Study.**

**Objective:** Posttraumatic stress disorder (PTSD) and Traumatic Brain Injury (TBI) are not uncommon in the general population. There is growing evidence that TBI increases the risk of suffering PTSD. The present study examined the prevalence and predictors (demographic and injury related) of PTSD at one year following TBI in a population-based sample.

**Participants and Methods:** The study examined baseline demographic (eg, ethnicity, gender, age, prior mental health issues) and TBI characteristics (eg, severity indicators, mechanism) and their relationship to presence/absence and severity of PTSD at one year post-injury as assessed using the Posttraumatic Diagnostic Scale in 431 adults (aged >15 years) who experienced a TBI in the 12 months from Feb 2011 to March 2012.

**Results:** Just over 12% of the sample met all criteria for PTSD on the PDS, with heightened arousal being the most commonly reported symptom, followed closely by avoidance. On average participants reported 3 PTSD symptoms. The greatest proportion of participants were injured as a result of a fall, with approximately one quarter of all injuries classified as intentional, and a similar proportion having alcohol implicated. Those who met all criteria for PTSD at one year post-TBI were significantly more likely to report a prior history of depression or anxiety, and to have drugs involved/implicated in the injury. Increased length of loss of consciousness (LOC) was significantly related to increased severity of PTSD symptoms reported, as was female gender and intentional injury. Regression analyses indicate that female gender, longer LOC and intentional injury were predictive of PTSD severity.

**Conclusions:** The findings indicate that PTSD is a common long-term sequel of TBI, with increased risk associated with gender injury severity (LOC) and the intentionality of the incident injury. These findings have implications for identification and targeting of assessment and intervention resources towards those at greatest risk of developing PTSD following a TBI

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**K. BEECKMANS, K. MICHELS, R. CLUYDTS, R. SMIJERS & P. VANCOILLIE. Evaluation of Impaired Self-awareness of Memory Deficits after Traumatic Brain Injury by means of the Predicted Performance Method.**

**Objective:** Patients with a traumatic brain injury (TBI) show frequently an impairment of memory self-awareness. In this study the magnitude of impaired self-awareness of memory deficits was determined by means of the predicted performance method (PPM).

**Participants and Methods:** The results of 30 patients with a TBI (mean post-TBI duration of 25 weeks) were compared with the results of a matched control group of 30 healthy subjects. The lack of memory self-awareness was examined using the difference between predicted and actual performance (i.e. the PPM) on 2 episodic memory tests (Rey Auditory-Verbal Learning Test (RAVLT) and Rey Visual Design Learning Test (RVDLT)) and an event-based prospective memory task (PMT).

**Results:** The results suggest that TBI patients, in comparison with healthy subjects, show significant more unrealistic expectations about their performance on both episodic memory tests (for the variables total immediate recall (after five trials) and short-term and long-term (after 20 min.) delayed free recall) and the PMT (remembering 3 items). However, no significant difference could be detected between the two groups for the variable delayed (after 20 min.) recognition of both memory tests. In our TBI patients we also noticed that post-TBI duration was correlated significantly with an increase in memory self-awareness for the 3 recall variables of the RAVLT and RVDLT.

**Conclusions:** In conclusion we can state that the PPM seems to be a useful method to evaluate memory self-awareness in patients with a TBI. Correspondence: *Kurt Beeckmans, Ph.D., CEPOS, Rooienberg 21, Duffel 2570, Belgium. E-mail: kurt.beeckmans@emmaus.be*

**C. YANG, K. YUEN, S. HUANG, S. HSIAO, Y. TSAI & W. LIN. 'Good-old-days' Bias: A Prospective Follow-Up Study to Examine the Pre-Injury Super-Normal Status in Patients with Mild Traumatic Brain Injury.**

**Objective:** Post-concussion syndrome (PCS) is not uncommon in patients with mild traumatic brain injury (mTBI). Although the cause of the PCS is still controversial, a psychological mis-perception, the 'Good-old-days' bias, has been indicated as one of the influencing factors on symptom reporting after injury. Unfortunately, this response bias could only be examined in fewer cross-sectional studies. The purpose of this study thus is to prospectively evaluate the 'Good-old-days' bias in patients following mTBI.

**Participants and Methods:** A total of 106 participants, which consisted of 53 mTBI patients and 53 healthy subjects, were recruited in this prospective study. The PCS of the mTBI patients was evaluated by the modified Checklist of Post-Concussion Symptoms (mCPCS) at one month and three months post-injury respectively. All healthy participants were also evaluated twice for their PCS symptoms.

**Results:** Patients with mTBI showed significantly higher PCS reporting at one month post-injury but not at three months post-injury. Consistent with the 'Good-old-days' bias, mTBI patients would remarkably underestimate their pre-injury PCS both at one month and three months post-injury. Interestingly, our results further revealed that this response bias might be gradually diminished by three months after mTBI.

**Conclusions:** This study might be the first one to prospectively examine the 'Good-old-days' bias in patients with mTBI. Obviously, this response bias is prominent after mTBI, and might be one of the most influencing factors on the presence of the persistent PCS.

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**A.A. FEDIO, J. SEXTON, K. NIRSCHL, S. GOLDEN, S. EFANOV & P. FEDIO. Quality of Life following Traumatic Brain Injury: The Importance of Family and Friends.**

**Objective:** The present study examined quality of life (QOL) of individuals recovering from traumatic brain injury (TBI) in relation to their cognitive and emotional functioning, self-concept, and motivation for treatment.

**Participants and Methods:** Fourteen individuals with moderate-severe TBI (8M/6F, mean age: 36, post-injury 4 years) rated their functioning in somatization, motor, attention/memory, communication, depression, and aggression (Neurobehavioral Functioning Inventory [NFI]). They completed the Quality of Life (QOL) Inventory, Tennessee Self-Concept Scale, 2nd ed. (TSCS-2; physical, personal, moral, family, social), and Motivation for Treatment Questionnaire.

**Results:** NFI and TSCS-2 results were within the average range, with the exception of individuals' perceived value as a family member falling below expectations ( $t(13)=-3.67, p<.005$ ). Overall QOL was average ( $T=47$ ), with individuals' responses ranging from Very Low to High. Problems with love relationships and employment accounted for poorest QOL. Individuals reporting poorer cognitive functioning endorsed lower QOL regarding interactions with their children and relatives ( $r=.62$ ). Poor family QOL appeared to motivate interest in treatment ( $r=-.63$ ), and higher QOL regarding community interests correlated with motivation for treatment ( $r=.52$ ). Physical self-concept directly related to QOL ( $r=.59$ ). Self-concept regarding social relationships related to total QOL ( $r=.50$ ), as well as subscales of QOL regarding one's creativity ( $r=.78$ ) and helping others ( $r=.87$ ).

**Conclusions:** Findings underscore the importance of family and social support in recovery from TBI and address the need for family interventions. Relationships outside the immediate family affect productive attributes of the individual including creative energy and prosocial behaviors. Results suggest that addressing social relationships as part of treatment is important to enhancing QOL of individuals with TBI.

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**S.C. LANTING, G.L. IVERSON, A. AQUINO, L. HOLLAND, L. CASAGRANDE HOSHINO, J. BUCHANAN, J.R. BRUBACHER & R.T. LANGE. Examination of Recruitment Bias in a Prospective Study on Outcome from Mild Traumatic Brain Injury in a Level 1 Trauma Center.**

**Objective:** To examine recruitment bias in a prospective study following mild traumatic brain injury (MTBI) or orthopedic/soft tissue injury [i.e., trauma controls (TC)].

**Participants and Methods:** Participants from a level 1 trauma center (Jan 2007 - July 2012) were selected in 3 phases. In Phase 1, all patient visits were triaged for basic inclusion/exclusion criteria (e.g., age, injury mechanism). In Phase 2, medical charts were reviewed to address comprehensive inclusion/exclusion criteria (e.g., psychiatric and neurological history). Those selected were mailed an information package. In phase 3, patients were contacted by telephone to determine if they met final inclusion/exclusion criteria and were willing to consent.

**Results:** Following Phase 1, 1,509 patients (876 MTBI; 633 TC) were selected. Following Phase 2, 65% ( $n=988$ ) were excluded (MTBI=592; TC=396) and 35% ( $n=521$ ) were designated for further follow-up. Of those, 66% declined to participate (MTBI=170; TC=172) and 34% were enrolled (MTBI=114, 13.0% of those from Phase 1; TC=65, 10.3% of those from Phase 1). Enrolled MTBI patients had higher frequency of positive day-of-injury CT findings (31.2% vs. 21.0%,  $p=.02$ ) and an initial GCS score  $<15$  (51.8% vs. 40.6%,  $p=.01$ ) compared to those who were not enrolled. In the TC group, those who enrolled had a lower frequency of surgery (13.8% vs. 31.4%,  $p=.01$ ) and were less frequently injured in an MVA (20.0% vs. 37.2%,  $p=.01$ ). Comparing the enrolled MTBI and TC groups, there was a greater proportion of MTBI participants who were intoxicated at the time of injury (46.4% vs. 15.6%,  $p<.001$ ) and who had more extensive (26.3% vs. 6.1%) and severe soft tissue injuries (71.1% vs. 55.4%) compared to the TC group.

**Conclusions:** There was a higher frequency of CT abnormality and lower GCS scores in MTBI patients who enrolled compared to those who declined. Enrolled MTBIs were more frequently intoxicated and had more extensive and severe soft tissue injuries than enrolled TCs.

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**C. BOSWORTH, K. KRISHNAN, J. GATSON, M. CULLUM, R. DIAZ-ARRASTIA & C. MARQUEZ DE LA PLATA. Compromised Structural and Functional Connectivity Among Professional Boxers.**

**Objective:** Repeated mild traumatic brain injuries are believed to have detrimental long-term effects on the brain and cognition. Boxers frequently receive multiple sub-concussive and concussive blows during a fight, and are at risk for white matter damage as is seen in Traumatic Axonal Injury (TAI) given the rotational forces involved in blows to the head. The current study aims to examine the structural and functional connectivity among professional boxers immediately after a fight in which they experienced a concussion.

**Participants and Methods:** A sample of 12 professional boxers with an average of 24 boxing-related concussions was compared to healthy controls. Within 48 hours of experiencing a concussion during a boxing match, boxers were scanned using structural and functional imaging modalities (i.e., T1, diffusion tensor imaging, and resting state functional MRI) and completed a computerized neuropsychological battery (ImPACT). White matter (WM) volumes, fractional anisotropy (FA), and hippocampal interhemispheric connectivity (i.e., BOLD synchrony) were measured using published techniques.

**Results:** Compared to controls, boxers had significantly less WM, and lower FA within existing WM. Boxers displayed significantly less interhemispheric functional connectivity (IFC) between bilateral hippocampi. Number of concussions correlated strongly with reduced hippocampal IFC, slower processing speed, and impaired cognitive efficiency. All statistical analyses are significant at  $p < 0.05$ .

**Conclusions:** Boxers demonstrate WM damage suggestive of axonal injury and possible Wallerian degeneration. Interhemispheric functional connectivity for the hippocampus is compromised, and may be explained, at least in part due to the compromise of WM connections including the corpus callosum. While the results are preliminary, they suggest compromise to structural and functional connectivity among boxers may be associated with decreased neurocognition.

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**J.S. MASSEY, S. MEARES, J. BATCHELOR, A.J. TAYLOR & R.A. BRYANT. The Effect of Acute Stress Disorder on Information Processing Under Conditions of Increasing Cognitive Load in Individuals with Mild Traumatic Brain Injury.**

**Objective:** While there is clear evidence that psychological disorders can affect cognition in nonbrain-injured populations, the effect of psychological distress on cognitive outcome following mild traumatic brain injury (mTBI) has received little attention. The aim of the current research was to investigate the effect of acute stress disorder (ASD) on information processing under increasing cognitive load following mTBI. As pain may be a confounding factor in the neuropsychological evaluation of those with either mTBI or ASD, an additional aim was to examine whether pain mediated any relationship between ASD and performance.

**Participants and Methods:** Consecutive adult mTBI admissions to a level 1 trauma hospital were prospectively screened for inclusion. Forty-three participants completed self-report measures of acute stress, pain, and a timed cancellation task under increasing cognitive load, including standard, distraction (background noise) and dual task conditions, on average 2.75 ( $SD = 2.21$ ) days post-injury.

**Results:** Mixed analysis of variance was used to compare those who met criteria for ASD ( $n = 12, 28%$ ) with those who did not ( $n = 31, 72%$ ). The analysis was repeated with pain as a covariate. Results indicated an interaction between ASD and performance under increasing cognitive load,  $F(2, 40) = 3.76, p = .03, \eta_p^2 = 0.16$ . Participants with ASD showed a greater performance decrement as load increased. Although that interaction was no longer significant when pain was included as a covariate, ASD still accounted for 11% of the variance in performance,  $F(2, 38) = 2.28, p = .12, \eta_p^2 = 0.11$ . A significant interaction was found between pain and increasing load,  $F(2, 38), p = .004, \eta_p^2 = 0.25$ .

**Conclusions:** Those experiencing ASD after mTBI may have an increased risk for poorer cognitive outcomes in the acute phase, particularly when faced with increased cognitive demands. Concurrent pain appeared to exacerbate that vulnerability.

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**J.L. MATHIAS, V. DENNINGTON, S.C. BOWDEN & E.D. BIGLER. Traumatic Brain Injury Research: How Comparable are Community and Orthopaedic-injury Control Groups?**

**Objective:** Researchers typically use community (CC) or orthopaedic/injury (OC) control groups, and occasionally both, to assess the impact of traumatic brain injuries (TBIs) on outcomes. Whereas CCs are readily available and control for a variety demographic variables, OCs are more time-consuming and costly to recruit but are thought to control for additional pre- and post-injury variables (e.g., risk-taking, injury-related stress). Together, the two groups enable an examination of brain- versus general-injury effects. To date, most TBI studies have used CCs, with many fewer using OCs and very few using both. However, the comparability of these groups, and the incremental increase in control over potentially confounding variables that is thought to be obtained by using OCs, has rarely been examined.

**Participants and Methods:** The current study examined data from samples of CCs (N = 71) and OCs (N=69), aged between 18 and 80, who were recruited on a prospective basis for a TBI study in order to determine how similar they were. Specifically, the two groups were compared on a large number of demographic (age, gender, education, socio-economic status), background (medical history, handedness), psychosocial (alcohol use, fatigue, pain, depression, social support, community integration, 'post-concussion' symptoms) and cognitive (e.g., motor and information processing speed, memory, intellectual ability) variables.

**Results:** These analyses revealed that the CC and OC groups were comparable on all variables, except alcohol use, with the OC group having higher levels of alcohol consumption. However, alcohol use did not correlate with any other variable, including commonly used measures of cognitive outcome following TBI.

**Conclusions:** The current findings suggest that orthopaedic controls do not have any clear advantages over a community control group that is carefully recruited and that the additional costs associated with recruiting and screening such a group may yield limited benefits.

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**L. MBAKILE-MAHLANZA, J. PONSFORD & L. MANDERSON. The Experience of Traumatic Brain Injury in Botswana.**

**Objective:** Whilst the consequences of traumatic brain injury (TBI) are understood in Western countries, it is not known how cultural background and beliefs affect response and outcome following TBI in African countries, including Botswana, where health services and socioeconomic factors differ from industrialized nations. This study aimed to explore the experiences of TBI in individuals with TBI, caregivers and health care professionals.

**Participants and Methods:** Participants, recruited through Princess Marina and Nyangabgwe Hospitals, included 21 individuals with moderate-severe TBI (68% males, mean age 35.2 years), 18 caregivers (90% female) and 25 healthcare workers (66% nurses), including 12% medical officers and 22% allied health staff. TBI cause was motor vehicle accident for 52% and assault for 48%. Qualitative semi-structured interviews were transcribed, translated and thematically coded.

**Results:** Thematic analysis indicated several themes: Injury related changes, Attributions and beliefs about the cause of the injury, Family reactions, Communication and Service availability. Participants described the common physical, cognitive, emotional and behavioural effects of TBI. Many participants attributed their injury to supernatural causes. Immediate family members to TBI expressed a sense of love and devotion towards the injured person, whereas distant friends and relatives tended to be judgemental. Communication was extremely problematic - characterized by inadequate information given to those injured and their caregivers. Provision of care was impeded by insufficient staff, limited supplies and lack of training of nurses.

**Conclusions:** This study will improve understanding of cultural responses and approaches to brain injuries in Botswana which may in turn inform improved practice.

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**S. MEARES, A. SHORES, T. SMYTH, J. BATCHELOR, M. MURPHY & M. VUKASOVIC. The Impact of the Abbreviated Westmead Post-Traumatic Amnesia Scale on Length of Stay in an Emergency Department.**

**Objective:** The aim of the current study was to evaluate the impact of the introduction of the Abbreviated Westmead Post-Traumatic Amnesia Scale (A-WPTAS), a valid measure of acute cognitive impairment in mild traumatic brain injury, on length of stay in an Emergency Department (ED).

**Participants and Methods:** The design was a retrospective before and after study examining the length of stay of individuals aged between 18 and 65 years of age, presenting to the ED of a Level 1 trauma hospital, for a 6-month period before and a 6-month period after the A-WPTAS was introduced. Inclusion criteria included a Glasgow Coma Scale of 13 – 15, and either a loss of consciousness of less than 30 minutes or amnesia for events before or after the injury. The final sample comprised 224 individuals in the Before A-WPTAS group and 169 in the group that received the A-WPTAS.

**Results:** A two-way independent groups ANCOVA was conducted to assess the impact of the A-WPTAS on length of stay when 'readiness for discharge or admission', based on a pass/fail performance on the A-WPTAS, was used as a proxy for length of stay in the group that had received the A-WPTAS. After adjusting for age, there was a significant difference in the Before A-WPTAS group and the group that had received the A-WPTAS,  $F(2, 454) = 62.5, p < .001$ . The effect size was large,  $\eta^2 = .22$ . The adjusted mean for length of stay was significantly lower in the group that had received the A-WPTAS group in comparison to the Before A-WPTAS group.

**Conclusions:** The results provide the first evidence of the impact of the A-WPTAS following introduction to the ED. The A-WPTAS may assist in clinical decision making regarding the management of individuals with acute cognitive impairment following mild traumatic brain injury and reduce the length of stay in the ED.

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**A.A. DE PEREIRA & C. BORGES-PARANA. Executive functions after TBI in Brazilian patients.**

**Objective:** Traumatic brain injury is one of the most difficult health problems in Brazil. The public health system is organized to provide acute care but the long term rehabilitation needs of patients are neglected. There is a paucity of studies that investigate neuropsychological profile in TBI Brazilian patients. Currently, formal neuropsychological assessment still lacks adapted instruments that allow measurement of these functions after TBI, though deficits in executive functions (EF) are frequently reported. The present study aims to assess EF in adults after severe TBI.

**Participants and Methods:** Three instruments, still without Brazilian normative data, that assess EF were part of the assessment: the D-KEFS Tower subtest, a Verbal Fluency task, and the WCST. A total of 20 TBI patients were recruited in an public hospital (mean age= 35.05, SD=10.68) and a neuropsychological assessment of executive functions was administered. A control group (n=20), paired by sex (90% males) and age (32.04, SD=11.07), was later assessed using the same battery. Group comparison was calculated (Mann-Whitney test).

**Results:** Results were calculated using raw scores and suggested that TBI group presented lower scores in all measures. In the Tower test, there were significant differences in the total time to finish the test ( $U=118, z=-2.22, p= 0.026$ ) and the number of rules broken ( $U=114, z=-2.40, p= 0.020$ ). Groups also showed significant differences on the WCST's number of perseverative errors ( $U=63, z= -2.41, p= .016$ ) and Verbal Fluency ( $U=55, z=-2.70, p= .007$ ).

**Conclusions:** TBI group showed significantly lower results on EF measures. The present study suggested that the traditional instruments used worldwide could be sensitive to EF deficits in Brazilian patients with TBI as well. Therefore, efforts to develop Brazilian norms are needed in order to enable clinicians to assess systematically assess those patients.

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**A. PHILLIPS, R. EVANS, H. WILLIAMS, M. HARRINGTON, A. HARRIS & A. REUBEN. Keeping the mind on the game, and the brain in mind: Concussion care in elite rugby.**

**Objective:** Rugby is a high impact contact sport in which there is substantial levels of orthopaedic, neck and head injuries. Injuries are even more commonplace as player speed and strength are increasing. There is concern over psychological wellbeing in players, especially in context of concussion. We sought to determine what links there are between injury history, coping styles, rumination, pain, sleep and current symptoms of concussion in elite professional rugby players

**Participants and Methods:** 40 elite rugby players, who have repeated concussion history ascertained via Cogstate® computerised test systems, were assessed pre-season and mid season. At mid season they were given measures of injury history (including orthopaedic etc.), pain, sleep, coping styles and “in season” concussion. A comparison group of tennis players were also selected, for a “non-contact” control.

**Results:** Between and within group comparisons will be made for those with various dosage of concussion history to examine for contribution of non-concussion variables in post-concussion reports.

**Conclusions:** We will describe how concussion care may be integrated into a psychologically oriented injury management system in elite contact sports

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**A. RASMUS & M. BIDZAN. The changes of cognitive functions in patient after head injury followed by coma during 10 year observation period.**

**Objective:** The aim of our study was to describe dynamics of changes in the area of cognitive functions in female patient awoken from coma after head injury during a ten year observation period.

The analysis included physical, mental and social functions.

**Participants and Methods:** We present the case of female patient, who suffered the head injury in 21 week of pregnancy, followed by prolonged coma.

The cognitive functions were analyzed with the use of WMS-III test, TMT, COWAT, MMSE.

The quality of life was measured with the use of SF-36 questionnaire. During 10 year observation period the patient underwent 3 examinations: 1, 5 and 10 years after injury.

**Results:** We observed, in the first phase of rehabilitation, high dynamics of changes in the area of cognitive functions and improvement of subjective estimation of quality of life.

Ten years after the trauma we observed decrease of subjective estimation of quality of life and slight decrease of results within the range of cognitive functions.

**Conclusions:** Obtained results will be explained on the basis of Micro-genetic Theory

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**C.J. RICHARDSON, J. PONSFORD & A. MCKAY. A Cross-Sectional Analysis of Self-Awareness Deficits after Traumatic Brain Injury from 3 months to 20 years Post-Injury: The Importance of Injury Severity and Emotional Distress in Self and Close-Others.**

**Objective:** Reduced self-awareness of deficits is common following traumatic brain injury (TBI) and can impact rehabilitation. This study examined the effect of time post-injury on self-awareness and its domains (cognition, behaviour/affect and motor/sensory) as well as the influence of predictive factors including demographics (e.g., age), injury-related (e.g., PTA duration) and emotional state (self and close-other depression).

**Participants and Methods:** 168 TBI participants (112 males) with mean age 43.78 years and mean PTA of 25.35 days and their close others (N=109) completed the Awareness Questionnaire (AQ) and Hospital Anxiety and Depression Scale at either 3, 6, 12, 24, 36, 60, 120 or 240 months post-injury. AQ discrepancy scores between TBI participants and close-others' ratings of current versus pre-injury functioning were examined. Self and close-other AQ mean scores were also investigated.

**Results:** There were statistically significant effects of time post-injury on the AQ total discrepancy score, AQ behavioural/affective discrep-

ancy subscale and the AQ close-other motor/sensory mean score. Time post-injury did not influence self-rating scores on the AQ. Examination of predictive factors showed that TBI participants' self-ratings on the AQ were associated with their own level of depression. AQ close-other scores were associated with TBI individuals' level of depression as well as the close-other's own level of depression and longer PTA duration. The same predictive factors emerged for AQ discrepancy scores.

**Conclusions:** These findings demonstrate a pattern of predictive factors impacting self and collateral awareness ratings. Increased depression in the TBI individual as well as the close-other and more severe injuries have a dramatic effect on how they rate current level of function overall and across domains. It highlights that these emotional and injury-related factors should be taken into account when investigating awareness and/or implementing interventions.

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**J. RUSHBY, S. MCDONALD, F. FROREICH, A. FISHER & J. IREDALE. Impaired Emotional Prosody Processing in Severe Traumatic Brain Injury: An Event-Related Potentials Study.**

**Objective:** Impaired communicative competence and interpersonal functioning are well-documented among individuals with a severe traumatic brain injury (TBI). These impairments may in part result from a reduced perception of paralinguistic cues, such as emotional prosody, which help inform judgments about another's emotional state. This study used event-related potentials to examine the neural mechanisms of emotional prosody perception in TBI, within the framework of Schirmer and Kotz's (2006) model of vocal emotion perception.

**Participants and Methods:** 19 adults with severe TBI (15 male, age 46.12 ys, education 12.58 ys, average post-traumatic amnesia 66.78 days, average time post-injury 12.53 ys), and 18 neurologically-healthy controls (11 males, age 33.94 ys, education 15.44 ys) completed a discrimination task which presented semantically-neutral word pairs from five prosody conditions (happy/happy, angry/angry, neutral/neutral, angry/happy, happy/angry); participants were required to judge the emotional prosody as the 'same' or 'different' whilst electroencephalogram and accuracy were recorded.

**Results:** Preliminary analyses indicated that event-related potential (ERP) amplitudes were larger in control compared with TBI participants. ERPs were larger in central compared with mean hemisphere sites for both emotion categories (Happy and Angry) compared with neutral, for control participants, whereas the converse was found in the TBI population who showed a hemisphere > midline topography in central sites, but no topographical differentiation across frontal/posterior regions ( $F = 4.26, p = .046$ ). This difference was also reflected in reduced accuracy for both emotion conditions for TBI group.

**Conclusions:** These findings are consistent with the frontal and posterior poles being more vulnerable to damage in TBI which results in impaired evaluation of emotional prosody. Reduced amplitudes and regional differentiation appears to result in a lowered ability to distinguish between different emotions in the voice.

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**N.J. STARKEY, K. JONES, A. THEADOM, S. BARKER-COLLO, K. MCPHERSON, M. KAHAN & V. FEIGIN. Executive Functions in Adults One, Six and Twelve Months after Mild Traumatic Brain Injury.**

**Objective:** Traumatic brain injury (TBI) is a leading cause of disability. Even mild TBI (mTBI) can lead to on-going memory and concentration difficulties but the effects of such injuries on executive functions (EF) are unclear. We examined EF in adults over 12 months following mTBI using data collected as part of a prospective population based TBI incidence and outcomes study (Brain Injury Outcomes New Zealand in the Community: BIONIC).

**Participants and Methods:** At 1-, 6-, and 12-months post-TBI, participants (N=87: 15 mild low; 15 mild medium; 57 mild high risk TBI: injury severity defined using Servadei's (2001) criteria) completed the Behavioural Dyscontrol Scale (BDS) and the computerised CNS Vital Signs test (CNS-VS).

**Results:** Results showed processing speed and sustained attention (CNS-VS) improved over the 12 months following mTBI ( $p < .05$ ) irrespective of injury severity. Psychomotor domain scores (CNS-VS) significantly improved in the mild high risk group over time ( $p = .02$ ). There were no significant changes in the total BDS score. Using qualitative performance categories, ranging from low average to above average, based on the Neurocognition Index (CNS-VS summary score), we examined patterns of EF recovery over time. For 22% of participants, EF performance deteriorated (> 1 category) from 1 month post-TBI to either 6 or 12 months later. The declining EF group was comprised of more males (73%:57%), with four or more prior TBIs (26%:16%), and greater likelihood of alcohol involvement in the index TBI (42%:7%) compared to the stable EF group. By 12 months post-TBI the declining EF group obtained significantly lower scores than those with stable EF on the Neurocognition Index, and for the CNS-VS executive function, attention and cognitive flexibility domain scores ( $p$ 's < .05).

**Conclusions:** These findings may help to identify adults facing increased risk for increasing EF difficulties following mTBI, who may benefit from early intervention.

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### Invited Symposium: Cognition and Cancer

Chair: Sanne B. Schagen

10:30 a.m.–12:00 p.m.

#### S.B. SCHAGEN, J. DIETRICH, J.S. WEFEL & M. KLEIN. Cognition and Cancer.

**Symposium Description:** Compared to classical oncological outcome measures such as time to progression and survival, the importance of cognitive functioning in patients with solid cancers and primary or metastatic brain tumors has only recently been recognized.

Many patients with CNS or non-CNS tumors develop cognitive dysfunction. While the adverse effects associated with radiotherapy are frequently discussed, much less attention has been paid to potential effects of chemotherapy. This central neurotoxicity may be manifest as both acute and delayed CNS complications. Adverse neurological effects have been associated with most categories of chemotherapeutic agents, and can include both acute and chronic encephalopathy. More subtle cognitive dysfunction has also been demonstrated.

In this symposium we will summarize knowledge on the incidence of cognitive deficits, the neuropsychological pattern and brain changes associated with various treatments, risk factors for developing neurotoxicity, underlying mechanisms as well as current treatment options to prevent or diminish adverse effects of chemotherapy and radiotherapy on cognition. We will also demonstrate how assessment of cognitive functioning and study of the underlying causes of cognitive deficits not only benefit patient outcome but also merits more fundamental research into brain functioning.

Patients with brain tumors comprise a distinct group in terms of incidence, histology and outcome, which is fatal in virtually all cases. Attention will be paid to the specific factors affecting cognitive function in patients with primary brain tumors or brain metastases. The recent notion that extensive tumor resections may have significant benefits for these patients opened a new area of research. Cognitive functioning in relation to surgery will be discussed, giving examples of how surgery beyond neuroanatomical boundaries affects cognitive outcome, and discussing the role of plasticity in cognitive functioning of these patients. Correspondence: Sanne B. Schagen, PhD, Psychosocial Research and Epidemiology, The Netherlands Cancer Institute, Plesmanlaan 121, Amsterdam 1066CX, Netherlands. E-mail: s.schagen@nki.nl

#### S.B. SCHAGEN. Neurocognitive Deficits in Patients with Non-CNS Tumors.

**Objective:** Patients with central nervous system malignancies almost universally experience cognitive dysfunction during their disease course.

In recent years it has become clear that systemic therapies such as chemotherapy and endocrine therapy applied in the treatment for non-central nervous system malignancies may also be associated with cognitive and brain changes. The vast majority of the work in this area has occurred in the context of breast cancer. This presentation will discuss the neuropsychological findings in patients with non CNS cancer who receive systemic chemotherapy. It will be shown that cognitive decline occurs in a subgroup of patients, that the most common domains affected are consistent with a frontal subcortical profile including deficits in learning and memory, processing speed and executive function, and that currently no clear predictors have been identified. It will be shown that lower than expected cognitive performance can still be observed many years into the survivorship period.

Neuroimaging studies in non-CNS patients in patients following administration of chemotherapeutic compounds without targeted CNS delivery will be presented as well. These studies are indicative of brain atrophy and white matter microstructural damage. Recent imaging studies using DTI suggest that brain white matter may be particularly sensitive to the adverse effects of chemotherapy.

Specific attention will also be paid to the potential cognitive impact of adjuvant endocrine therapies, which a large part of breast cancer patients undergoing chemotherapy also receive. The cognitive pattern of different therapies will be discussed.

And finally some diagnostic and intervention guidelines for professionals confronted with non-CNS patients who report cognitive changes following systemic therapy will be presented that follow from the current knowledge base in this field.

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#### J. DIETRICH. Chemotherapy associated CNS damage.

**Objective:** Chemotherapy can be associated with harmful effects to multiple organ systems, including the central nervous system. Neurotoxicity may manifest as both acute and delayed CNS complications, which is particularly a concern for long-term survivors. Patients may experience a range of neurotoxic syndromes, from neuro-vascular complications and focal neurological deficits to generalized neurological decline and cognitive impairment.

The mechanisms by which chemotherapy results in neurological complications have been poorly understood. Several factors have been proposed to play a role in chemotherapy-induced neurotoxicity, including the direct toxic effects of chemotherapeutic agents on various brain cells, vascular injury, and indirect immune-mediated inflammatory processes. Studies have started to unravel the cell-biological basis for commonly seen neurotoxic syndromes and have shown that chemotherapy-induced damage of mature post-mitotic oligodendrocytes and immature progenitor cell populations required for ongoing neurogenesis, gliogenesis, and maintenance of white matter integrity is an important etiologic factor in the development of neurotoxicity. Damage on the level of neural progenitor cells has therefore offered a compelling explanation for the frequently seen delayed toxicities in patients, such as progressive dementias and leukoencephalopathies. It has been hypothesized that long-term/progressive cognitive decline in cancer survivors is the result of a combination of decreased proliferation of neural progenitor cells, impaired hippocampal neurogenesis, and damage to oligodendroglial cells and white matter tracts.

Unraveling the mechanisms underlying chemotherapy-related cognitive side effects will enable the identification of novel treatment strategies. A very important goal will be the identification neuroprotective strategies along with the development of tumor-specific therapies to avoid unnecessary toxicities, and to promote nervous system repair.

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#### J.S. WEFEL. Neurocognitive Function in Patients with Brain Tumor.

**Objective:** Patients with brain tumor comprise a heterogeneous group in terms of both histology (e.g., low grade glioma versus brain metastases) and outcome (e.g., median survival time). Brain tumor patients frequently receive aggressive therapies including surgery, radiation and chemotherapy in an effort to control disease progression and extend survival time; however, these therapies are infrequently given with the expectation of cure. Thus, the impact of tumor and treatment on patient's neurocognitive function, quality of life and functional outcomes are of critical importance.

This presentation will discuss neurocognitive function in patients with primary brain tumor and patients with brain metastases. While relatively few neuropsychologists specialize in the area of oncology, a growing number of scientist-practitioners are encountering cancer patients and a more mature body of literature is emerging to help guide neuropsychological practice.

Research will be presented demonstrating that lesion momentum is related to the differential neurocognitive presentation of brain tumor patients, pre-operative neurocognitive function predicts postoperative neurocognitive outcome, postoperative neurocognitive function and changes in neurocognitive function after concurrent chemoradiation is prognostic for survival time, tumor related epilepsy has an adverse effect on neurocognitive function, and radiation and chemotherapy related toxicities can include neurocognitive decline. Results from several recently completed large multi-site clinical trials will be presented. These trials reported on differential toxicity between treatment strategies and demonstrated the efficacy of an NMDA-receptor antagonist used prophylactically to prevent neurocognitive decline associated with radiation therapy. Lastly, evidence will be presented supporting behavioral strategies to enhance neurocognitive function and quality of life. Correspondence: *Jeffrey S. Wefel, 1515 Holcombe Blvd, Houston, UT TX 77030. E-mail: jwefel@mdanderson.org*

#### **M. KLEIN. Resective surgery for infiltrative brain tumors: plasticity of function.**

**Objective:** Our understanding of the effects of neurosurgery on cognition is largely based on studies in patients with refractory epilepsy, with only a few studies in brain tumor patients. While extensive tumor resection can greatly benefit survival of these patients, it poses at the same time a risk for cognitive compromise. The dilemma of cerebral surgery is to maximize the extent of resection (EOR) while preserving brain functions. Due to the frequent location of supratentorial primary brain tumors near/within eloquent areas and due to the poorly demarcated feature of most tumors, it was long considered that chances to perform extensive tumor removal were low, whereas the risk to generate postoperative sequelae was high. Accounting for interindividual anatomo-functional variability, the last decade has seen an increase in functional mapping methods to optimize the benefit-to-risk ratio of surgery. The use of intraoperative electrostimulation in awake patients has improved the results of neurosurgery, with an increase of surgical indications for tumors located within eloquent areas classically considered as inoperable; an optimization of the EOR with an increased impact on the natural history of the tumor; and preservation/improvement of cognitive functioning.

Surgical outcome is dependent on changes in interconnected and spatially distributed neuronal networks whose morphological and functional connectivity is modified by experience-dependent plasticity. After initial postoperative cognitive deficits, long-term plasticity mechanisms will attempt to compensate for loss in function. Biological modifications of individual neuronal properties will support rewiring of the brain, usually facilitated by rehabilitation strategies.

This presentation will discuss cognitive function in relation to surgery, give examples of how surgery beyond anatomical boundaries during awake craniotomies affects cognitive outcome and discuss the role of plasticity in cognitive functioning.

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### **Symposium 12: "Getting a Life" – Return to Previous Activities Following Traumatic Brain Injury**

**Chair: Catherine Willmott**

**10:30 a.m.–12:00 p.m.**

#### **C. WILLMOTT, S. MCDONALD, C. WILLMOTT & R. TATE. "Getting a Life" – Return to Previous Activities Following Traumatic Brain Injury.**

**Symposium Description:** Recovery is often gauged by successful return to previous activities. Re-engaging in the community and pursuing vocational and leisure interests following TBI is fraught with numerous challenges, and rehabilitation research is driven by the need to develop evidence-based recommendations to guide these transition periods.

The aim of this symposium is to highlight some of the challenges facing those returning to previous community pursuits and to investigate the success of tools and interventions designed to facilitate this process. In the first study, McDonald et al., evaluated the performance of adolescents with TBI, compared with typically developing peers on the Awareness of Social Inference Test (TASIT), and investigated correlations between identified deficits and reported difficulties with everyday communication. Willmott et al., investigated rates and success of return to study in young adults following moderate-severe TBI. Accommodations made to course enrolment, and provision of extra supports such as tuition and special consideration are outlined. In addition, the student's experience of returning to study was evaluated, incorporating factors such as effort and fatigue. The study by Tate et al., examines the effectiveness of an intervention based on coaching models with motivational interviewing components in high school students. A broad range of variables compatible with a coaching philosophy was selected to evaluate changes in a variety of areas, capturing both client-centred values (satisfaction, emotional functioning, hope for the future) and objective functioning as reported by the parent (community participation, behaviour, support needs).

This body of research emphasises the importance of evaluating our rehabilitation interventions, and the complex myriad of personal and environmental factors which contribute to, and predict, successful return to previous lifestyle activities following TBI across the spectrum of injury severity and developmental trajectory.

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#### **S. MCDONALD, T. ENGLISH, R. RANDALL, T. LONGMAN, L. TOGHER & R.L. TATE. Social Cognition in Adolescents with Traumatic Brain Injuries.**

**Objective:** A major area of impairment and disability for adolescents with traumatic brain injuries (TBI) is in the arena of social skills, and specifically, the ability to "read" social cues in others – social cognition. Despite this, assessment tools are virtually non-existent. This study was designed to determine whether such deficits are reliably revealed on a test developed for adults, the Awareness of Social Inference Test (TASIT).

**Participants and Methods:** A group of 16 adolescents with TBI were compared to a group of 16 typically developing (TD) adolescents on TASIT, which comprises professionally enacted audiovisual vignettes of everyday conversational exchanges. They and their families also completed a questionnaire regarding difficulties in communication at home.

**Results:** Adolescents with TBI were, on average, no different to their TD peers on emotion recognition and could also recognise lies and sarcasm when provided with cues. They were, however, less able to interpret sarcastic and sincere conversational exchanges with few cues other than the demeanor of the speakers. Poor TASIT performance amongst the adolescents with TBI correlated to both relative and self-reported communication difficulties at home. It also correlated with IQ, face recognition and severity of injury as indexed by duration of post-traumatic amnesia.

**Conclusions:** TASIT appears to be a valid measure for adolescents although it raised questions as to how effective normative data is for comparing performance in social cognition during childhood and adolescence.

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#### **C. WILLMOTT, J. PONSFORD, M. DOWNING & M. CARTY. Frequency and Quality of Return to Study Following Traumatic Brain Injury.**

**Objective:** To determine the likelihood of returning to secondary or tertiary study, changes to enrolment and students' experience, over a 10 year period following traumatic brain injury (TBI).

**Participants and Methods:** Frequency of return to secondary or tertiary study was documented in a group of 415 students with moderate to severe TBI who had received rehabilitation and had access to sup-

port for return to study. Of those, 295 attended follow-up 1-10 years post-injury, with 167 (56%) having returned to study. Those who did not return to study had significantly longer post-traumatic amnesia (PTA) duration. A sub-sample of 95 (61.1% males) reported on their educational experience post-injury.

**Results:** The cross sectional follow-up revealed that 60.4% were studying at 1 year post-injury, 37.5% at 2 years, 50.0% at 3 years, 31.1% at 5 years and 2.0% at 10 years. Many had migrated into employment. Of the 95 participants, 28.7% changed their course enrolment from full-time to part-time. Whilst supports such as tuition and special consideration were greatly increased post-injury, most students (79.0%) reported passing. This was, however, associated with cognitive difficulties, fatigue, requiring more effort, and feeling less satisfied with their studies.

**Conclusions:** The rate of return to study was relatively high in this TBI sample, most of whom received comprehensive rehabilitation support. The majority were successful, albeit generally with additional tuition. This was, however, associated with the experience of fatigue and need for far greater effort, assistance and reduced study hours, and somewhat less overall satisfaction. Correspondence: *Catherine Willmott, School of Psychology & Psychiatry, Monash University, Building 1/270 Ferntree Gully Road, Notting Hill, VIC 3168, Australia. E-mail: catherine.willmott@monash.edu*

**R. TATE, M. GENDERS, U. ROSENKOETTER, M. MATHERS & R. MOTBEY. Preparing Adolescents for Life After School: A Randomized Controlled Trial into the Effectiveness of a Coaching-based and Motivational Interviewing Intervention.**

**Objective:** Existing resources specifically designed to assist adolescents with acquired brain injury in the transition from school to the 'adult world' are limited. Consequently, they can fall through the gap, which in turn may cause severe disadvantage for their entry to the 'adult world'. The aim of this study was to evaluate the effectiveness of an intervention based on coaching models with motivational interviewing components.

**Participants and Methods:** The participants (n=43), aged 14 to 19 years and in years 8 to 12 at school, were randomised to either standard care (control group, n=22) or coaching intervention (n=21). A broad range of variables compatible with a coaching philosophy was selected to evaluate changes in a variety of areas, capturing both client-centred values (satisfaction, emotional functioning, hope for the future) and objective functioning as reported by the parent (community participation, behaviour, support needs).

**Results:** Participants in the coaching group received, on average, six coaching sessions with the interventions occurring over an average of 22 weeks. There was no evidence that, relative to baseline, the coaching group showed greater improvement following the intervention in comparison with the control group on any of the primary (satisfaction, community participation) or secondary (emotional functioning, hopefulness, behaviour and support needs) outcome measures.

**Conclusions:** Although this study indicated that the intervention based on a coaching model with motivational interviewing components did not result in significantly different outcomes in comparison with standard care, it is hoped that transition supports for all adolescents with acquired brain injury continue to be developed.

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**Symposium 13:  
Regulatory Mechanisms and their Neural Substrates  
in Aggression and Antisocial Behavior**

**Chair: Stephan Huijbregts**

**Discussant: Hanna Swaab**

**10:30 a.m.–12:00 p.m.**

**H. SWAAB, S. HUIJBREGTS, H. SWAAB, A. POPMA, L. VAN ZONNEVELD & S. HUIJBREGTS. Regulatory Mechanisms and their Neural Substrates in Aggression and Antisocial Behavior.**

**Symposium Description:** Considering the high costs to society, families, and individuals, it is no surprise that the last few decades have

seen significant investment in therapies and training programs aimed at reducing aggression and antisocial behavior. Such programs involved, among others, social skills training, psycho-education, training of parenting skills and improvement of parent-child interactions. Although successes have definitely been booked, there is still a high relapse rate for aggressive and antisocial behavior with important crossover effects as well, for instance to substance use and internalizing behavior problems. This could, in part, be due to biologically-determined trajectories of externalizing behavior, and to cascading effects of biological dispositions and environmental factors, but it is also possible that interventions have not yet been sufficiently tailored to the specific cognitive, neurobiological, and neurophysiological factors underlying aggression and antisocial behavior. Studies have shown abnormalities in executive functioning (particularly inhibitory control), reward- and punishment sensitivity, verbal ability, emotion recognition and empathy, and their neurophysiological or neurobiological substrates, although results have not been very consistent. The present symposium offers extended insights into these mechanisms, incorporating the important concept of differential susceptibility based on cognitive strengths and weaknesses (Surland et al. presented by Prof. Dr. Hanna Swaab), the refinement of measurement of cognitive concepts and their neural and neurophysiological substrates (Popma et al; Van Zonneveld et al) and the subtyping and taxonomies of aggression (Huijbregts et al).

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**J. SUURLAND, K. VAN DER HEIJDEN, S. HUIJBREGTS, H. SMALING, L. DE SONNEVILLE, S. VAN GOOZEN & H. SWAAB. Aggressive Behavior in Preschoolers: Inhibitory Control Deficits Moderate the Influence of Negative Emotionality.**

**Objective:** The present study tests a proposed model in which the key executive function related to aggressive behavior, namely inhibitory control (IC), moderates the influence of temperamental negative emotionality (NE) on aggression in preschoolers. Parental reports of aggressive behavior, negative emotionality and inhibitory control were collected in a community sample of 855 preschoolers aged 2-5 years. Results indicated that both NE and IC were significantly associated to aggressive behavior and that IC moderated the relation between NE and aggression. Significant differences in the level of aggressive behavior were found between all four groups formed by hierarchical cluster analysis on NE and IC, with the NEhigh/IClow group showing the highest level of aggressive behavior compared to the three other groups (NElow/IClow, NEhigh/IChigh and NElow/IChigh). Comparisons of the effect size of the standardized mean differences suggested a marked protective effect of better IC in children with high levels of NE compared to children with low levels of NE. The results were consistent across gender and age. The outcomes of this study increase our understanding of how NE and IC contribute to the development of aggression during a period in which regulating abilities rapidly develop.

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**L. VAN ZONNEVELD, S. VAN RIJN, S. VAN GOOZEN & H. SWAAB. Eye-tracking and the Role of Social Attention Regulation in Aggressive Children.**

**Objective:** Social interactions are often very dynamic and involve a lot of implicit information. That is why humans heavily rely on social cues, such as the eyes, mouth and hand movements to understand social information. This information is crucial in adequate adaptation to the social environment. In this study we focused on the regulation of social attention and the predictive value for dysregulation of behavior, i.e. aggression, in children. Brothers and sisters of delinquents and children expelled from school were screened for externalizing behavior. The group of children with clinical levels of externalizing behavior participated in this study and consisted of 37 children (24 male and 13 female) between 6 and 18 years old. Eye-tracking (Tobii systems) was used to investigate social attention, as expressed in visual scanning patterns in response to the viewing of empathy evoking video clips. Results showed that the level of aggression was associated with social attention. The children with higher levels of aggression fixated significantly longer on the face area, but not longer on the eyes or the mouth ( $r = .47, p = .003$ ),

indicating that they increased their attention toward irrelevant parts of the face. Besides this, the level of social problems was also associated with social attention ( $r = .40$ ,  $p = .02$ ). The children with more social problems fixated significantly longer on the face. Although a possible explanation for these results is that children with high levels of aggression are more attentive to faces, we interpret these results in terms of social attention dysfunction, considering that they did not fixate more on relevant parts of the face. We speculate that the degree of aggressive behavior is related to social attention deficits, which may impact social understanding and social behavior.

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**S. HUIJBRECHTS, E. HIDDING, E. BRUIN & H. SWAAB. Executive Functioning and Reward Sensitivity in Proactive and Reactive Aggression.**

**Objective:** Aggression and antisocial behavior do not have straightforward links with cognitive impairment. The aim of the present study was to find specific associations between different aspects of executive functioning (EF) and reward sensitivity and different forms of aggression (i.e. reactive aggression, which is characterized by inadequate responses to frustration and perceived threats, and proactive aggression, where the behavior is more calculated and used to achieve certain goals).

Adolescent boys ( $N = 490$ , mean age 14.0 years,  $SD 1.2$ ) in relatively low educational settings and their parents filled out several questionnaires, including the Behavior Rating Inventory of Executive Function (BRIEF) and the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ). Partial correlations, linear multiple regression, and multinomial regression showed that reactive aggression was associated with, and uniquely predicted by poor EF and high reward sensitivity. Importantly, predictions by EF were most evident for those BRIEF-scales and dimensions incorporating “affective” components (i.e. emotion regulation and the Behavior Regulation Index). After statistical control for reactive aggression, proactive aggression was only uniquely predicted by the SPSRQ-dimension “impulsivity/fun-seeking”, with some further indications for reduced punishment sensitivity. Whereas these results already suggest that different aspects of cognition should be targeted for prevention and treatment of reactive and proactive ag-

gression, both forms of aggression often co-occur. Thus, more clear-cut taxonomies may be required, which could also be based on personality traits rather than behavior. For instance, further results from the present study showed that, after statistical control for behavioral aggression levels, callous and, particularly, unemotional traits were uniquely related to a number of meta-cognitive executive abilities.

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**A. POPMA, M. COHN, W. VAN DEN BRINK, L. PAPE, M. KINDT, L. VAN DOMBURGH, D. VELTMAN & T. DORELEIJERS. Neural Correlates of Deficient Fear Conditioning and Reward/Punishment Anticipation in Delinquent Male Adolescents.**

**Objective:** Children diagnosed with Disruptive Behavior Disorders (DBD), especially those with psychopathic traits, are at risk of developing persistent and severe antisocial behavior. Deficiencies in fear conditioning and reward/punishment anticipation have been hypothesized as mechanism underlying persistence, and have been associated with altered regional brain function in adult antisocial populations. Therefore, in the current study, the neural correlates of fear conditioning and reward/punishment anticipation were investigated in relation to persistence of childhood-onset DBD during adolescence as well as psychopathic traits. From a cohort of children arrested before the age of 12, participants ( $n = 150$ ) were re-assessed at mean age 17.6 ( $SD 1.4$ ) years. A functional Magnetic Resonance Imaging protocol was applied including a differential fear conditioning task and a monetary incentive delay task. Differential effects were observed for specific subdimensions of psychopathic traits. For example, preliminary analyses revealed that impulsive-irresponsible and grandiose-manipulative psychopathic traits were associated with higher differential activation in fear-related brain areas during fear conditioning, whereas callous-unemotional psychopathic traits were related to lower activation in fear-related areas. In this presentation, further results will be discussed in the light of recently accumulating evidence for heterogeneity in the neurobiological mechanisms underlying persistent antisocial behavior. In addition, implications for the development of personalized interventions will be discussed.

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