Neuropsychological Evaluation

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Hinduja Hospital, Mumbai
Global Hospitals, Mumbai

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Neuropsychology
Brain Behavior Relationship

"Clinical Neuropsychology is an applied science concerned with the behavioural expression of brain dysfunction"

Muriel Lezak

PSYCHIATRY

- Krapelin (1919) ‘Dementia Praecox’
- “A mental disorder is a health condition caused by significant dysfunction in an individual’s cognitions, emotions or behaviors that reflects disturbances in psychological, biological or developmental processes underlying mental functioning…’ DSM V

Neuropsychiatric Signature

- Schizophrenia: Ventricular enlargement and 'Hypofrontality'
- Mood Disorders: Fronto-temporal networks, over-activation of amygdala and alterations in hippocampus, anterior cingulate cortex
- OCD: Disruptions in the control loops, circuits that initiate/inhibit actions; the link between the orbito-frontal cortex with basal ganglia.
- Substance Abuse: The Orbito-Frontal Cortex (OFC) is the key area involved in decision making and addiction is regarded as deficits in the ability of weighing costs and rewards.

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Cognitive Dysfunction in Psychiatry

- Impaired performance on NP tests correlated with deficits in everyday living (self care, community living skills, employment) and social functioning.

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Cognitive Dysfunction in Psychiatry

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- Neuropsychological assessments useful for prognostication (treatment tracking, predicting outcomes) rather than diagnosis.
- The NP profile of relative strengths and difficulties useful in rehabilitation planning.

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Outline

- Neuropsychology
  - The Brain Behavior Relationship-In the Beginning...
- Neuropsychology Evaluation
  - Choosing the Right Too l- *One Size Does Not Fit All*
  - The Indian Tool Box: *Yehi Hai Right Choice..?*
- Neuropsychological Profiles
  - The Scores Story

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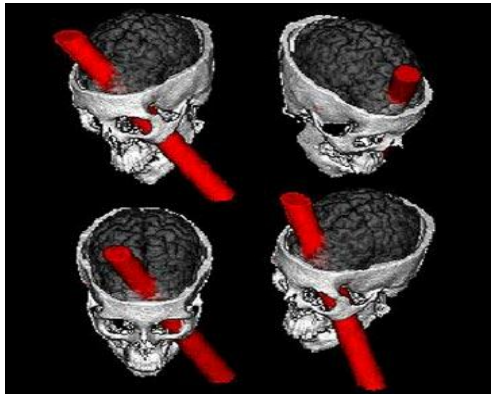
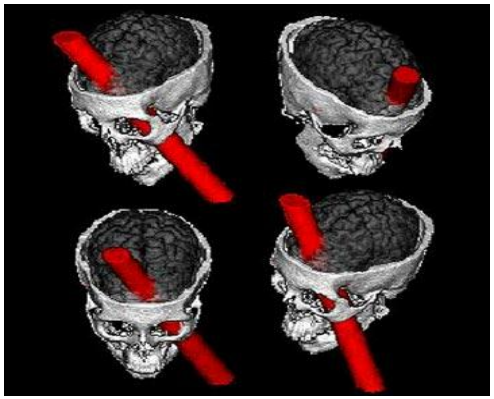
The 19th Century
Era of Localization



The 19th Century
Era of Localization

Carl Wernicke (1848-1905)

Paul Broca (1824-1880)



1940's

Ralph Reitan

1940's

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A.R Luria

1940's

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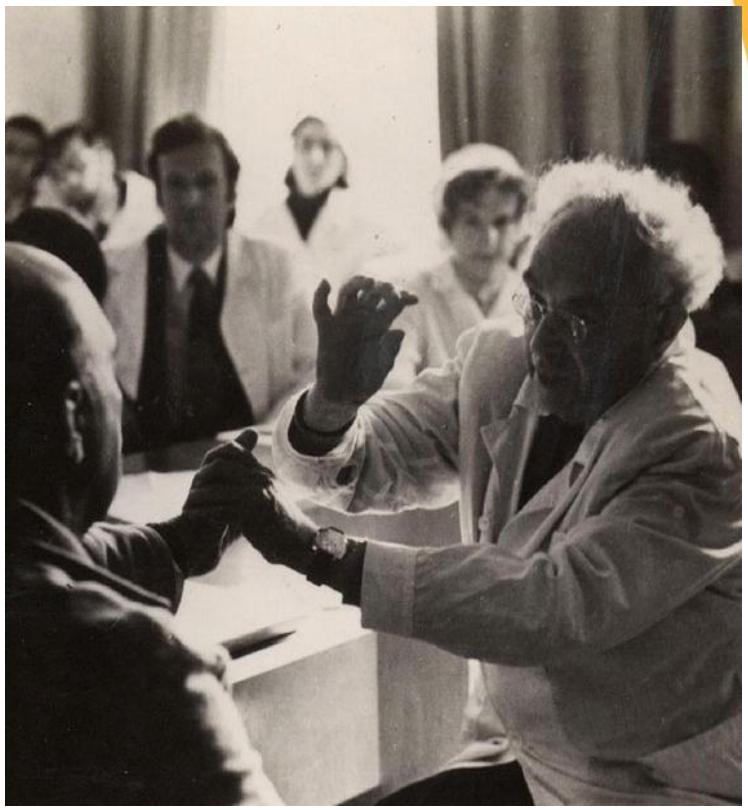
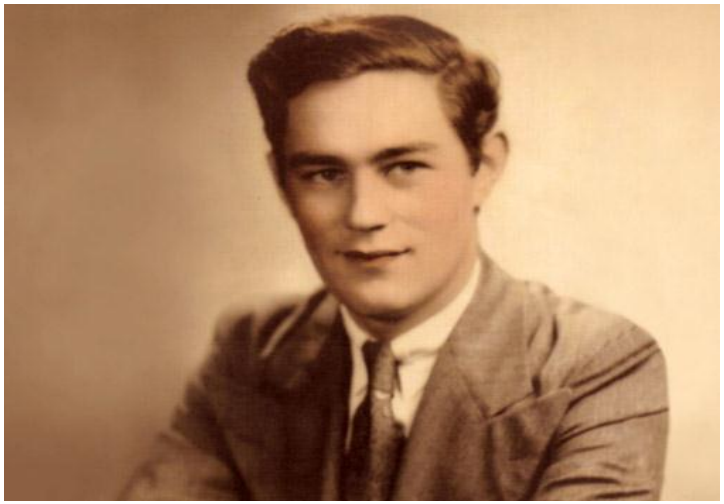


A.R Luria

The 1950's



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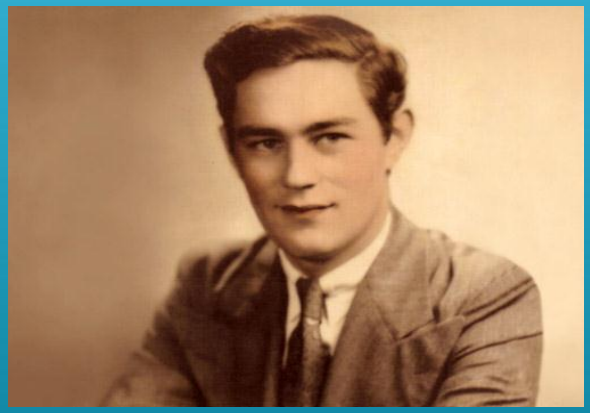

The pathos and fame of pt. H.M. are pertinent to neuropsychology and epilepsy surgery since he demonstrates the benefits i.e becoming seizure free, as well as the cognitive risks of epilepsy surgery"

Christopher Helmstaedler
Neuropsychological aspects of epilepsy surgery Epilepsy & Behaviour, 2004

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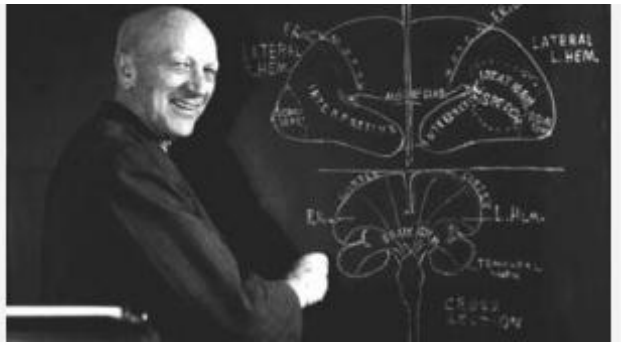
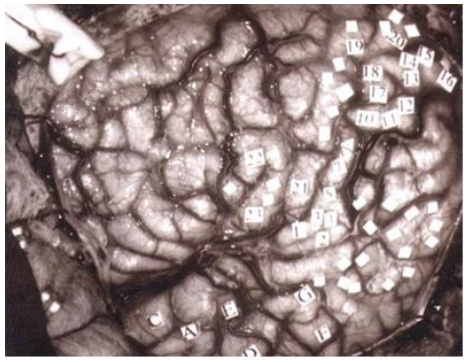
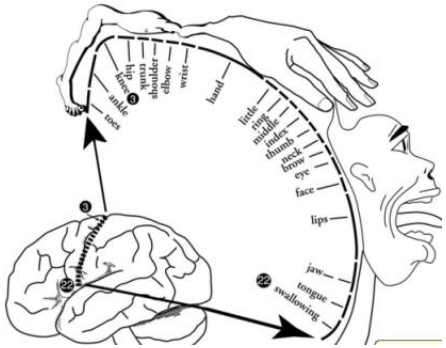
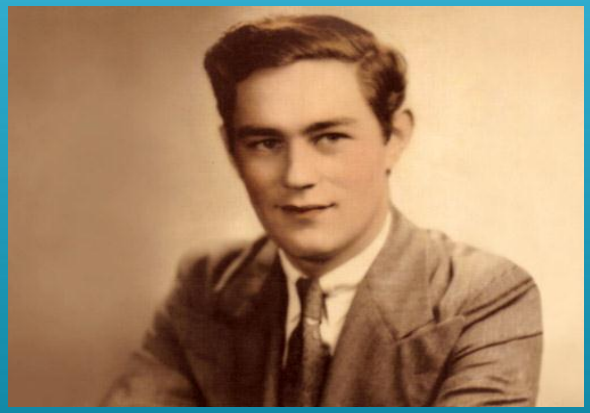
The 1950's



Wilder Penfield







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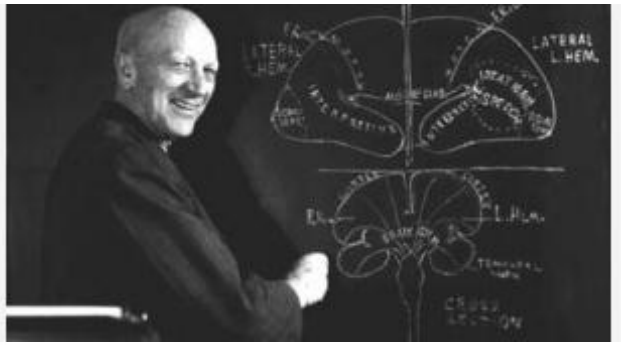

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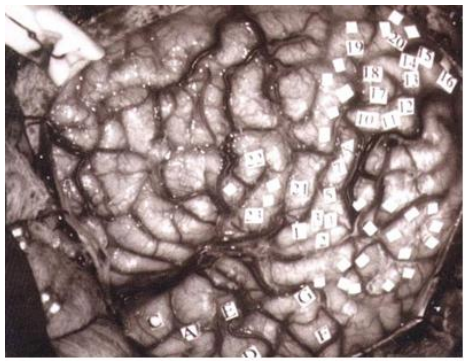
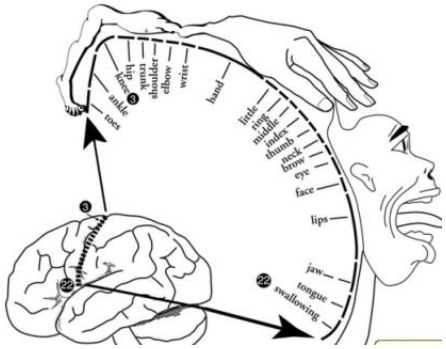
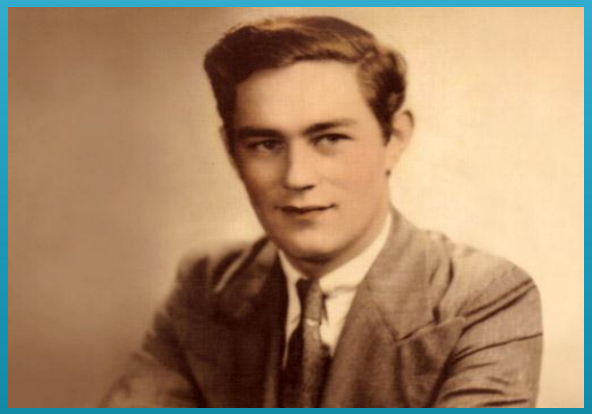




Brenda Milner



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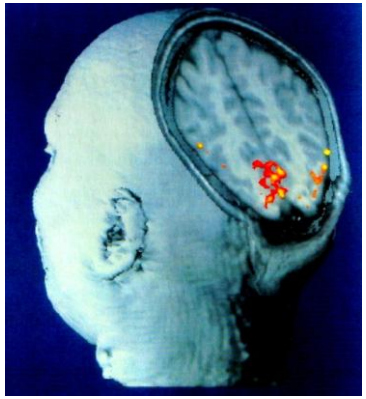
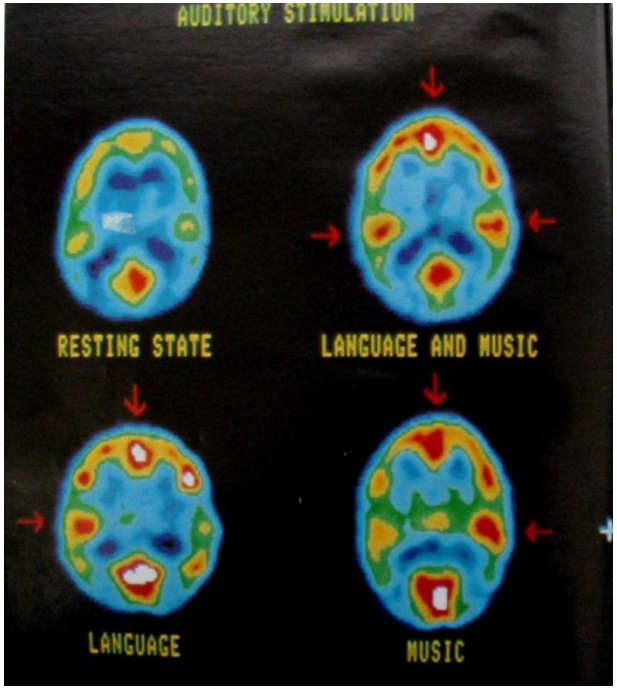
Era of Imaging 1970's & 1980's

PET





Era of Imaging 1970's & 1980's

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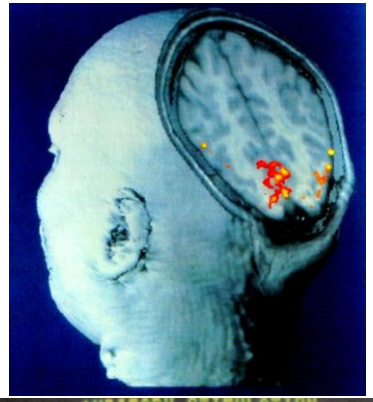
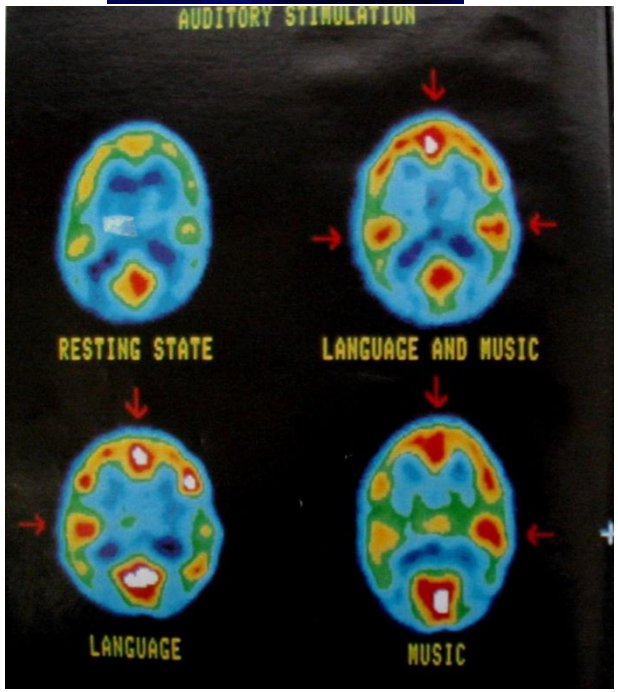
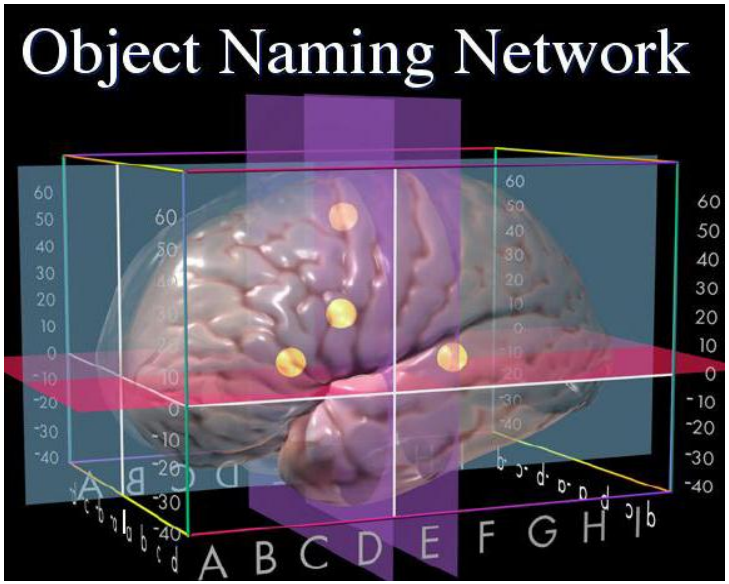
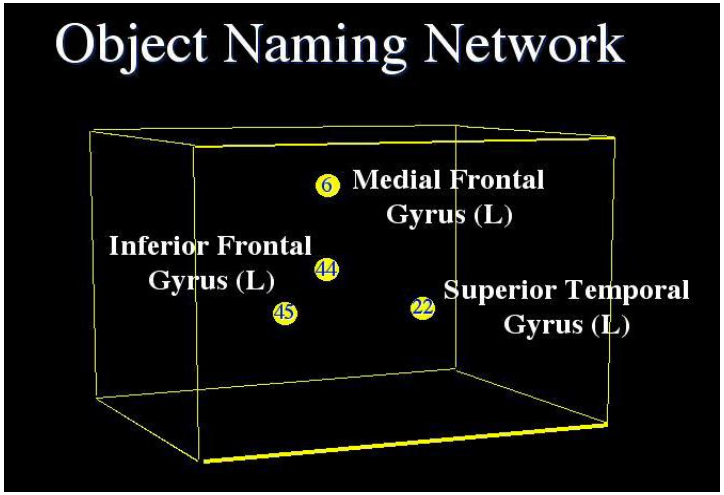




fMRI





Neuropsychology
Brain Behavior Relationship

Neuropsychology disengaged itself from its parent disciplines of neurology and psychology to emerge as a separate field

1970

INTERNATIONAL NEUROPSYCHOLOGICAL SOCIETY

1980

DIVISION 40 OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION

THE SOCIETY FOR CLINICAL NEUROPSYCHOLOGY

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Neuropsychology
Brain Behavior Relationship

The neuropsychological evaluation involves cognitive and psychological (behavior, mood, personality, QoL) assessments.

What and How Do We Examine?

OUR TOOL KIT
Paper Pencil Tests, Quantitative Norms

- Cognitive Tests
- Mood, Personality and Behavior Scales
- Collation of this data with…
  - Detailed clinical history
  - Review of medications
  - Imaging and other investigations.

Boston Process Approach
Qualitative, Flexi Battery

Dr Edith Kaplan et al, 1986

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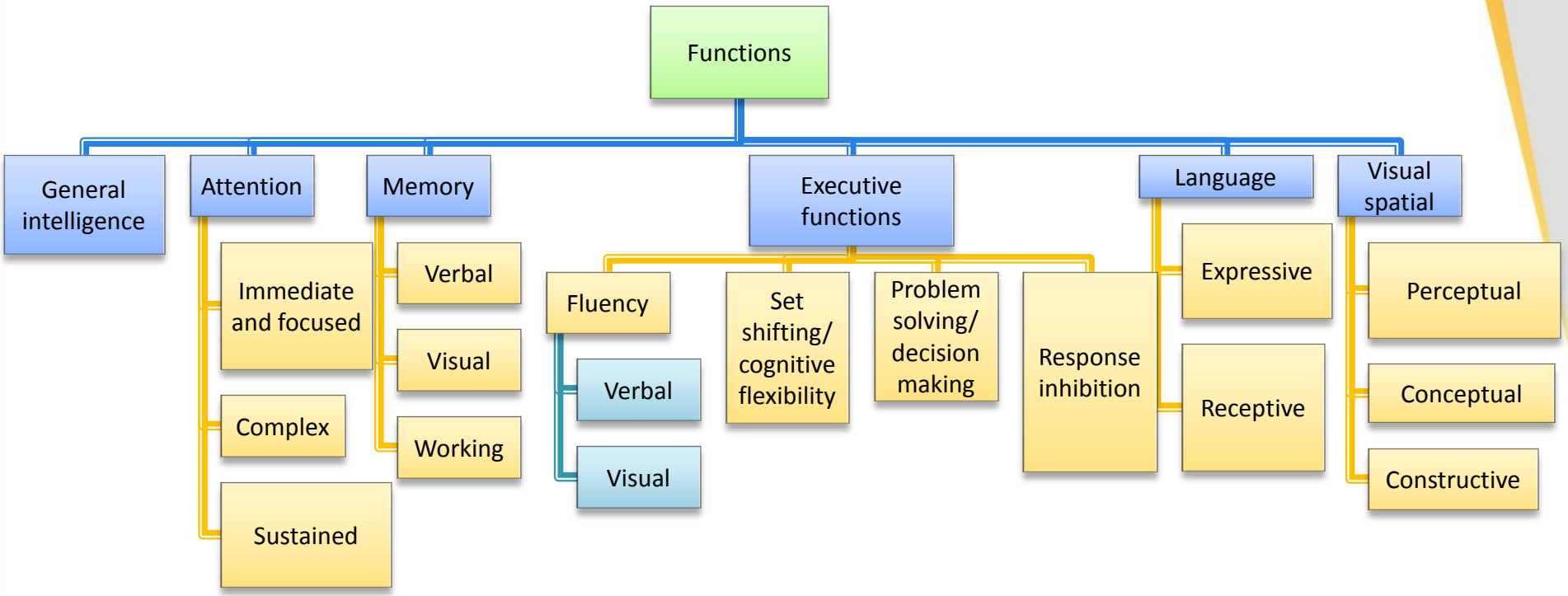
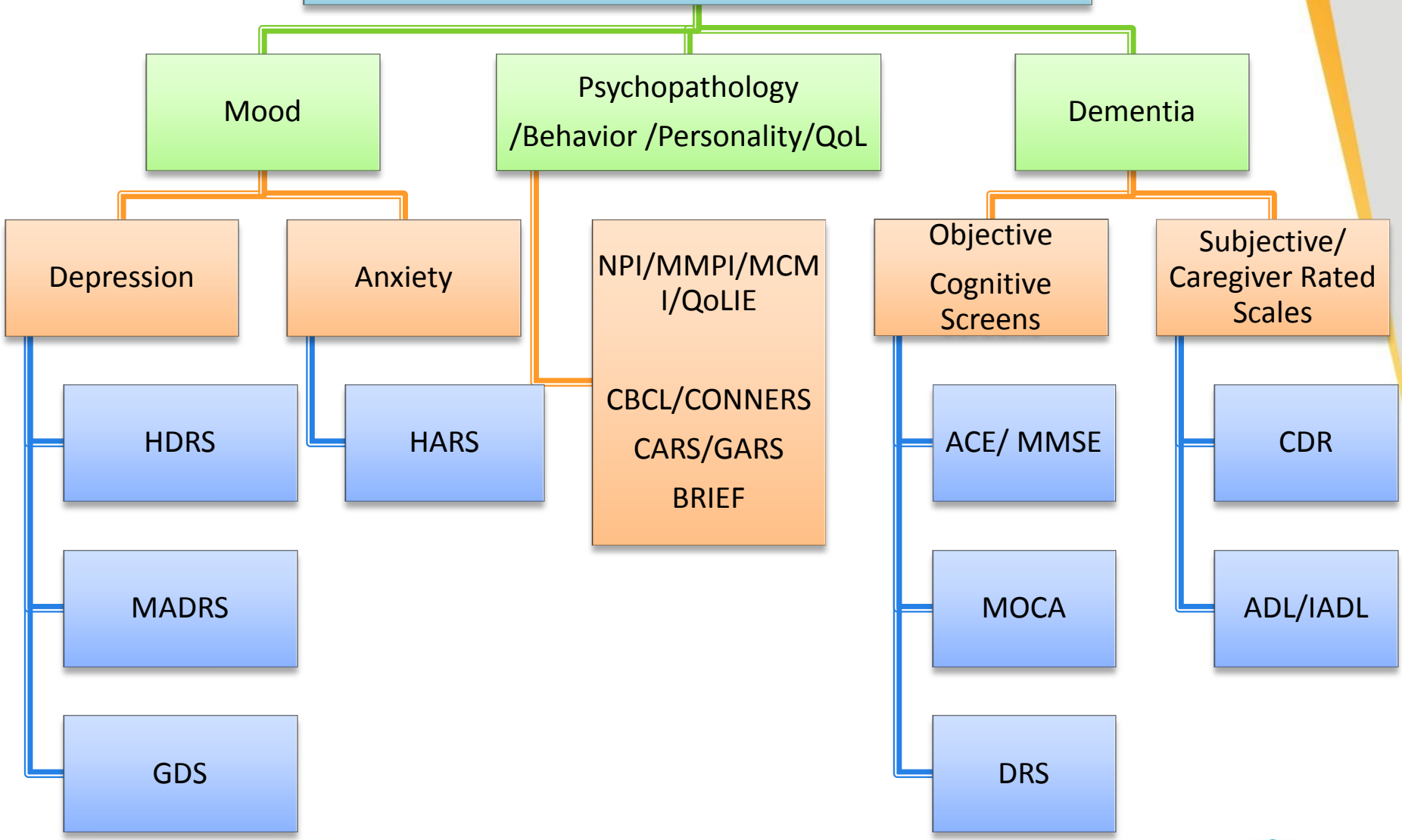
Comprehensive Cognitive Evaluation

Multiple domains and sub domains, >1 test per domain, approx 4 to 6 hours.



Detailed domain specific testing useful for defining patterns of cognitive loss and differential diagnosis

Rating Scales and Screens



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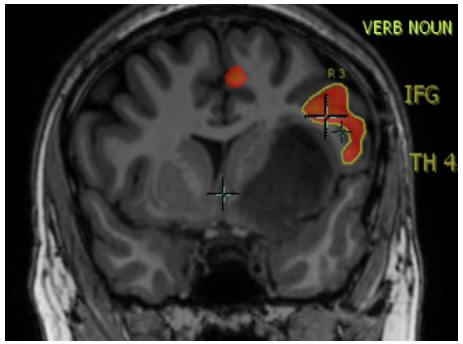
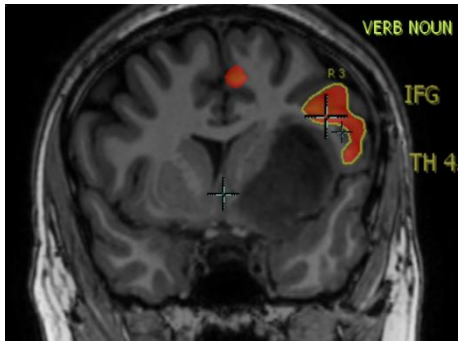
The Expanding Tool Kit….

- Paradigms in fMRI



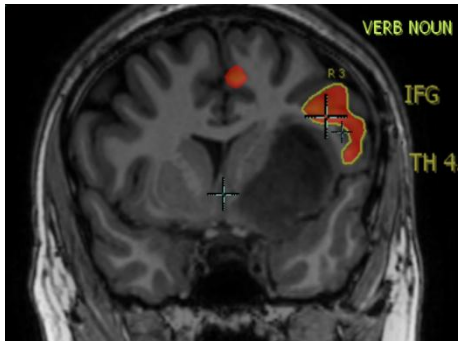
The Expanding Tool Kit….

- Paradigms in fMRI
- Wada Tes



The Expanding Tool Kit….

- Paradigms in fMRI
- Wada Test
- Extra and Intra operative mapping



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Choosing the Right Tool…
APPROPRIATE NORMS

- One Size (Does Not) Fit All…..

Education Effects

Detecting Dementia with the Mini-Mental State Examination (MMSE) in Highly Educated Individuals

Sid E. O'Bryant, Ph.D.[1], Joy D. Humphreys, M.A.[2], Glenn E. Smith, Ph.D.[3], Robert J. Ivnik, Ph.D.[3], Neill R. Graff-Radford, M.D.[4], Ronald C. Petersen, M.D., Ph.D.[5], and John A. Lucas, Ph.D.[6]

Arch Neurol. 2008 July ; 65(7): 963–967.

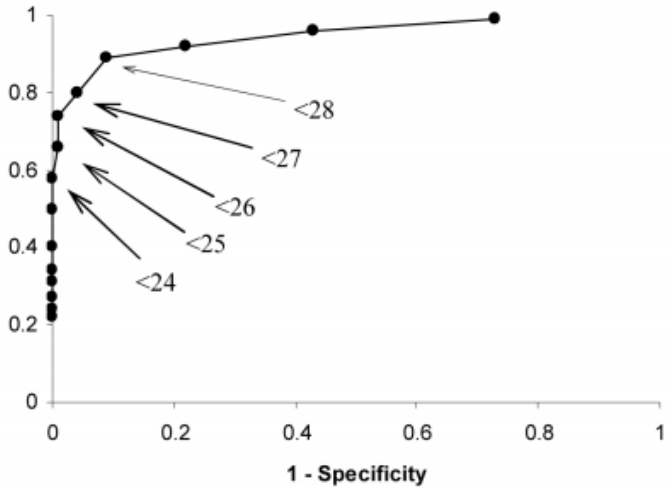

Figure 1.
Receiver operating characteristic curve for Mini-Mental State Examination scores (indicated by numbers within figure) in detecting dementia.

Cut Off Score	Sensitivity	Specificity
<24 (Dementia)	0.66	0.99
<27 (Dementia)	0.89	0.91

The Ballabgarh Study (1995-1998)
Indo-US Cross National Dementia Epidemiology Study

TABLE 2. Distribution of Test Scores by Age (Nondemented Sample, $n = 374$)

Test	n[a]	Age (years) 55–64 $n = 120$ Mean (*SD*)	Median	10th Percentile	65–74 $n = 140$ Mean (*SD*)	Median	10th Percentile	75–93 $n = 114$ Mean (*SD*)	Median	10th Percentile
HMSE Total	374	26.3 (3.0)	27	21	25.6 (4.1)	27	18	24.3 (4.4)	26	17
HMSE Calculation	346	3.2 (1.7)	4	0	3.5 (1.6)	4	0	2.9 (1.7)	3	0
Verbal fluency										
Fruits	374	8.8 (2.7)	9	5	8.3 (2.7)	8	5	7.7 (3.0)	8	3
Animals	373	11.9 (3.4)	11.5	8	12.3 (3.9)	12	7	10.7 (3.6)	11	6
Fruits + animals	373	20.7 (5.0)	20	14	20.5 (5.7)	20	12	18.4 (5.8)	18.5	10
Object naming	362	14.7 (0.6)	15	13	14.5 (1.2)	15	13	14.0 (1.2)	14	12
Constructional praxis	357	9.2 (2.8)	10	4	8.5 (3.1)	9	3	7.7 (3.3)	9	2
Word list learning	370	16.3 (3.7)	16	11	15.2 (4.2)	16	9	13.1 (3.6)	13	8
Word list recall	370	5.6 (1.9)	6	3	4.9 (2.1)	5	2	3.7 (2.1)	4	0
Word list recognition										
Originals	370	9.1 (1.4)	10	6	9.2 (1.3)	10	7	9.1 (1.4)	10	7
Foils	370	9.5 (1.1)	10	8	8.8 (2.1)	10	6	7.9 (3.0)	9	1

Note. HMSE = Hindi Mental State Exam.
[a]Sample size is less than 374 for some tests because some subjects did not complete all tests.

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Cognitive Screening Tools
&
Neuropsychological Tests in India

A List

Prepared by
Dr Aparna Dutt
Consultant Neuropsychologist

5/30/2012

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COGNITIVE SCREENING TOOLS FROM INDIA

Name Author / Year	Type of Study	Place of study	Cognitive Domains Assessed	N	Age Range (years)	Education	Language	Normative Data	Validation
Hindi Mental State Examination (HMSE) Ganguli et al., 1996	tural Community ased on demented	Northern India, Ballabgarh State - Haryana	HMSE total Calculation Word list learning, recall & recognition Object Naming Verbal fluency (category – animals & fruits) Constructional praxis	374	55-64 65-74 75+	Iliterate & semi illiterate	Hindi	Age, Gender & Literacy stratified	No
Kolkata Cognitive Screening Battery Das et al., 2006	Urban Community Based (Epidemiological Study) Healthy elderly	Eastern India, Kolkata State – West Bengal	-do-	745	50-59 60-69 70-70 80-89 90 & above	Illiterates 1-5 6-12 Graduation & above	Bengali	Age, Gender & Education stratified	Yes

Name Author / Year	Type of Study	Place of study	Cognitive Domains Assessed	N	Age Range (years)	Education	Language	Normative Data	Validation
Addenbrooke's Cognitive Examination (ACE-R) Mathuranath et al., 2004	Adaptation Community Based Unimpaired elderly	South India Trivandrum State – Kerala	Attention & Orientation Memory Verbal Fluency Language Visuospatial	100		> 9 years; n=50 ≤ 8 n=50	Malayalam		
Mathuranath et al., 2007	-do-	-do-	-do-	519	55-64 65-74 ≥ 75	0 1-4 5-8 9-12 >12	-do-	Education stratified normative data	No
Alladi et al., 2008		South India Hyderabad Andhra Pradesh	-do-		NA	Illiterates	Telugu Hindi		

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NEUROPSYCHOLOGICAL TEST BATTERIES FROM INDIA

Name/Year/ Author/Place	Type of Study	Cognitive Function	Tests	N	Age Range (years)	Gender wise	Education	Validation
PGI Battery of Brain Dysfunction, 1990 Pershad & Verma,	Not mentioned	Performance Intelligence Verbal Intelligence Memory Perceptuo-motor-organization	Revised Bhatia's Short Battery of Performance Tests of Intelligence Verbal Adult Intelligence Scale PGI-Memory Scale Nahor Benson Test Bender Visual Motor Gestalt Test	Varied sample size for the different tests		Yes	0-5 6-9 10 and above	Yes
NIMHANS Neuropsychological Battery, 2004 Rao SL, Subbakrishnan DK Gopulkumar K Bangalore	Hospital Based	Tests of Speed Attention Memory Executive Function Comprehension	Finger tapping Test Digit Symbol Substitution Test Colour Trails Test Digit Vigilance Test Triads Test Auditory Verbal Learning Test Logical Memory Test Complex Figure Test Design Learning Test Controlled Word Association Test Animal Names Test Design Fluency Test N Back tests (Verbal & Visual) Self Ordered Pointing Tests Tower of London Test Wisconsin Card Sorting Test Stroop Test Token test	180	16-30 31-50 51-65	Yes	Illiterates School College	No

18 tests, 5 domains

WMS-III India: Adaptation and Standardization Project

Author information:
The adaptation and standardization of the WMS-III India was carried out as part of doctoral thesis by Dr. Pushpalatha Gurappa in the Department of Mental Health and Social Psychology, National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, India. Dr. Pushpalatha G is currently working as a Produc Development Leader at Pearson Clinical and Talent Assessment, Bangalore, India The publication of the project work was carried out by Pearson Clinical and Talent Assessment, Bangalore, India.

NEUROPSYCHOLOGICAL TESTS: NORMATIVE STUDIES

Name/Year/ Author/Place	Type of Study	Cognitive Function	Study Objective	Tests	N	Age Range (years)	Gender wise	Education
Mathuranath et al, 2003 Kerala	Normative study Community Based	Verbal Fluency	Effect of age, education & gender on verbal fluency	Animal & Letter	153	55-84	Yes	0 1-3 4-12 >12
George et al., 2007 Kerala	Community Based	Naming Test	Development of culturally appropriate stimuli (line drawings) for naming and normative data		192	21-54 (51) 55-64 (56) 65-74 (49) 75 & above (36)		0-4 Middle School High School College University

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TEST PROTOCOL

Domains/Functions	Tests
• **GLOBAL COGNITIVE SCREENS**	Mini Mental Status Examination (MMSE)
	Addenbrooke's Cognitive Examination (ACE) and ACE III- Indian Adaptation
GENERAL INTELLIGENCE	Wechsler Adult Intelligence Scale WAIS
• **SPEED OF PROCESSING**	
➢ *Mental*	Digit Symbol (Wechsler, 1981)
• **ATTENTION**	
➢ *Immediate*	Digit Span Test
➢ *Focused*	Colored Trails
➢ *Sustained*	Digit Vigilance
• **MEMORY**	
➢ *Verbal*	CERAD Neuropsychological Battery (**Consortium to Establish a Registry for Alzheimer's Disease) –Memory sub test**
	Auditory Verbal Learning Test (AVLT)
	Passages
	Paired Associates
➢ *Visual*	Complex Figure Test (CFT)
	Visual Reproduction
	Benton Visual Retention Test BVRT
• **EXECUTIVE**	
➢ *Verbal Fluency*	Phonemic Fluency Test-FAS
	Category Test- Animals
o *Working Memory*	Verbal N- back task
o *Cognitive Control*	Stroop Test
o *Cognitive Flexibility*	Wisconsin Card Sorting Test (WCST)
o *Problem Solving*	Tower of London
• **LANGUAGE**	
o *Comprehension*	Token Test
o *Naming*	Boston Naming Test (BDAE)
o *Global*	Boston Diagnostic Aphasia Examination (BDAE)
• **MOOD**	Geriatric Depression Rating Scale (GDS)
• **BEHAVIOR**	Neuropsychiatric Inventory (NPI)
• **DEMENTIA RATING**	Clinical Dementia Rating Scale (CDR)

SPEED OF PROCESSING

- Mental Speed of Processing
  - Digit Symbol Substitution Test DSST (WAIS)
- Motor Speed of Processing
  - Finger Tapping
  - Grooved/Purdue Pegboard

2. DIGIT SYMBOL

SAMPLES

2	1	3	7	2	4	8	1	5	4	2	1	3	2	1	4	2	3	5	2	3	1	4	6	3

1	5	4	2	7	6	3	5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3

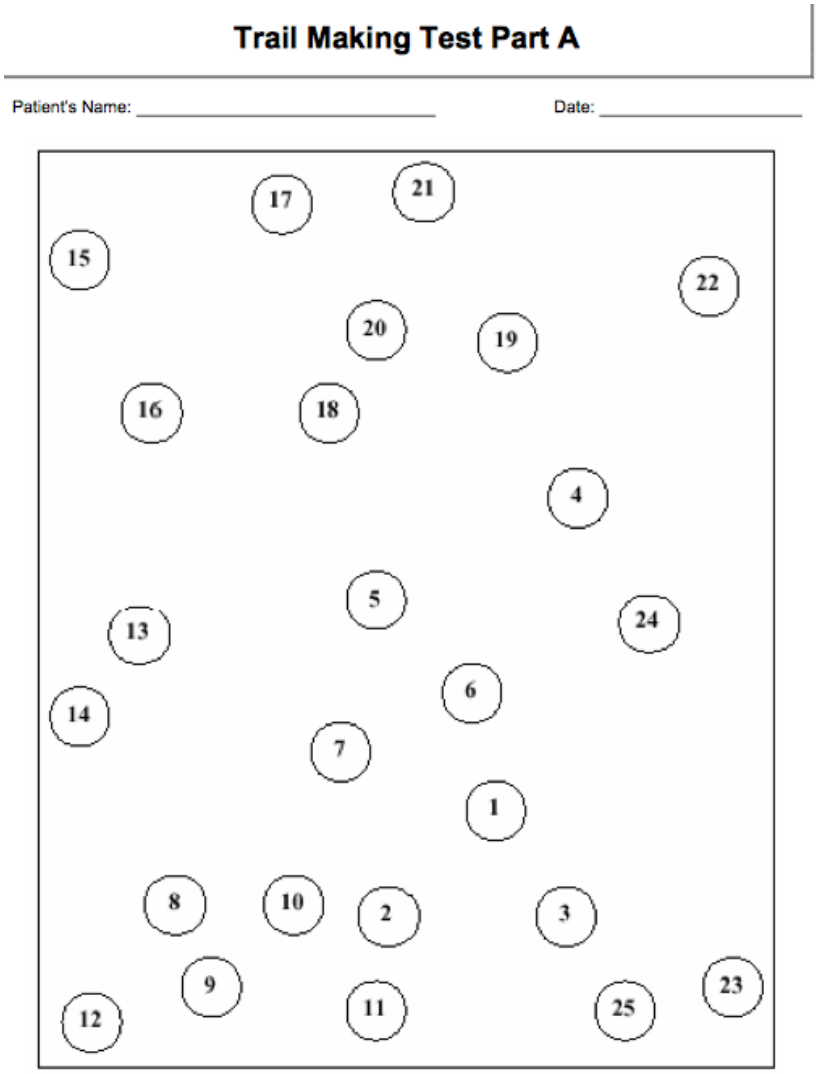
6	2	5	1	9	2	8	3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7

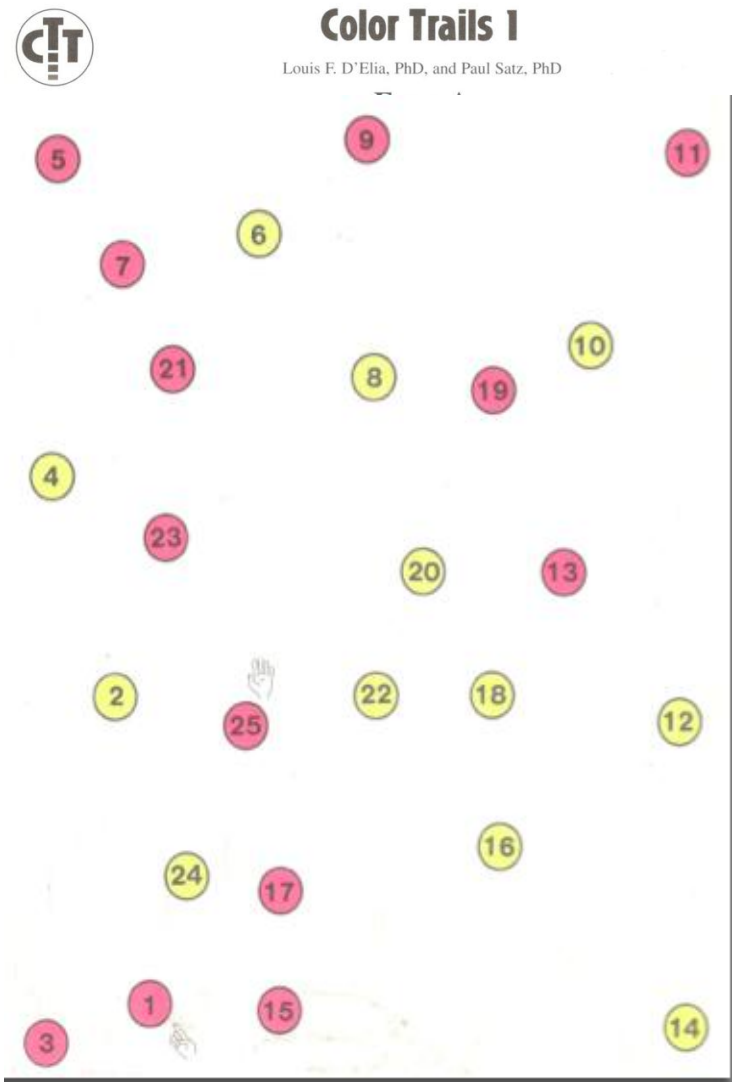
9	2	8	1	7	9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

ATTENTION

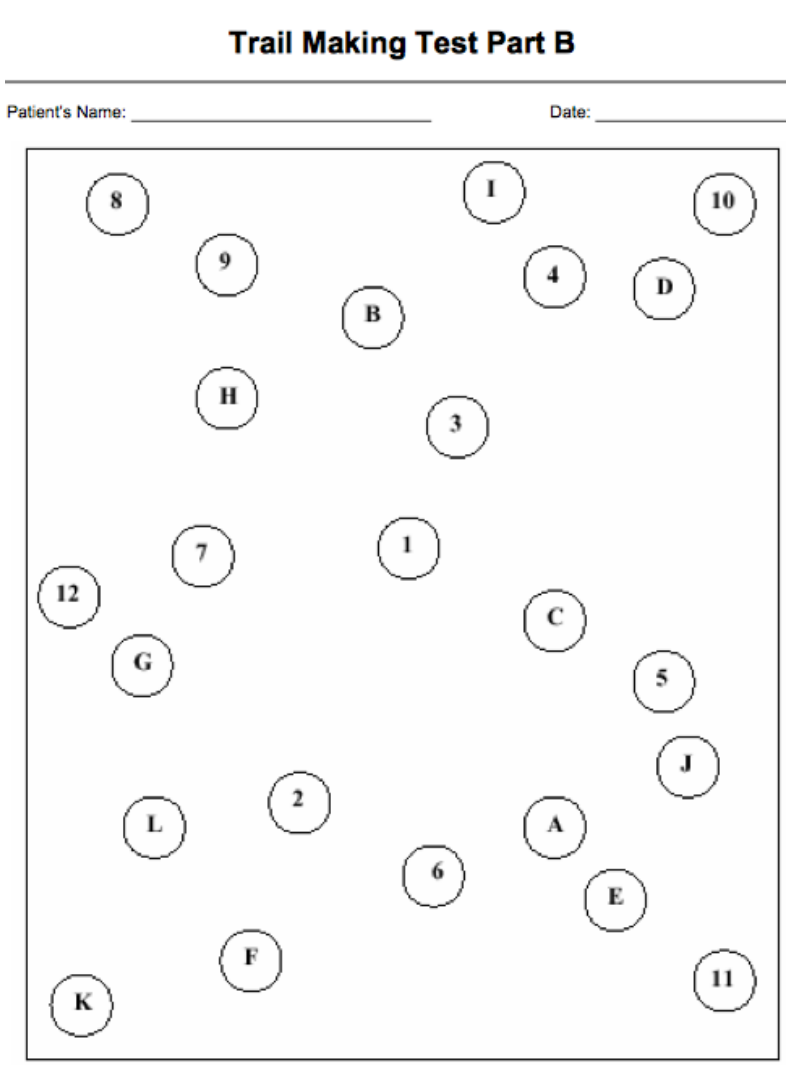
- Immediate Attention
  - Digit Span Forward
- Focused Attention
  - Colored Trails I
- Sustained Attention
  - Digit Vigilance

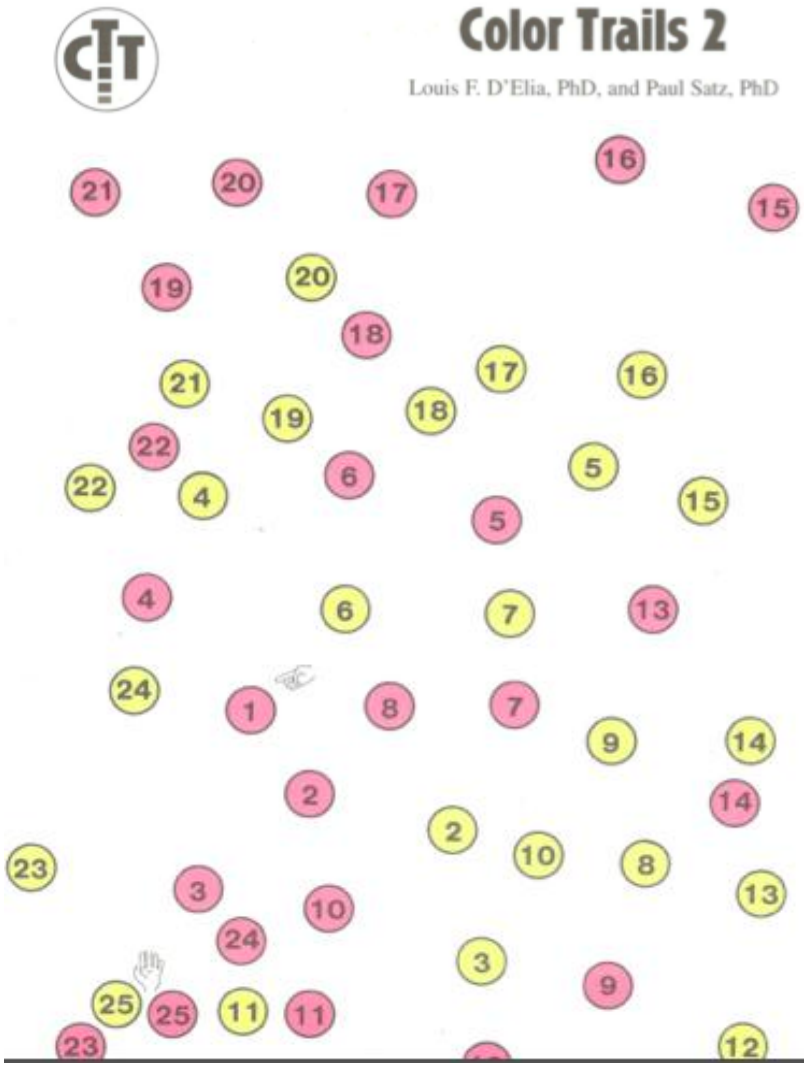
Trails I : Focused Attention



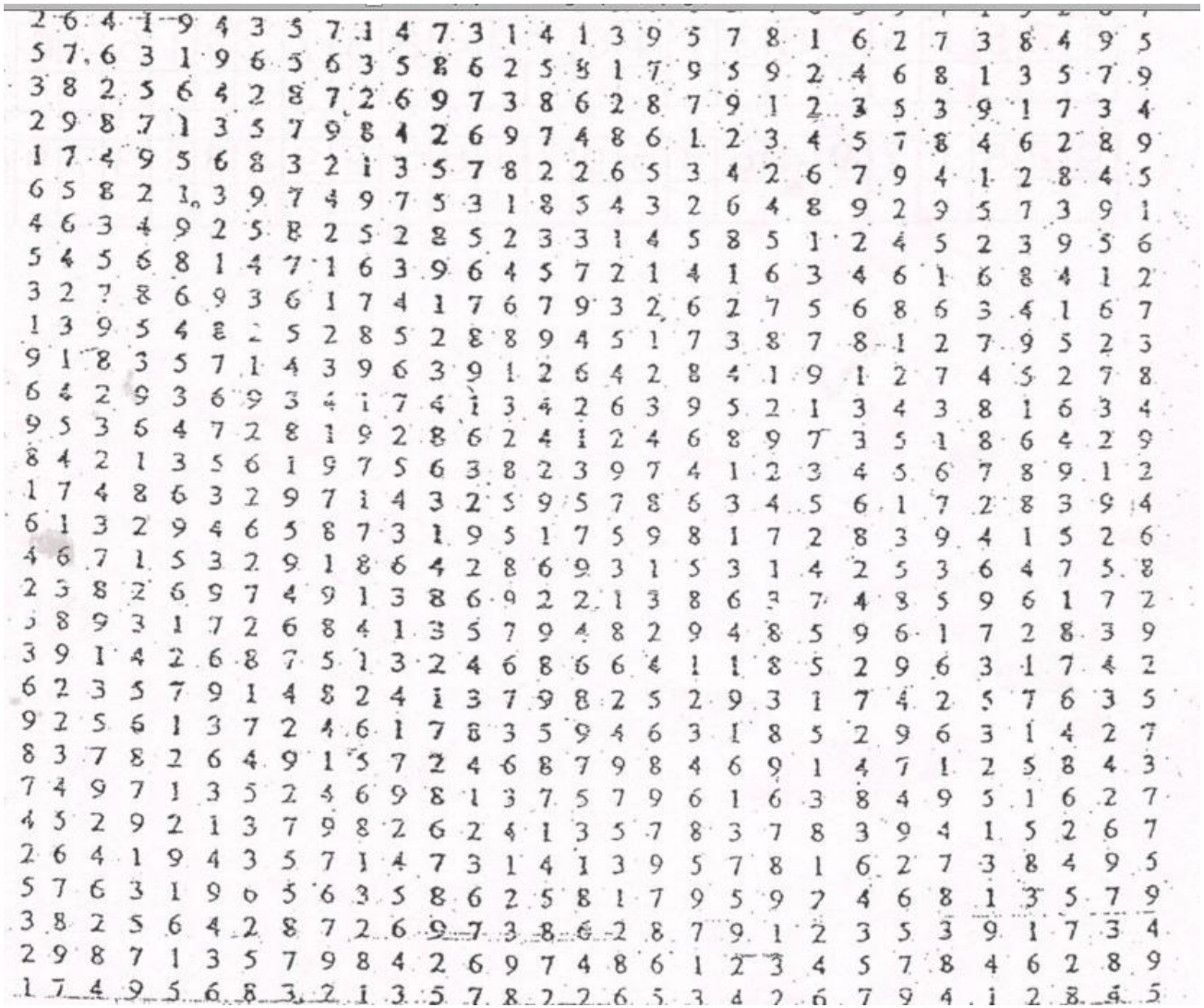


Trails II : Focused Attention





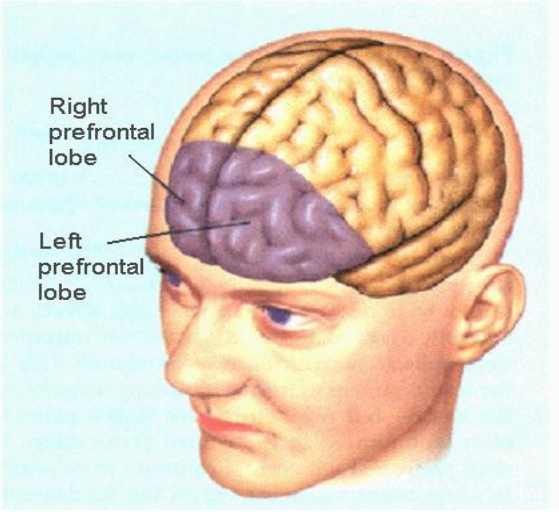
Digit Vigilance:Sustained Attention

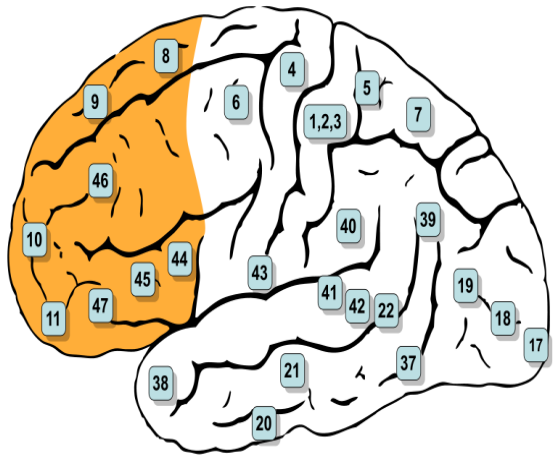


EXECUTIVE FUNCTIONING

- Problem Solving/Planning
  - Tower of London
- Cognitive Flexibility
  - Wisconson Card Sorting Test (WCST), Colored Trails II
- Cognitive Control
  - Stroop Test
- Working Memory
  - N-Back Tests
- Digit Span Backwards/Serial Subtractions
  - Fluency
- Verbal Fluency-COWAT, Category tests

PRE-FRONTAL CORTEX (PFC)





Phylogenetically and ontogenetically last to develop…..

- Dysexecutive Syndrome- Dorsolateral Areas
- Disinhibited-Orbital Areas
- Akinetic-Medial Areas

Dysexecutive Syndrome
Dorsal-Lateral

Difficulty planning/ setting goals

Problems being organized

Difficulty being flexible

Difficulty problem solving

Difficulty prioritizing

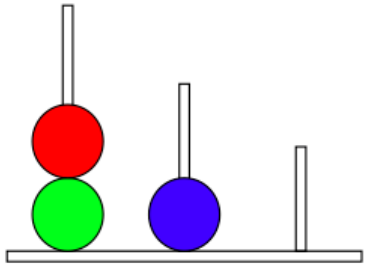
Decreased awareness of thinking changes in self

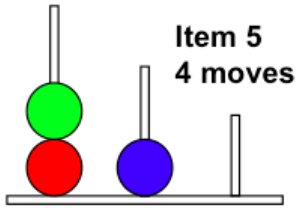
Emotional Dyscontrol

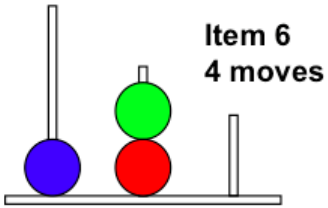
Tower of London Test

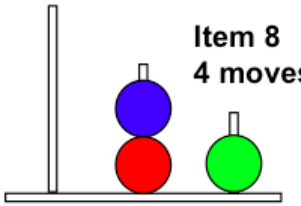
Executive Function – Problem Solving

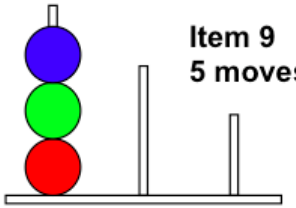
Standard Configuration

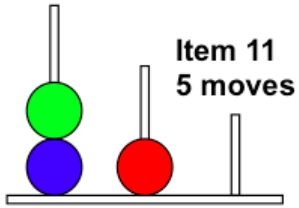


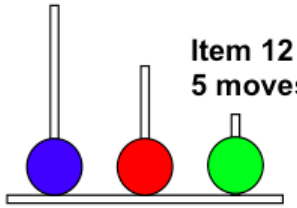




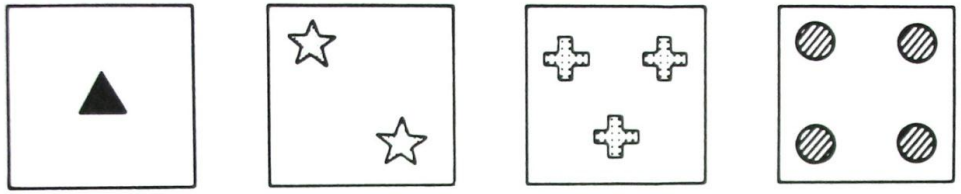


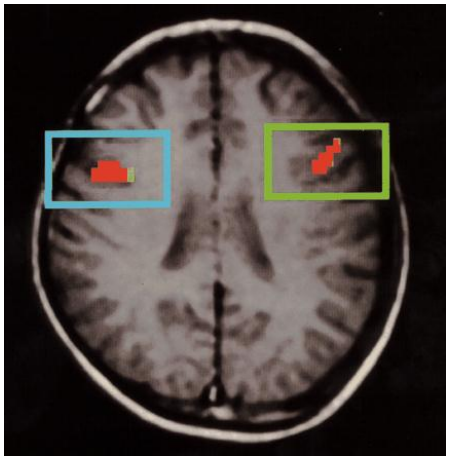


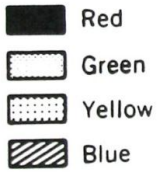


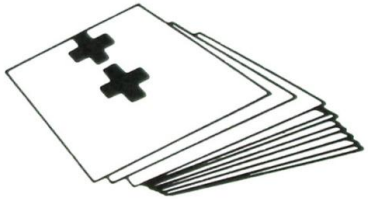


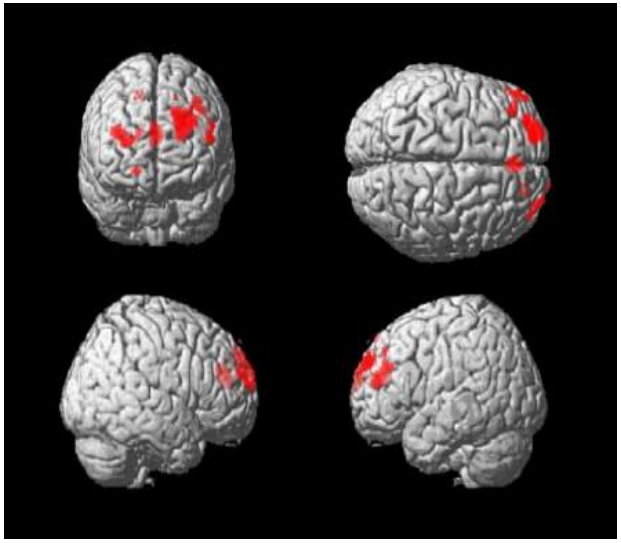
Wisconson Card Sorting Test
WCST



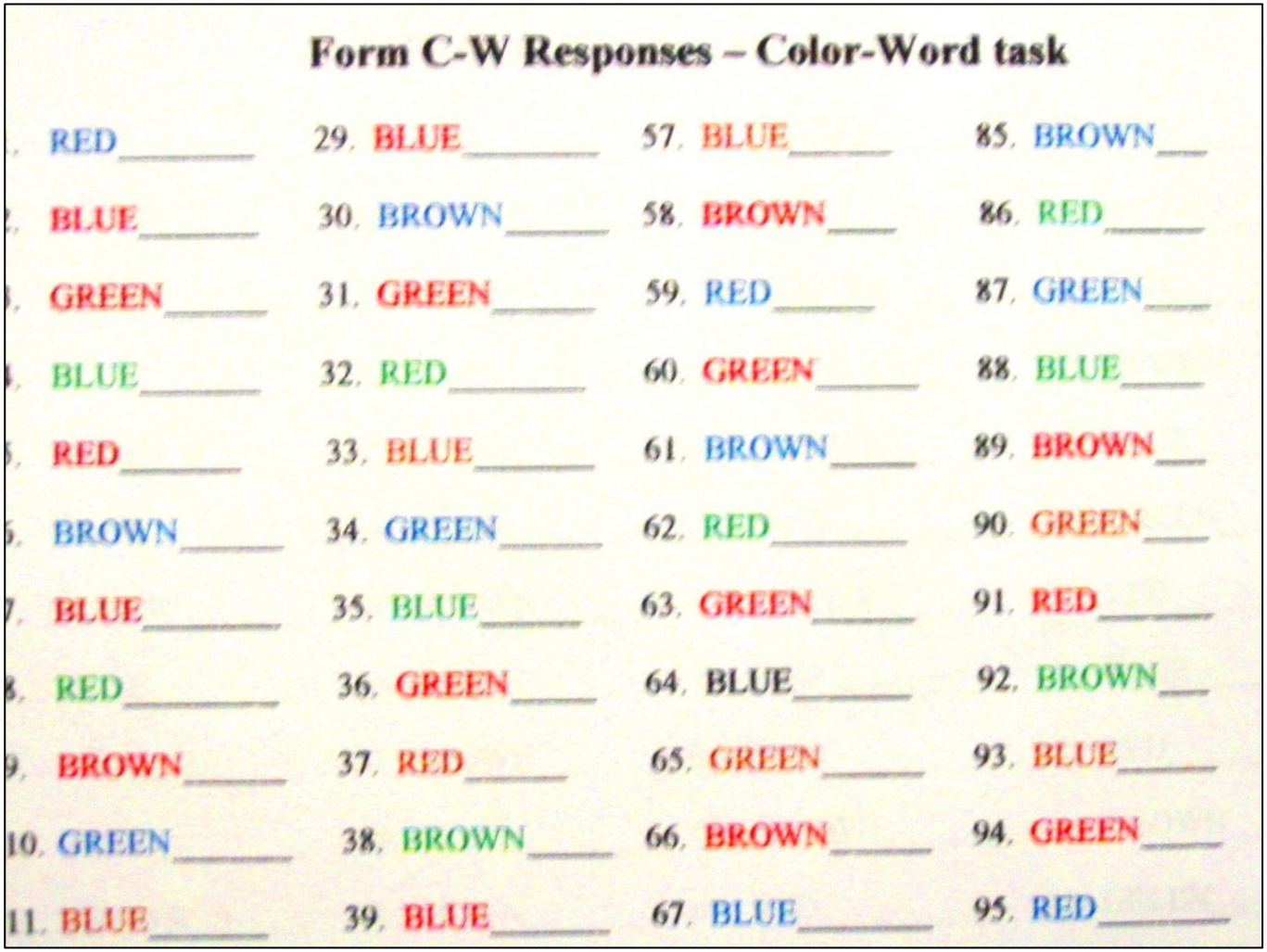








Stroop Test

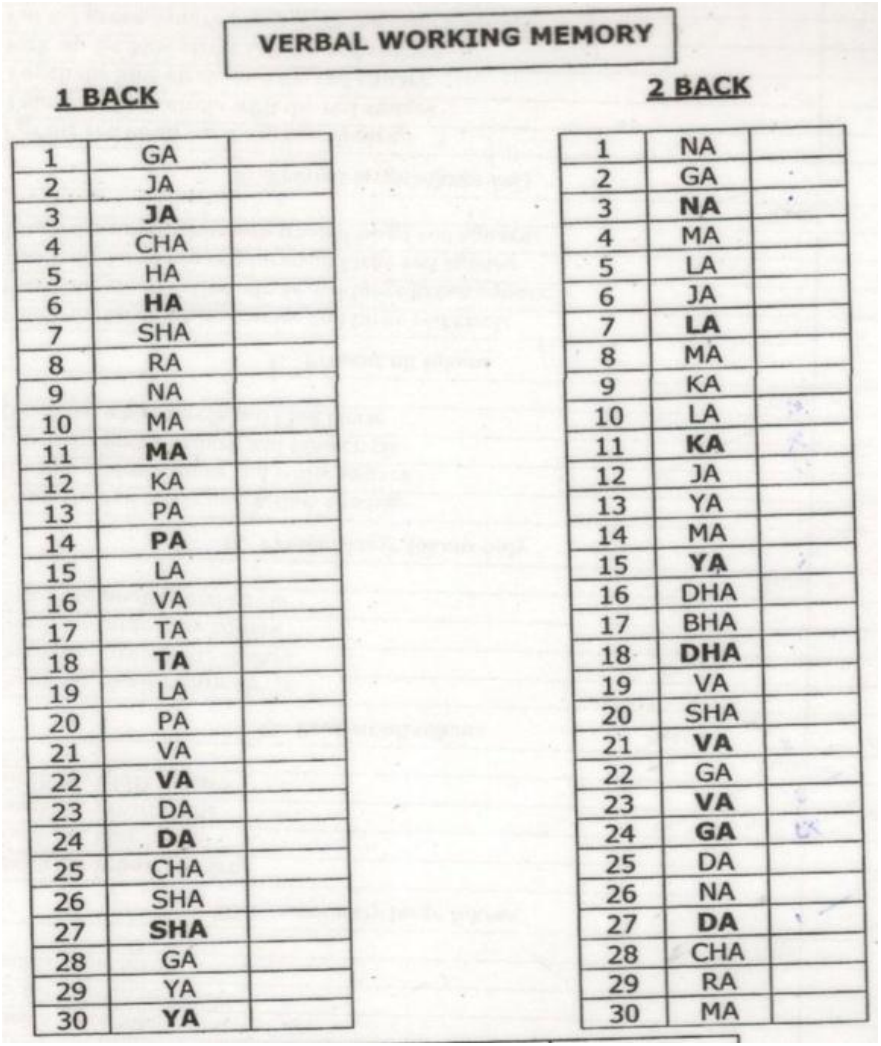


Form C-W Responses – Color-Word task

. RED_____	29. BLUE_____	57. BLUE_____	85. BROWN___
2. BLUE_____	30. BROWN_____	58. BROWN____	86. RED_____
3. GREEN_____	31. GREEN_____	59. RED_____	87. GREEN____
4. BLUE_____	32. RED_____	60. GREEN_____	88. BLUE_____
5. RED_____	33. BLUE_____	61. BROWN_____	89. BROWN___
6. BROWN_____	34. GREEN_____	62. RED_____	90. GREEN____
7. BLUE_____	35. BLUE_____	63. GREEN_____	91. RED_____
8. RED_____	36. GREEN_____	64. BLUE_____	92. BROWN___
9. BROWN_____	37. RED_____	65. GREEN_____	93. BLUE_____
10. GREEN_____	38. BROWN_____	66. BROWN_____	94. GREEN_____
11. BLUE_____	39. BLUE_____	67. BLUE_____	95. RED_____

MISSING LINK

Working Memory N Back Tests



VERBAL WORKING MEMORY

1 BACK

1	GA	
2	JA	
3	**JA**	
4	CHA	
5	HA	
6	**HA**	
7	SHA	
8	RA	
9	NA	
10	MA	
11	**MA**	
12	KA	
13	PA	
14	**PA**	
15	LA	
16	VA	
17	TA	
18	**TA**	
19	LA	
20	PA	
21	VA	
22	**VA**	
23	DA	
24	**DA**	
25	CHA	
26	SHA	
27	**SHA**	
28	GA	
29	YA	
30	**YA**	

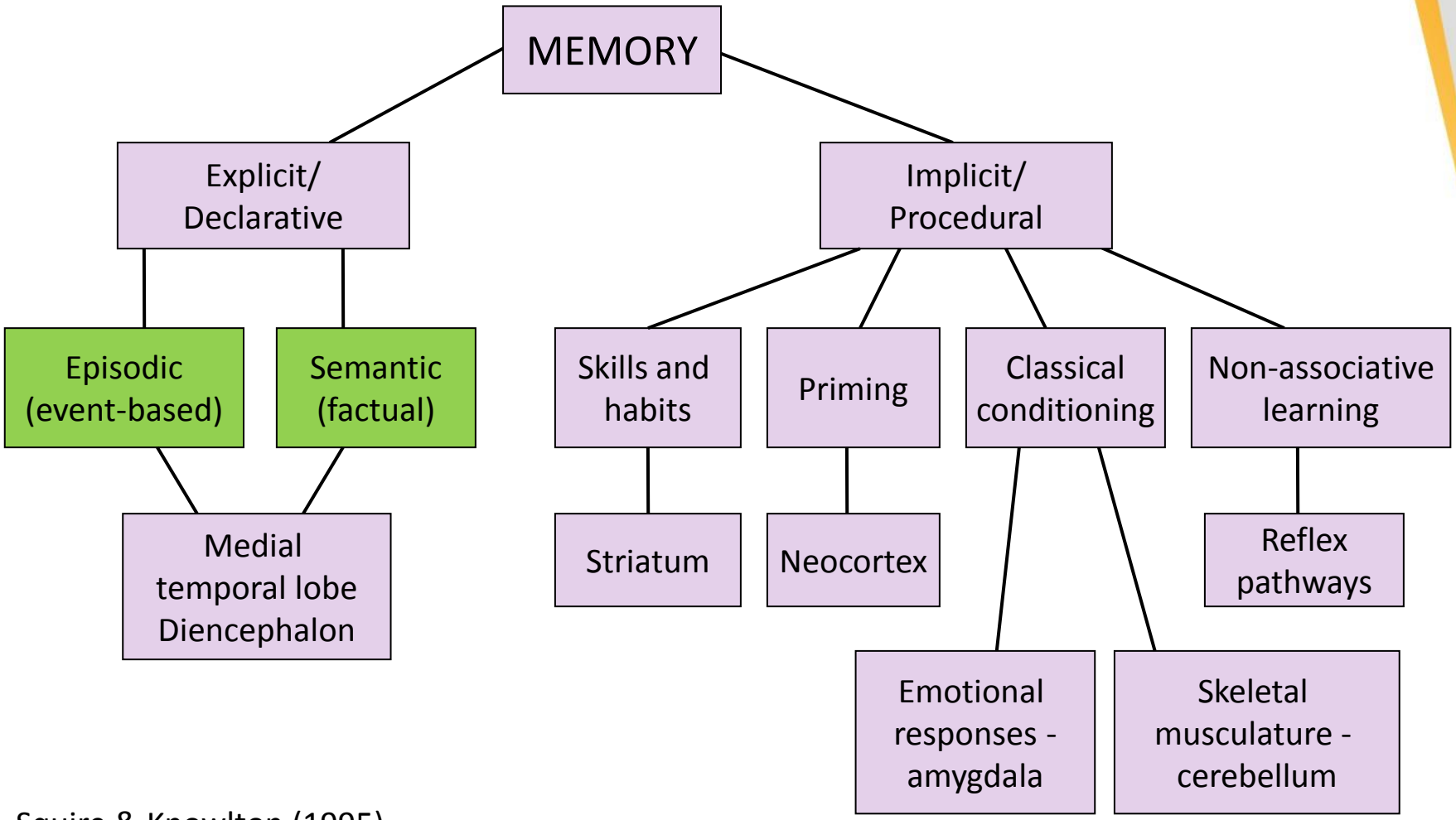
2 BACK

1	NA	
2	GA	
3	**NA**	
4	MA	
5	LA	
6	JA	
7	**LA**	
8	MA	
9	KA	
10	LA	
11	**KA**	
12	JA	
13	YA	
14	MA	
15	**YA**	
16	DHA	
17	BHA	
18	**DHA**	
19	VA	
20	SHA	
21	**VA**	
22	GA	
23	**VA**	
24	**GA**	
25	DA	
26	NA	
27	**DA**	
28	CHA	
29	RA	
30	MA	

MEMORY

- Verbal Memory
  - Auditory Verbal Learning Test
  - Passages (WMS III)
  - Paired Associates (WMS III)
- Visual Memory
  - Complex Figure Test (CFT)
  - Visual Reproduction (VR) (WMS III)
  - Faces (WMS III)
  - Design Learning (WMS IV)

Memory Systems and Substrates



Squire & Knowlton (1995)

Types of Memory

- Procedural Memory – How is tennis played?
- Semantic Memory – What are the rules of a tennis game?
- Episodic Memory – When did I last play tennis?

THE AUDITORY VERBAL LEARNING TEST (AVLT- WHO/UCLA

Items - English	Hindi	Marathi	Gujarati
1) Arm	Baanh	~~Baanh~~ दंड	Baanh
2) Cat	Billi	Maanzar	Bilaadi
3) Axe	Kulhadi	Kurhaad	Kuvaado
4) Bed	Palang/bistar	Palang	Palang
5) Plane	Vimaan	Vimaan	Vimaan
6) Ear	Kaan	Kaan	Kaan
7) Dog	Kutta	Kutra	Kutro
8) Hammer	Hathoda	Hathodi	Hathodo
9) Chair	Kursi	Khurchi	Khursi
10) Car	Gaadi	Gaadi	Gaadi
11) Eye	Aankh	Dole	Aankh
12) Horse	Ghoda	Ghoda	ghodo
13) Knife	Chhuri/chaaku	Chaaku	Chhari/chappu
14) Clock	Ghadi	Ghadiyal	Ghadiyal
15) Bike (Scooter)	Scooter	Scooter	Scooter

PAIRED ASSOCIATES

TRIAL 1

1	Truck-Arrow	*HINDI:* Truck-baan	Bank-	1	Star- Ladder	Elephant -
2	Ant-Seed	Chinti-beej	Snake -	2	Elephant -Glass	Ant -
3	Snake- Joker	Saanp-joker	Star -	3	Ant-Seed	Snake -
4	Bank- Picture	Bank-chitra	Rose -	4	Truck-Arrow	Rose -
5	Star- Ladder	Tara-seedi	Elephant -	5	Snake- Joker	Monkey -
6	Monkey- Paper	Bandar-kaagaz	Truck -	6	Bank- Picture	Bank-
7	Rose- Bag	Gulab-thaili	Ant -	7	Monkey- Paper	Truck -
8	Elephant -Glass	Haathi-sheesha	Monkey -	8	Rose- Bag	Star -
	Total =				Total =	

TRIAL 2

TRIAL 3

1	Rose- Bag	*GUJ:* Gulaab-thayli	Ant -	1	Monkey- Paper	Star -
2	Monkey- Paper	Vaandro-kaagal	Star -	2	Truck-Arrow	Rose -
3	Star- Ladder	Tara-seedhi	Truck -	3	Star- Ladder	Ant -
4	Snake- Joker	Saap-joker	Rose -	4	Ant-Seed	Monkey-
5	Elephant -Glass	Haathi-kaanch	Elephant -	5	Rose- Bag	Elephant -
6	Ant-Seed	Keedi-bee	Snake -	6	Snake- Joker	Bank-
7	Bank- Picture	Bank-chitra	Bank-	7	Bank- Picture	Snake-
8	Truck-Arrow	Truck-baan	Monkey -	8	Elephant -Glass	Truck-
	Total =				Total =	

TRIAL 4

MISSING LINK

Verbal Memory Tests: Indian Norms

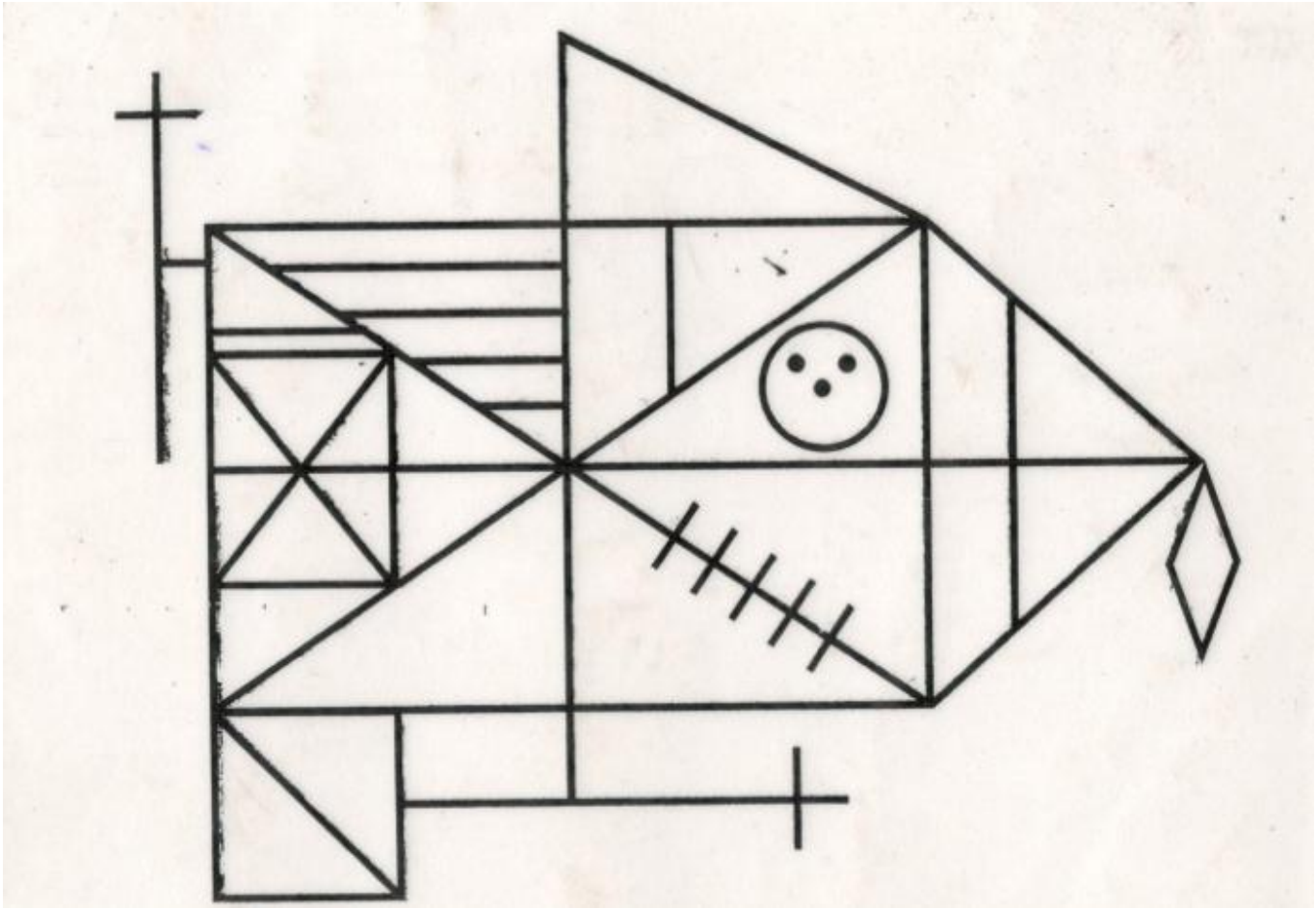
Type	Process	Screen/Battery/Test *Indian Elder Norms 65+years
3 Words	Immediate Recall	MMSE*
7 Word Address	Immediate Recall, 3 Learning Trials, Delayed Recall	ACE*
7 Word Address	Immediate Recall, 3 Learning Trials, Delayed Recall & Recognition Trial	ACE III
10 Word List	Immediate Recall, 3 Learning Trials, Delayed Recall, Recognition Trial	CERAD Kolkotta Norms*
15 Word List	Immediate Recall, 5 Learning Trials, Delayed Recall, Recognition Trial	AVLT
Paragraph/Story	Immediate Recall, Delayed Recall, Recognition Trial	WMS III
Paired Associate	Immediate Recall, 4 Learning Trials, Delayed Recall.	WMS III

MISSING LINK

CORTICAL/SUBCORTICAL

Function	Cortical Dementia (e.g Alzheimer's Disease)	Subcortical Dementia (e.g Huntington's disease)
SPEED OF PROCESSING	Normal	Marked 'slowing up' (bradyphrenia)
ATTENTION	Intact in early stages	Impaired
EPISODIC MEMORY	**Amnesia**	***Retrieval Deficits: Recognition better than Recall***
FRONTAL 'Executive'	Normal until later stage	Typically impaired from onset
PERSONALITY	Preserved	Apathetic, inert
LANGUAGE	Aphasic features	Normal, except for reduced output and dysarthria
PRAXIS	Impaired	Normal
VISUO-SPATIAL	Impaired	Impaired

Visual Memory: Complex Figure Test



COMMON fMRI PARADIGMS

- DLPFC: Working Memory N-Back Tasks, WCST
- OFC: Stroop, Go-No Go
- ACC: Attention Tasks
- Amygdala: Emotion Recognition Tasks
- Hippocampus: Memory Tasks

Outline

- Neuropsychology
  - The Brain Behavior Relationship-In the beginning to now..
- Neuropsychology Evaluation
  - Choosing the Right Tool - *One Size Does Not Fit All*
  - The Indian Tool Box: *Yehi Hai Right Choice..?*
- Neuropsychological Profiles
  - The Scores Story

EPILEPSY

- Neurobehavioral Comorbidities (cognition, behavior mood)
  - Most frequent and maximally impact QOL.
- Depression and suicidality major concerns. ADHD, Autism and IDD frequently co morbid
- Often precede epilepsy. Possible bidirectional relationship common pathogonomic pathways
- Atypical QoL trajectories and psychosocial outcomes

Neuropsychological Evaluations in Epilepsy

- Pre Surgical: Lateralization/Localization; Predicting Outcomes
- Identification: 'At Risk Populations', Pseudoseizures
- Tracking Changes: AED Tolerability, EEG changes
- Counseling and Rehabilitation: Cognitive, Behavior Issues/Academic Underperformance/ Vocational Rehabilitation

Cognitive Impairments

- Low General Intelligence
  - Domain Specific Profile
- Speed of Processing (AED'S)
- Memory, Naming (TLE)
- Attention & Executive Function (FLE)

ARTICLE IN PRESS

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Original research

Memory outcomes in mesial temporal lobe epilepsy surgery

Urvashi Shah [a, *], Aishani Desai [b], Sangeeta Ravat [a], Dattatraya Muzumdar [c], Yogesh Godge [b], Neena Sawant [d], Mayuri Jain [b], Neeraj Jain [b]

Score Sheet (19 year old Male/ College F.Y B.A)

DOMAINS	TESTS	SCORES	NORMS
• SPEED OF PROCESSING			
➢ *Mental*	Digit Symbol	TT= 350 secs	3-6
• ATTENTION			
➢ *Immediate and Complex*	Digit span (WAIS)	Forward- 5 Backward-4	
➢ *Focused*	Color trails test	Form I= 60 secs Form II= 127 secs	46 17-20
➢ *Sustained*	Cancellation task	TT- 303 secs Errors-O=1	89-91
• MEMORY			
➢ *Verbal*	Rey Auditory Verbal Learning Test (AVLT)	IR1=6 2=13 3=11 4=13 5=13 Total= 56 B=5 6A=14 DR=15 Recog = 15/15	20 60 10 30 25 20 10 60 95 95
	Logical Memory- Passages	IR= 13 DR=10	50 50
	Paired Associates Test (WMS III)	IR= 1,3,4,6=14 DR=8	5 95
➢ *Visual*	Visual Reproduction (WMS III)	IR= 73/104 DR= 26/104 Recognition= 39/48 V-S comp= 7/7	5-10 <5 <5
	Complex Figure Test (CFT)	Copy= 30 Org= very very poor IR= 3 DR=6	<3 <3 <3
	Benton Visual Retention Test (BVRT)	Score= 4/10	

Epilepsy and Depression

"Melancholics ordinarily become epileptics, epileptics melancholics: what determines the preference is the direction the malady takes;

- If it bears upon the body-epilepsy,
- If upon intelligence-melancholy".
- Hippocrates, 400 B.C.

Epilepsia, 52(Suppl. 1):21–27, 2011
doi: 10.1111/j.1528-1167.2010.02907.x

EPILEPSY SPECTRUM DISORDER

Depression and epilepsy: A bidirectional relation?

Andres M. Kanner

Article in Press

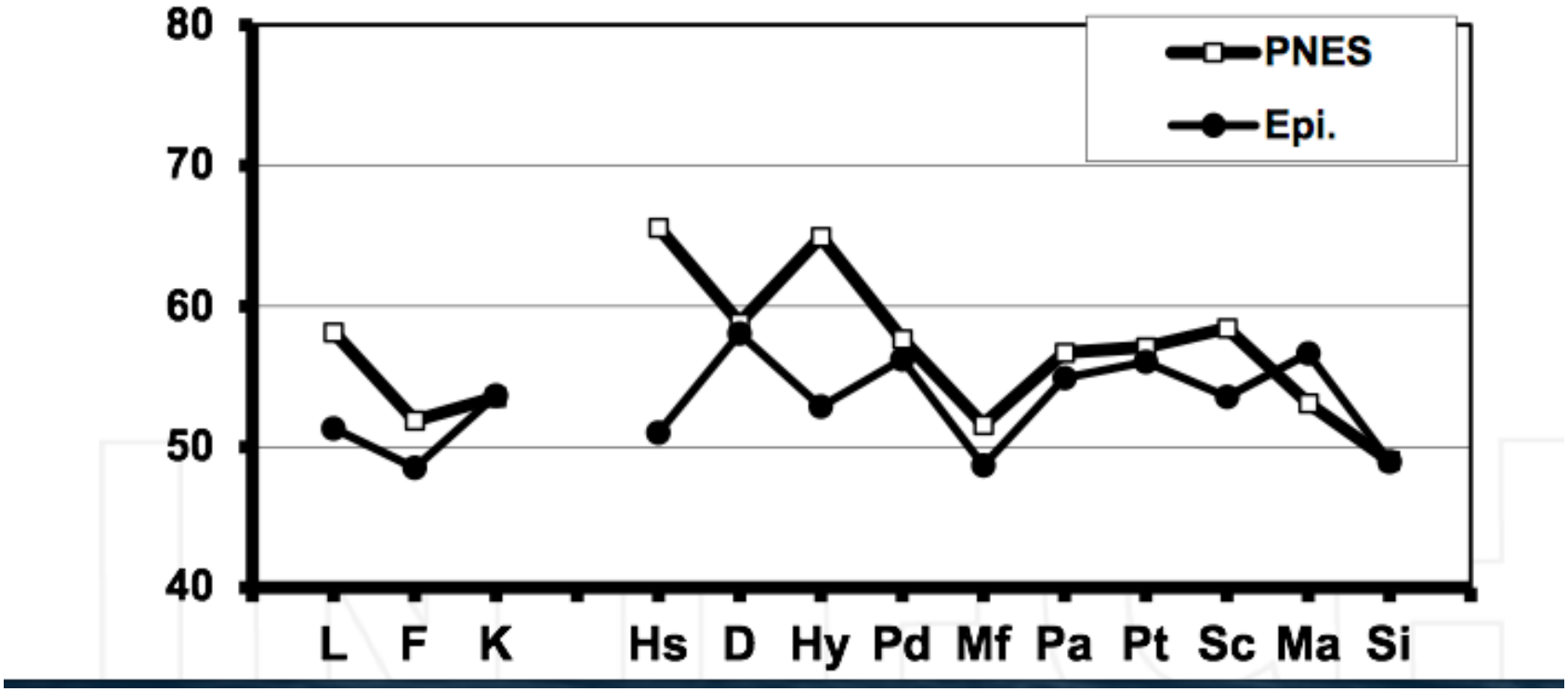
Is psychiatric assessment essential for better epilepsy surgery outcomes?

Neena Sawant, Sangeeta Ravat, Dattatraya Muzumdar, Urvashi Shah

DOMAINS	TESTS	First Evaluation		Repeat Evaluation	
		Score	%tile	Score	%tile
SPEED OF PROCESSING					
	Digit Symbol TT	160	50	128	80
ATTENTION					
Focused	Colored Trails 1- TT	58	20	31	70
Complex	Colored Trails 2 TT	147	17	62	87
Sustained	Digit Vigilance				
	Total time	542	16	404	61
VERBAL MEMORY	a) RAVLT				
	T1	4	<5	12	95
	T2	12	50	13	60
	T3	12	30	13	50
	T4	14	40	12	15
	T5	13	25	13	25
	Total Learning	55	20	63	50
	B	7	40	5	10
	6A (IR)	12	20	13	30
	Delayed Recall	13	25	15	95

Pseudoseizures: MMPI Profile

Personality Profiles of Patients with Psychogenic Nonepileptic Seizures



Benign Rolandic Epilepsy

- Normal intellectual functioning may mask subtle cognitive deficits in children with BECTS.
- Deficits usually missed unless tested for but have a significant impact on academic performance.
- Early detection, timely interventions, parental counseling may help ease the negative impact of the academic failures.
- These findings call into question the ‘benignness’ of BECTS

Shah et al, ECON 2006.

BECTS

• INTELLIGENCE	Malin's Intelligence Scale for Indian Children (MISIC, 1969)	
	Sub Tests	**Scores**
Verbal sub tests	Information	100
	Comprehension	92
	Arithmetic	95
	Similarities	107
	Digit span	120
	Verbal score	514
Performance subtests	Picture completion	100
	Block design	128
	Object assembly	131
	Coding	92
	Mazes	107
	Performance score	558
	Verbal IQ=	**103**
	Performance IQ=	**112**
	Full Scale IQ=	**107**

Domains	Tests	Scores	Cut off/Scale Scores
• SPEED OF PROCESSING			
➢ *Mental*	Coding	Raw Score= 34	TQ=92
• ATTENTION			
➢ *Immediate and Complex*	Digit span (WAIS)	Forward- 9 Backward-3*	TQ= 120
➢ *Focused*	Color trails test	Form 1= 120 secs Form 2= 190 secs	142 254
➢ *Sustained*	Color Cancellation task	TT- 109 secs* Errors-O= 0	88
• MEMORY			
➢ *Verbal*	Rey Auditory verbal learning test (AVLT)	IR= 5,9,12,13,14 Total= 53 B= 6 6A=13 DR=7*	3,6,7,8,10 38 7 8
➢ *Visual*	Memory for designs test	IR= 8,11,14,16,13 DR=14	1,6,8,7,8 10
• EXECUTIVE			
➢ *Planning*	Mazes	Score=16 TQ= 107	9
➢ *Working memory*	Verbal N-back test	1back= 9/9 2back= 10/16	8 11
	Visual spatial working memory task	Forward =4 Backward =3 Total=7	6
➢ *Fluency Verbal*	FAS Phonemic Fluency Test (Leak, 1995)	F= 8, A=8, P=8 Total= 8	
	Animal category test	11	
• VISUO- PERCEPTUAL	Motor Free Visual Perception Test (MVPT)	Score= 32/36	25
• VISUO-CONSTRUCTIVE	Block design test	Score = 30 TQ= 128	8
• VISUO- CONCEPTUAL	Picture Completion test	Score= 10 TQ=100	8
• LANGUAGE			
➢ *Comprehension*	Token test (De Rienzi & Vignola, 1962)	Score= 33/36	29
➢ *Expressive*	Luria's test for Expressive speech	Score= 28/30	

Behavior Rating

Frontal Cortical Dysplasia

Conner's Parent Rating Scale

Domains	Score	T Score
A – Oppositional	12	65
B – Cognitive Problems/ Inattention	16	68
C – Hyperactivity	10	65
D –Anxious/ Shy	3	50
E- Perfectionism	6	56
F – Social Problems	0	44
G –Psychosomatic	0	42
H – Conner's ADHD Index	17	66
I – CGI- Restless- Impulsive	11	70*
J – CGI- Emotional Lability	7	78*
K – Total CGI	18	75*
L – DSM IV Inattentive	10	61
M – DSM IV Hyperactive Impulsive	15	73*
N – DSM IV Total	25	68

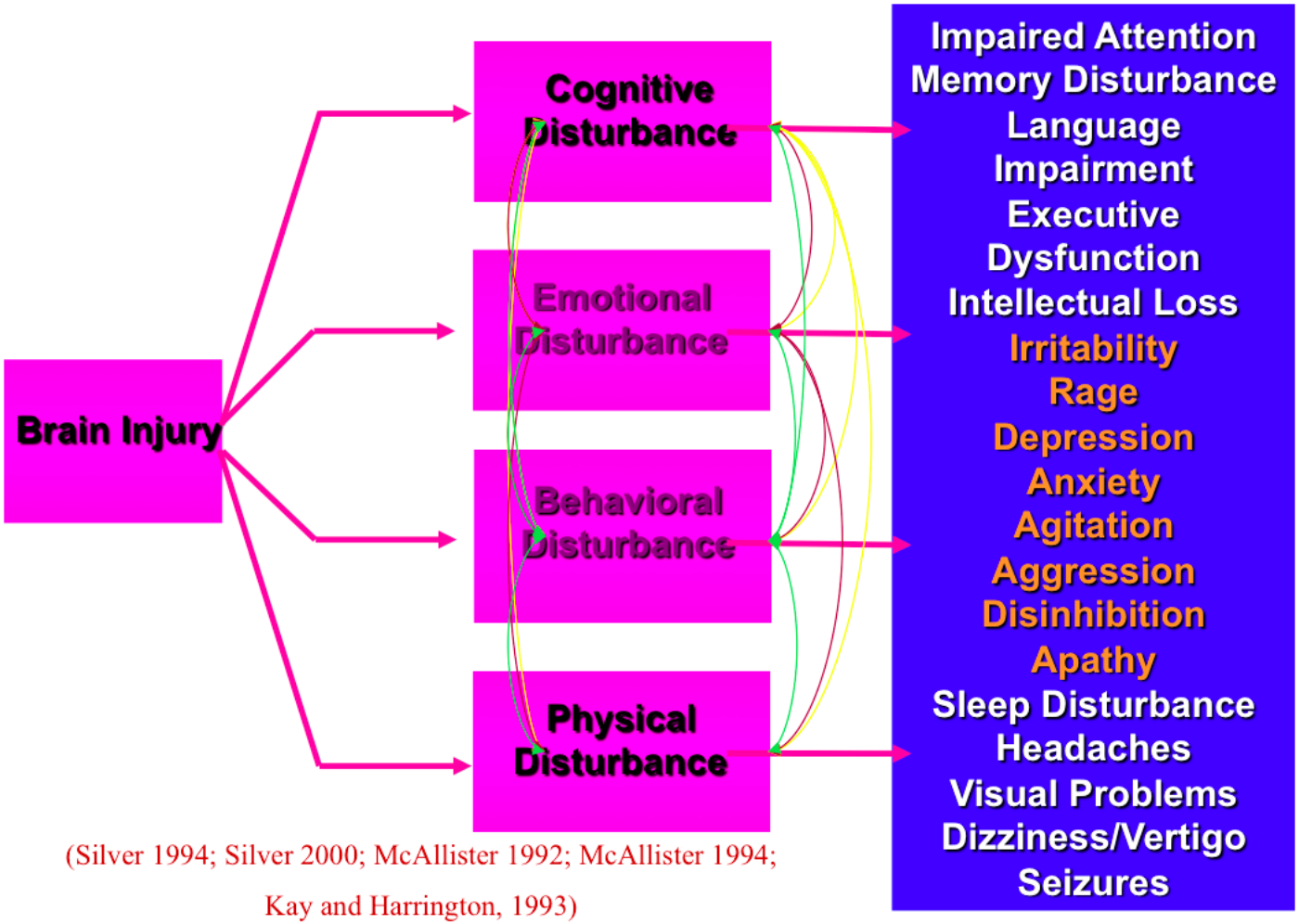
*Scores in clinical range

BRIEF SCORE SUMMARY TABLE

*T scores >65 are in the clinical range suggestive of dysfunction.

Index/Scale	Raw Score		*T* Score	
	Pre	Post	Pre	Post
Inhibit	23	30	72*	89*
Shift	15	19	59	71*
Emotional Control	24	27	67*	73*
BEHAVIORAL REGULATION INDEX (BRI)	62	76	69 *	82*
Initiate	13	15	52	59
Working Memory	16	24	52	70*
Plan/Organize	28	34	69*	80*
Organization of Materials	16	16	63	63
Monitor	15	19	55	67*
METACOGNITION INDEX (MI)	88	108	60	72*
GLOBAL EXECUTIVE COMPOSITE(GEC)	150	184	64	77*

Traumatic Brain Injury TBI



(Silver 1994; Silver 2000; McAllister 1992; McAllister 1994; Kay and Harrington, 1993)

Rehabilitation Planning

DOMAINS	TESTS	SCORES	NORMS
• **SPEED OF PROCESSING**			
➢ ***Mental***	Digit Symbol	TT= 357 seconds	**<3**
• **ATTENTION**			
➢ ***Immediate and Complex***	Digit Span (WAIS)	Forward- 7 Backward-5	
➢ ***Focused***	Color Trails	Form A=55 seconds Form B=184 seconds	65 80
➢	Digit Vigilance	788 seconds	**11**
• **MEMORY**			
➢ ***Verbal***	Auditory Verbal Learning Test (AVLT)	IR=3,3,5,5,6 Total=26 B= 3 6^{A}=4 DR=5 Recognition=15,	**<5, <5,<5,<5,<5** **<5** **10** **<5** **<5** **95**
• **EXECUTIVE**			
➢ ***Working Memory***	N-Back	1- Back=8/9 2- Back= 8/9	30 50
➢ ***Problem Solving***	Tower of London	**2 moves** Mean time=6.5 Mean moves=2 **3 moves** Mean time= 11 Mean moves=3 **4 moves** Mean time= 25.5 Mean moves=5 **5 moves** Mean time= 47.25 Mean moves=7.5	 60 100 38 100 43 83 9 54

CASE

DOMAINS	TESTS	SCORES	NORMS
• **SPEED OF PROCESSING**			
➢ ***Mental***	Digit Symbol	TT= 114 seconds	>100
• **ATTENTION**			
➢ ***Immediate and Complex***	Digit Span	Forward- 8 Backward-6	
➢ ***Focused***	Color Trails	Form A=30 Form B=58	>100 >100
➢	Digit Vigilance	375 seconds	95
• **MEMORY**			
➢ ***Verbal***	Auditory Verbal Learning Test (AVLT)	IR=6,13,14,14,15 Total=62 B= 8 6^{A}=15 DR=15	30, 95,95,60,95 70 70 95 95
➢	Passages	IR=12 DR=9	40 **20**
➢	Paired Associates	IR=1,4,6,7=18 DR=5	40 **20**
➢ ***Visual***	Complex Figure Test	IR=23 DR=24	40 40
• **EXECUTIVE**			
➢ ***Working Memory***	N-Back	1- back=9/9 2- back= 8/9	95 80
➢ ***Problem Solving***	Tower of London	**2 moves** Mean time=4 Mean moves=2 **3 moves** Mean time= 4.5 Mean moves=3 **4 moves**	 86 100 100 100

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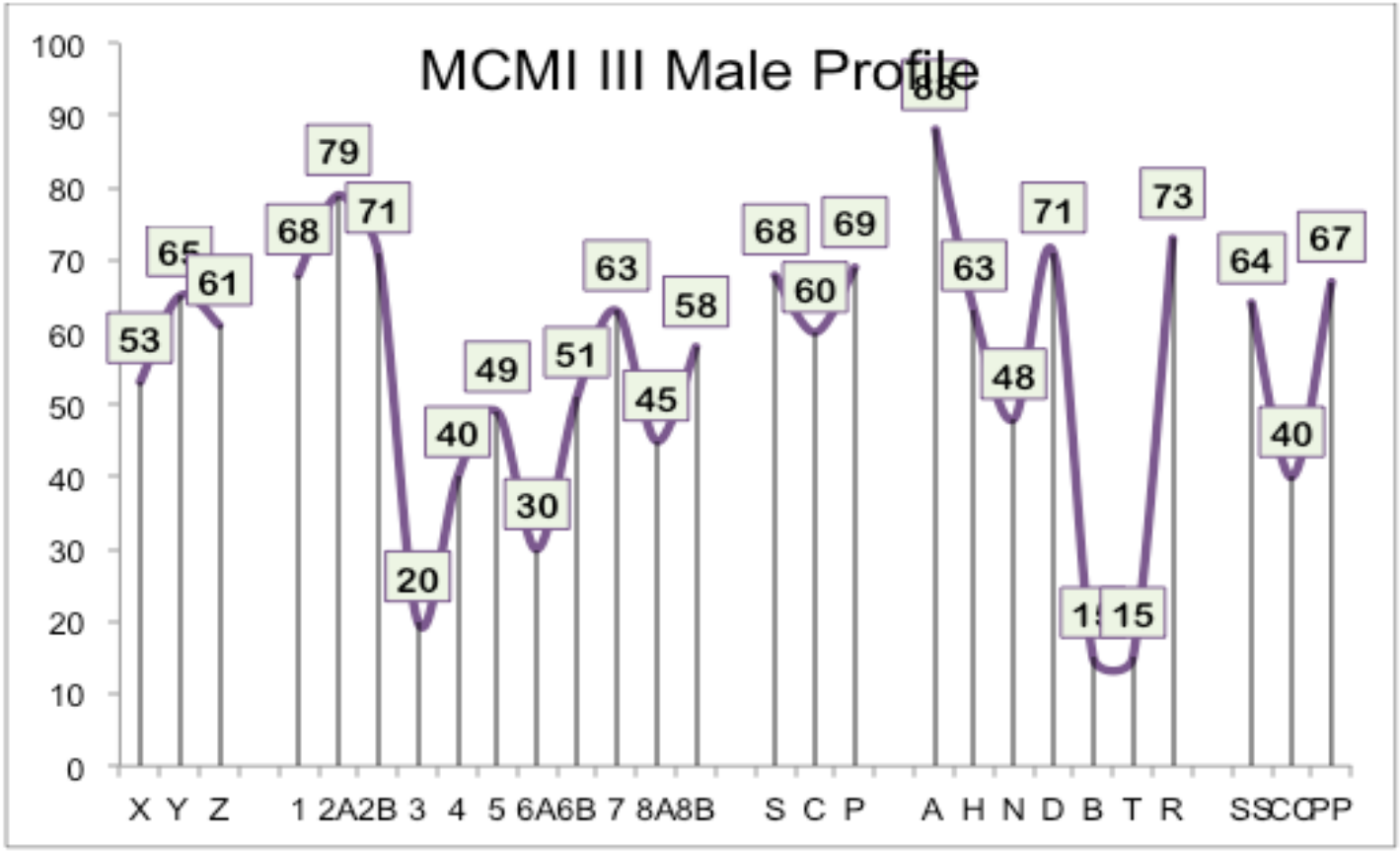
Million's Clinical Multiaxial Inventory MCMI III



Key: *Scores of 75 indicate presence and 85 and above indicates prominence.*

Significant scores in the profile
2A – Avoidant (Presence)
A-Anxiety (Prominence)

The Case of Mr R.A

DOMAINS	TESTS	SCORES	NORMS
• SPEED OF PROCESSING			
➢ *Mental*	Digit symbol	TT= 155 secs	85-88
• ATTENTION			
➢ *Immediate and Complex*	Digit span (WAIS)	Forward- 5 Backward-5	
➢ *Focused*	Color trails test	I= 33 secs II=45 secs	89-95 90
➢ *Sustained*	Cancellation task	TT- 394 secs	74-81
• MEMORY			
➢ *Verbal*	Rey Auditory Verbal Learning Test (AVLT)	IR1= 6 2= 9 3=8 4=10 5=10 Total= 43 B=4 6A=7 DR= 8 Recog = 12/15	30 25 ↓5 10 **5** ↓5 10 ↓5 5 ↓5
	Verbal Paired Associate test	IR= 3,3,4,3=13 DR= 2	↓5 ↓5
	Logical Memory- Passages	IR= 10 DR=10	30 30-40
➢ *Visual*	Visual Reproduction (WMS III)	IR= 76/104 DR= 26/104 Recognition= 42/48 V-S comp= 7/7	10 ↓5 ↓5 95
	Complex figure test (CFT)	Copy= 34/36 Org= poor IR=6/36 DR=11/36	5 ↓5 ↓5
	Benton Visual Retention Test (BVRT)	Score=5/10	

TEXTRUM

Journal of
Experimental Psychopathology

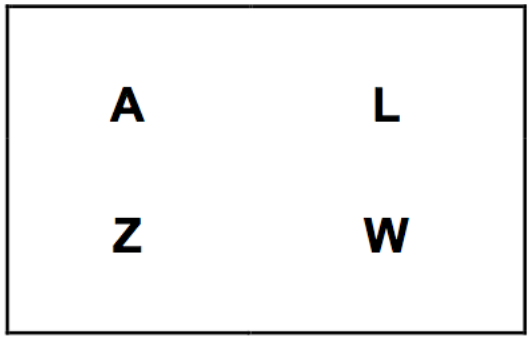
JEP Volume 4 (2013), Issue 1, 20–37
ISSN 2043-8087 / DOI:10.5127/jep.023711

Forced-Choice Tests as Single-Case Experiments in the Differential Diagnosis of Intentional Symptom Distortion

Thomas Merten[a] and Harald Merckelbach[b]

Symptom Validity Testing (SVT)

Presentation of the stimulus card



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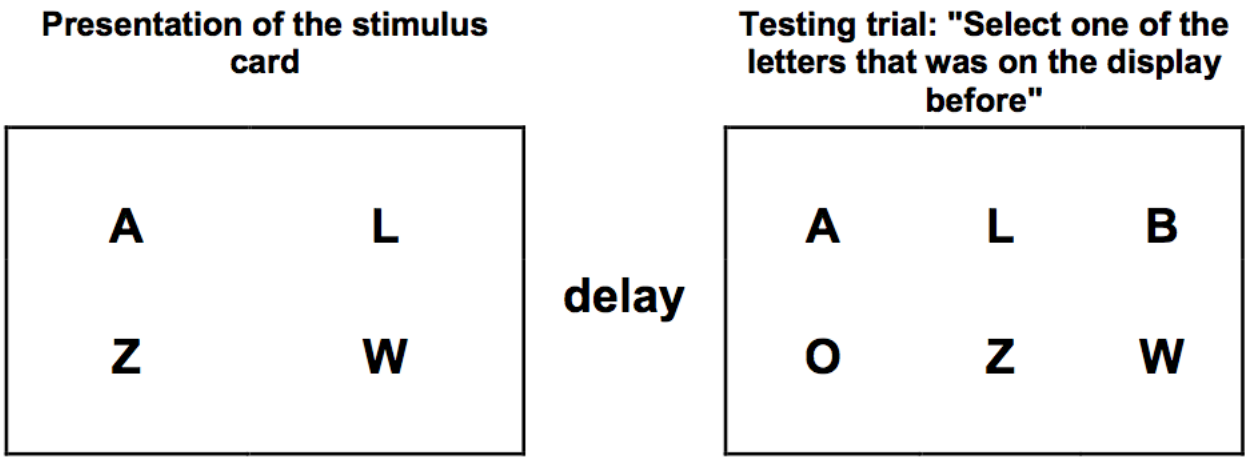

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Dementia

- Normal aging changes versus MCI changes.
- Normative data particularly in old-old (80+years) and uneducated illiterate populations.
- Cognitive Screens ACE versus MoCA
- Domain Specific Evaluation for Differential Diagnosis
- Mood, Behavior Functional Evaluation : GDS, NPI, CDR

Mini Mental State Exam MMSE

- Best known, most widely used measure of cognition worldwide. Overwhelmingly ubiquitous in practice.
- Brief (10 min), 11 items, max score 30, examines Orientation, Attention, Memory Recall, Language, Visual spatial. *No Executive Function test.*
- Lacks sensitivity in early dementia, FTD, LBD; has ceiling and floor effects. Affected by age, ethinicity and education. *Folstein et al, 1975*

Validation of the Addenbrooke's Cognitive Examination III in Frontotemporal Dementia and Alzheimer's Disease

Sharpley Hsieh[a] Samantha Schubert[a] Christopher Hoon[a] Eneida Mioshi[a, b]
John R. Hodges[a, b]

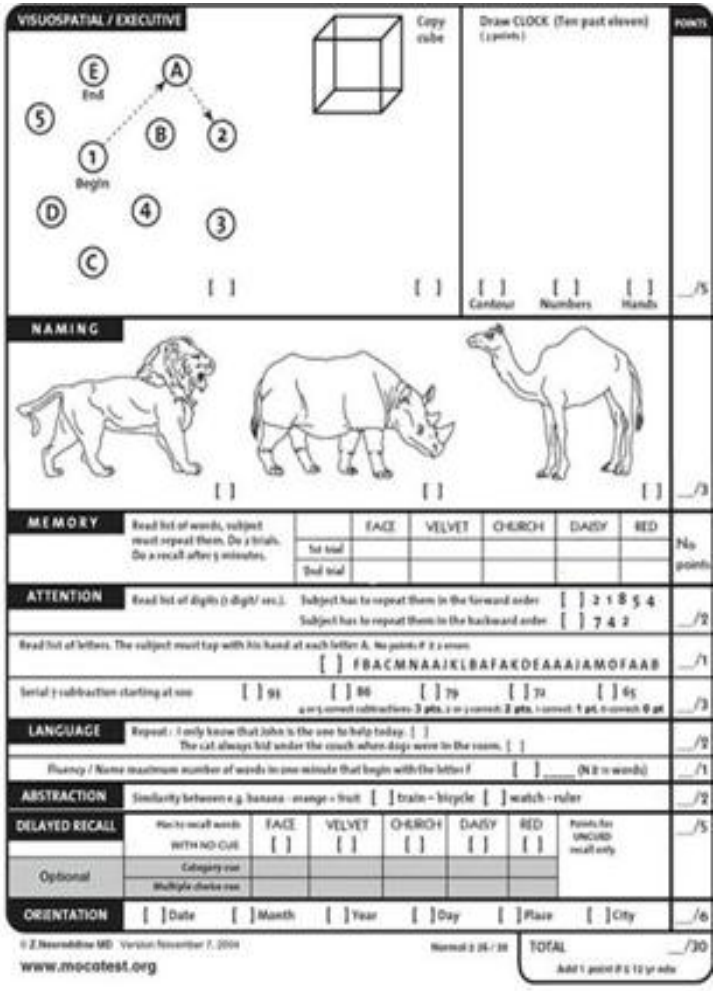
- Validated against standard neuropsychological tests- significant correlation between domain scores and performance on standard NP measures
- Certain weak items changed (language, visuo spatial)
- No longer possible to derive MMSE score

The Mini-Addenbrooke's Cognitive Examination: A New Assessment Tool for Dementia

Sharpley Hsieh[a–d] Sarah McGrory[e] Felicity Leslie[b] Kate Dawson[f]
Samrah Ahmed[j] Chris R. Butler[j] James B. Rowe[f, h, i] Eneida Mioshi[g]
John R. Hodges[b–d]

- M-ACE takes <5 minutes, total score of 30
- 5 items-Time Orientation, Animal Naming, Clock Drawing, Learning and Recall of Name and Address
- More sensitive than MMSE and less likely ceiling effects.
- Two cut off scores 25 and 21 with latter specificity of 1.00.

Montreal Cognitive Assessment MoCA



- Visuospatial and Executive
- Language: Naming, repetition and letter fluency ‘F’.
- Memory: 5 word, two trial learning, delayed recall, cued recall and recognition trials.
- Attention: Digit Span Forward/Backward and Vigilance
- Abstract Reasoning: Similarities
- Orientation: Time/Place

Nasredine et al, 2005

Neuropsychiatric Inventory

DOMAIN	N/A[1]	ABSENT	FREQUENCY	SEVERITY	FREQUENCY X SEVERITY	CAREGIVER DISTRESS
		0	1 2 3 4	1 2 3		0 1 2 3 4 5
A. Delusions	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
B. Hallucinations	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
C. Agitation/Aggression	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
D. Depression/Dysphoria	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
E. Anxiety	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
F. Elation/Euphoria	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
G. Apathy/Indifference	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
H. Disinhibition	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
I. Irritability/Lability	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
J. Aberrant Motor Behavior	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
TOTAL SCORE:					☐☐☐	☐☐
K. Sleep and Nighttime Behavior Disorders	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐
L. Appetite/Eating Changes	☐	☐	☐☐☐☐	☐☐☐	☐☐	☐☐☐☐☐☐

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Geriatric Depression Scale GDS

1.	Are you basically satisfied with your life?	Yes	No
2.	Have you dropped many of your activities and interests?	Yes	No
3.	Do you feel that your life is empty?	Yes	No
4.	Do you often get bored?	Yes	No
5.	Are you hopeful about the future?	Yes	No
6.	Are you bothered by thoughts you can't get out of your head?	Yes	No
7.	Are you in good spirits most of the time?	Yes	No
8.	Are you afraid that something bad is going to happen to you?	Yes	No
9.	Do you feel happy most of the time?	Yes	No
10.	Do you often feel helpless?	Yes	No
11.	Do you often get restless and fidgety?	Yes	No
12.	Do you prefer to stay at home, rather than going out and doing new things?	Yes	No
13.	Do you frequently worry about the future?	Yes	No
14.	Do you feel you have more problems with memory than most?	Yes	No
15.	Do you think it is wonderful to be alive now?	Yes	No
16.	Do you often feel downhearted and blue?	Yes	No
17.	Do you feel pretty worthless the way you are now?	Yes	No
18.	Do you worry a lot about the past?	Yes	No
19.	Do you find life very exciting?	Yes	No
20.	Is it hard for you to get started on new projects?	Yes	No
21.	Do you feel full of energy?	Yes	No
22.	Do you feel that your situation is hopeless?	Yes	No
23.	Do you think that most people are better off than you are?	Yes	No
24.	Do you frequently get upset over little things?	Yes	No
25.	Do you frequently feel like crying?	Yes	No
26.	Do you have trouble concentrating?	Yes	No
27.	Do you enjoy getting up in the morning?	Yes	No
28.	Do you prefer to avoid social gatherings?	Yes	No
29.	Is it easy for you to make decisions?	Yes	No
30.	Is your mind as clear as it used to be?	Yes	No

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Global Clinical Dementia Rating (CDR) Based on CDR Box Scores

Washington University Alzheimer's Disease Research Center

This page allows the user to input CDR box scores and submit them to a SAS computer program which returns the global CDR based on the Washington University CDR-assignment algorithm. This page may be used by anyone.

Select the CDR Box Scores

	0	0.5	1	2	3
Memory	◉	○	○	○	○
Orientation	◉	○	○	○	○
Judgement and Problem Solving	◉	○	○	○	○
Community Affairs	◉	○	○	○	○
Home and Hobbies	◉	○	○	○	○
Personal Care	◉		○	○	○

Submit **Press to submit.**

Reset **Press to reset all box scores.**

CDR Online Training

https://www.alz.washington.edu/NONMEMBER/train.html

- MMSE and ACE Normative Data

  Mathuranath et al, Neurology India, April-June 2007, Vol 55, Issue 2, pg 106-110

CASE

65 year old medical consultant presenting with memory complaints since last 2-3 years-forgetting names of junior colleagues, information during presentations at meetings, appointments and becoming over reliant on diary and secretary.

Cognitive Evaluation: MMSE=29/30, ACE=90/100. (DR= 5/7)
NIMHANS Battery: Scores in above average range (80th.-90th).

Memory: MMSE: 2/3; ACE: 7/10, AVLT Word List: DR=25th. Percentile

Mood and Behavior: NPI= Mild anxiety GDS= 5/30
Functional Evaluation: CDR=0.5, No changes in ADL/IADL

Diagnosis: _____

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65 year old medical consultant presenting with memory complaints since last 2-3 years-forgetting names of junior colleagues, information during presentations at meetings, appointments and becoming over reliant on diary and secretary.

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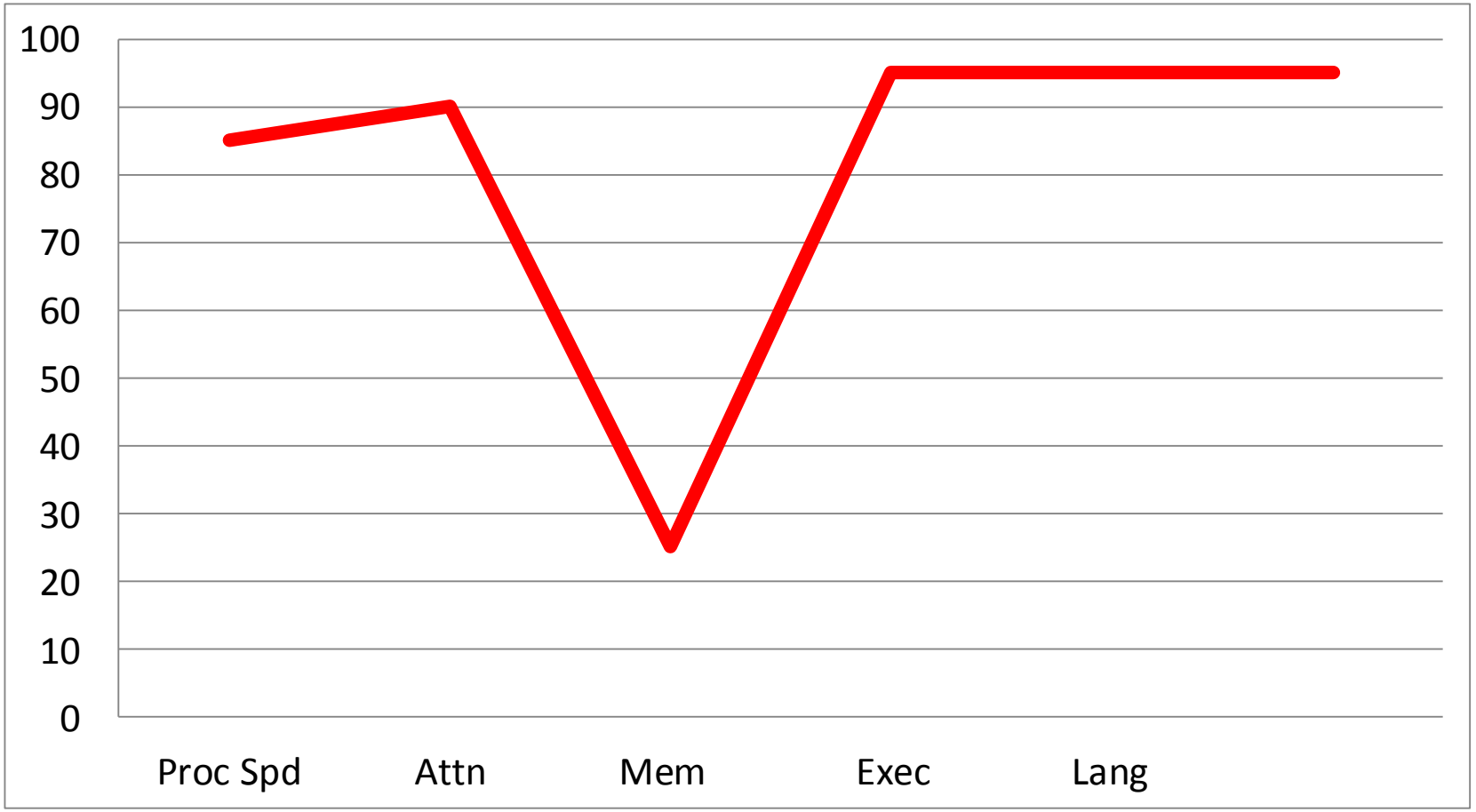
Memory: MMSE: 2/3; ACE: 7/10, AVLT Word List: DR=25th. Percentile

Mood and Behavior: NPI= Mild anxiety GDS= 5/30
Functional Evaluation: CDR=0.5, No changes in ADL/IADL
Diagnosis: Amnestic MCI

Cognitive Profile I



CASE

74 year old housewife presenting with symptoms of anxiety, agitation and forgetfulness since last 2-3 years. Referred by psychiatrist as anxiety decreased but increased apathy, mild disinhibition decreased IADL and persisting memory complaints.

Cognitive Evaluation: MMSE=26/30, ACE=70/100. (DR= 1/7)

Memory Recall: MMSE: 3/3; ACE: 4/10, Recognition: 5/5

Mood and Behavior: NPI= Apathy, disinhibition, GDS= 5/30

Functional Evaluation: CDR=1, No changes in ADL but significant decline in IADL

Diagnosis: _____

CASE

74 year old housewife presenting with symptoms of anxiety, agitation and forgetfulness since last 2-3 years. Referred by psychiatrist as anxiety decreased but increased apathy, mild disinhibition decreased IADL and persisting memory complaints.

Cognitive Evaluation: MMSE=26/30, ACE=70/100. (DR= 1/7)

Memory Recall: MMSE: 3/3; ACE: 4/10, Recognition: 5/5

Mood and Behavior: NPI= Apathy, disinhibition, GDS= 5/30

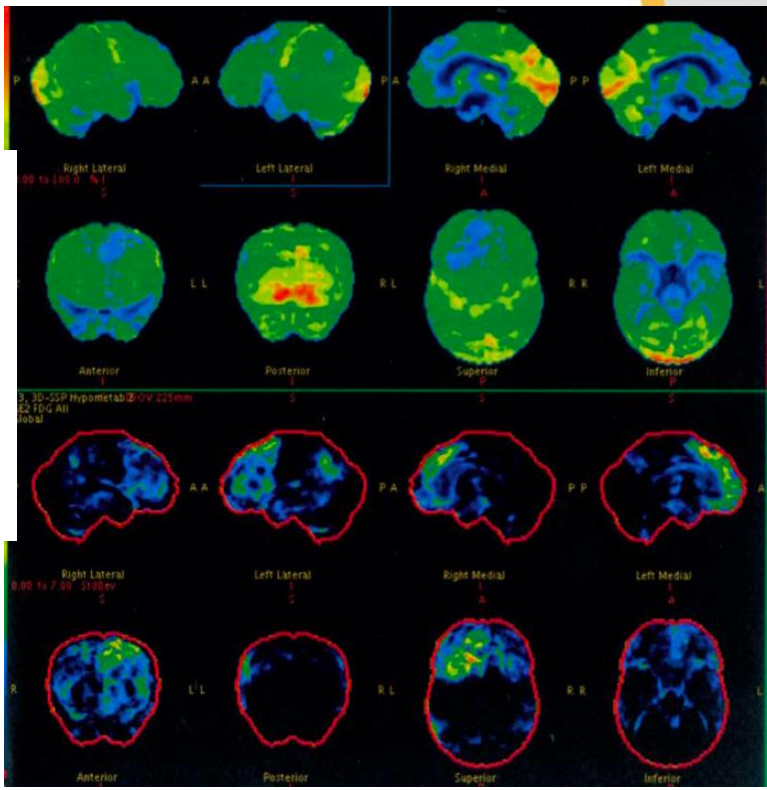
Functional Evaluation: CDR=1, No changes in ADL but significant decline in IADL

Diagnosis: bv FTD

BRAIN PET – CT

Clinical history: 74years female with suspected dementia under evaluation

Technique: 3.40mCi of ^{18}F-FDG is injected intravenously to patient after 6 hours of fasting. After 63 min of injection, patient was scanned on dedicated 16 slice PET – CT (GE – DISCOVERY IQ). CT scan was obtained as part of PET CT protocol on a multislice CT with 3.5 mm slice thickness with intravenous contrast injection.



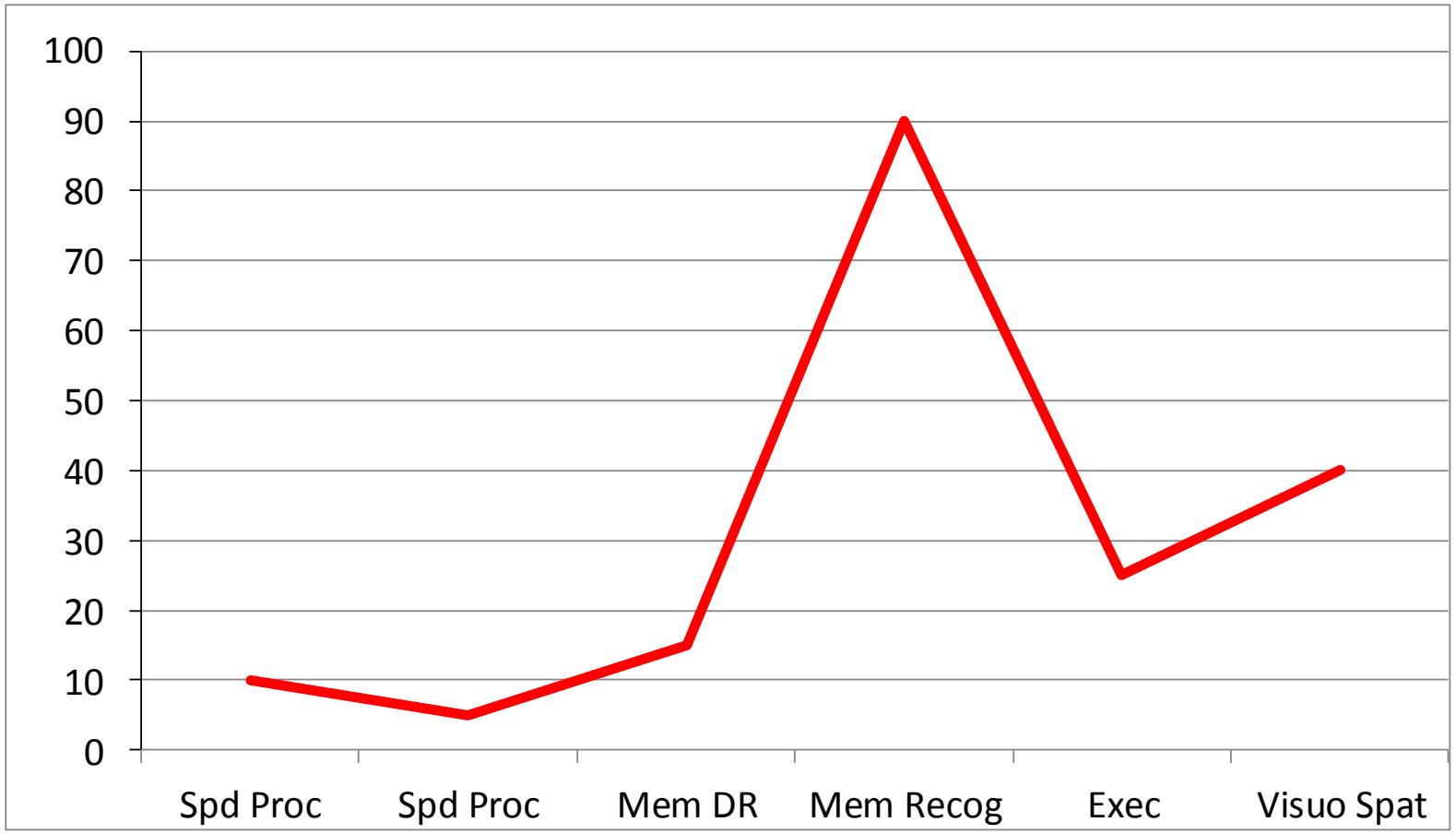
COMMENTS:

- 74years female with suspected dementia under evaluation.
- Brain PET scan is abnormal.
- Hypometabolism is seen in bilateral frontal and temporal lobes with sparing of sensorimotor and occipital cortex.
- Scan findings are suggestive of Fronto-temporal dementia.

Dr. V. R. LELE, MD, DRM. DNB
DIRECTOR,
NUCLEAR MEDICINE & PET -CT

Dr. PARAG ALAND, DNB, DRM, FEBNM
CONSULTANT,
NUCLEAR MEDICINE& PET -CT

Cognitive Profile II



CASE

64 year old educated housewife, h/o increasing forgetfulness since 2 yrs-names, faces, reading difficulties, following TV serials, conversations in a group. Slow in comprehending and responding, repetitive and tangential- 'not connecting with the Q asked'.

Cognitive Evaluation: MMSE=28/30, (Recall=3/3); ACE=74/ 100. (cut off 88/100) Naming=1/10 (camel = elephant…' what does elephant look like?')

Memory: MMSE: 3/3; ACE: 4/7; AVLT List: DR=5th percentile Recog= 100th. percentile

Mood and Behavior: NPI= Irritability and Anxiety GDS= 8/30

Functional Evaluation: CDR=1, Changes in IADL (card playing)

Diagnosis:

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Mood and Behavior: NPI= Irritability and Anxiety GDS= 8/30
Functional Evaluation: CDR=1, Changes in IADL (card playing)

Diagnosis: FTD Language Variant/Semantic Dementia

To Summarize

Role of Neuropsychological Evaluation

- Diagnosis: Detection and/or Differential diagnosis
- Prognosis: Tracking Changes
- Rehabilitation: Planning and Training
- Certification: Fitness/Competency
- Pre-Surgical: Lateralization/Localization, Predicting Outcomes/ Fitness for Surgery

The Tool Box

- Tests with appropriate psychometric properties and Indian normative data.

Development of an ICMR comprehensive neuropsychological test battery for patients with vascular cognitive disorders in the Indian context.

Stroke Specialists
- Dr. Subhash Kaul,
- Dr. M.V. Padma

Cognitive Neurologists
- Dr. Suvarna Alladi,
- Dr Manjari Tripathi
- Dr. Amitbha Ghosh,
- Dr. Ratnavalli E.,
- Dr. P.S. Mathuranath,
- Dr. R.S. Menon,
- Dr. Robert Mathew
- Dr. Apoorva Pauranik

Neuropsychologists
- Dr. Urvashi Shah
- Dr. Aparna Dutt
- Dr. Jwala Narayanan
- Dr. Gowri Iyer
- Dr. Shailaja Mekala

Speech Language Pathologists
- Dr. Sunil Kumar Ravi
- Dr. Vasantha Duggarla

ICMR Task Force Experts
- Dr. Meenakshi Sharma
- Dr. J.S. Chopra
- Dr. S.K. Das

- Multi center
- 60/ 30 /5min, versions
- Tests for illiterates

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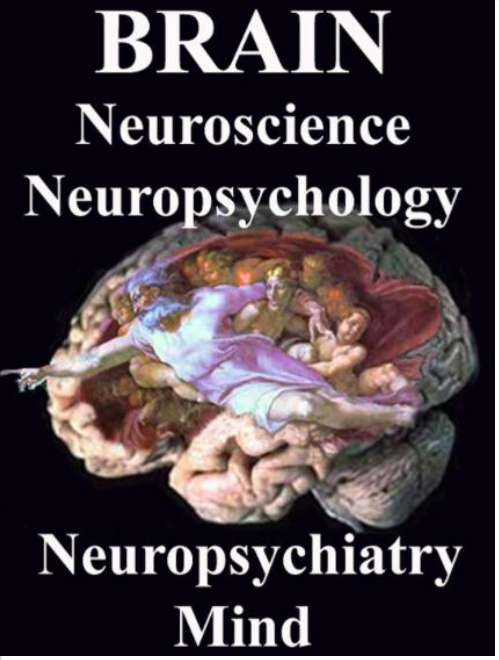

Thank You

"The mind is ephemeral and mysterious, the brain concrete …. But both essential for a full understanding of why we act as we do…"

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