2023 GW Epilepsy Board Review & Best Practices

Clinical Neuropsychology and Epilepsy

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GW

Objectives

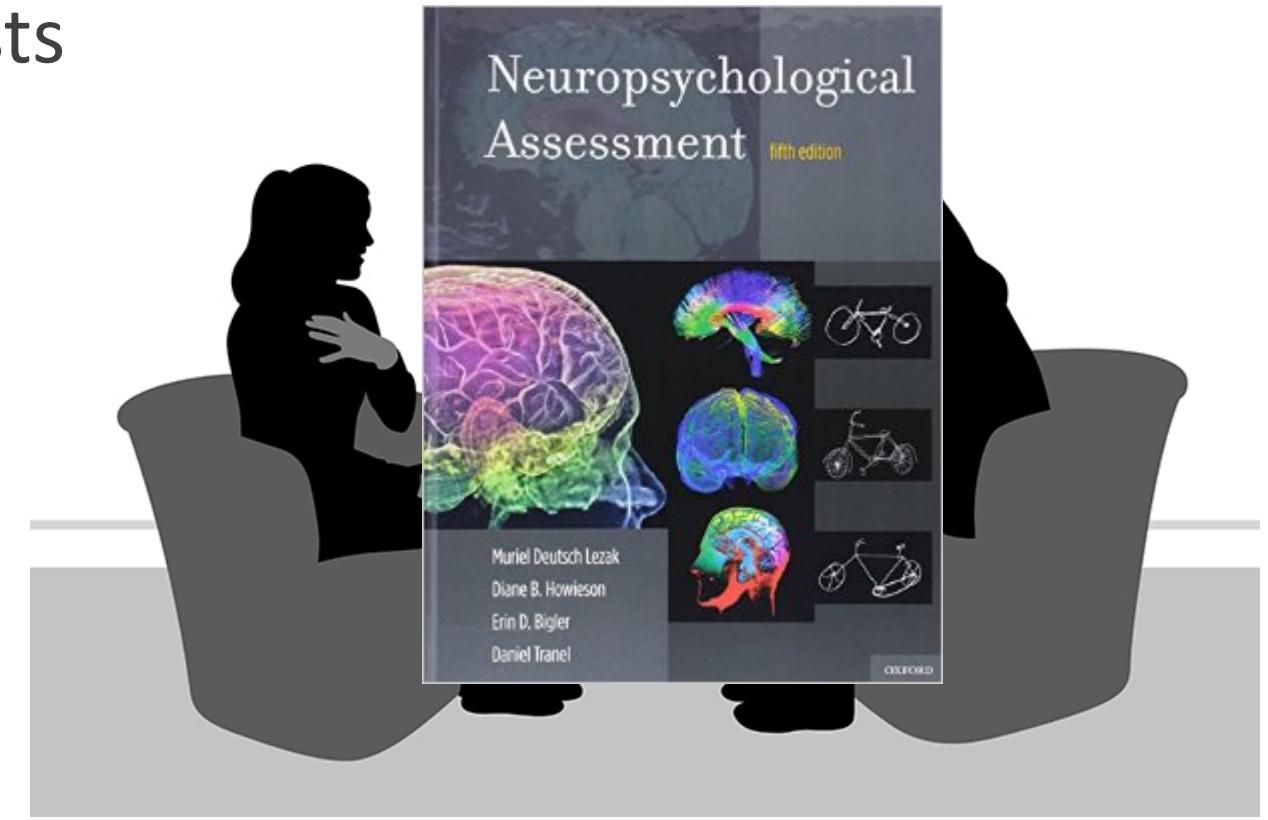
1. Who are we?
2. What is neuropsychological assessment?
3. Utility in Epilepsy
   - How are they useful for pts with epilepsy?
   - What factors influence test performance in epilepsy?
   - Who is considered a “good” surgical candidate?

Who are we?

- Psychologists
- Clinical psychology
  - Brain-behavior relationships

What do we do?

- Clinical Neuropsychologists
  1. Assessment
  2. Treatment
     - Psychotherapy
     - Cognitive Rehabilitation

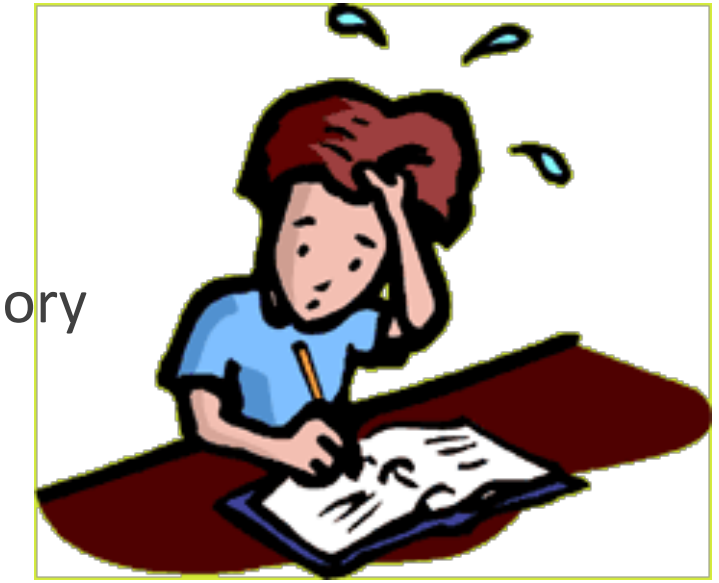


Assessment

- Clinical Interview
  - Personal history & presenting symptoms
- Mental Status Exam
- Testing

Assessment

- Testing
  - IQ
  - Motor functions
  - Cognition
    - Language, attention, executive functions, and memory
  - Psychiatric
    - Emotional functioning and personality
  - Effort or validity measures

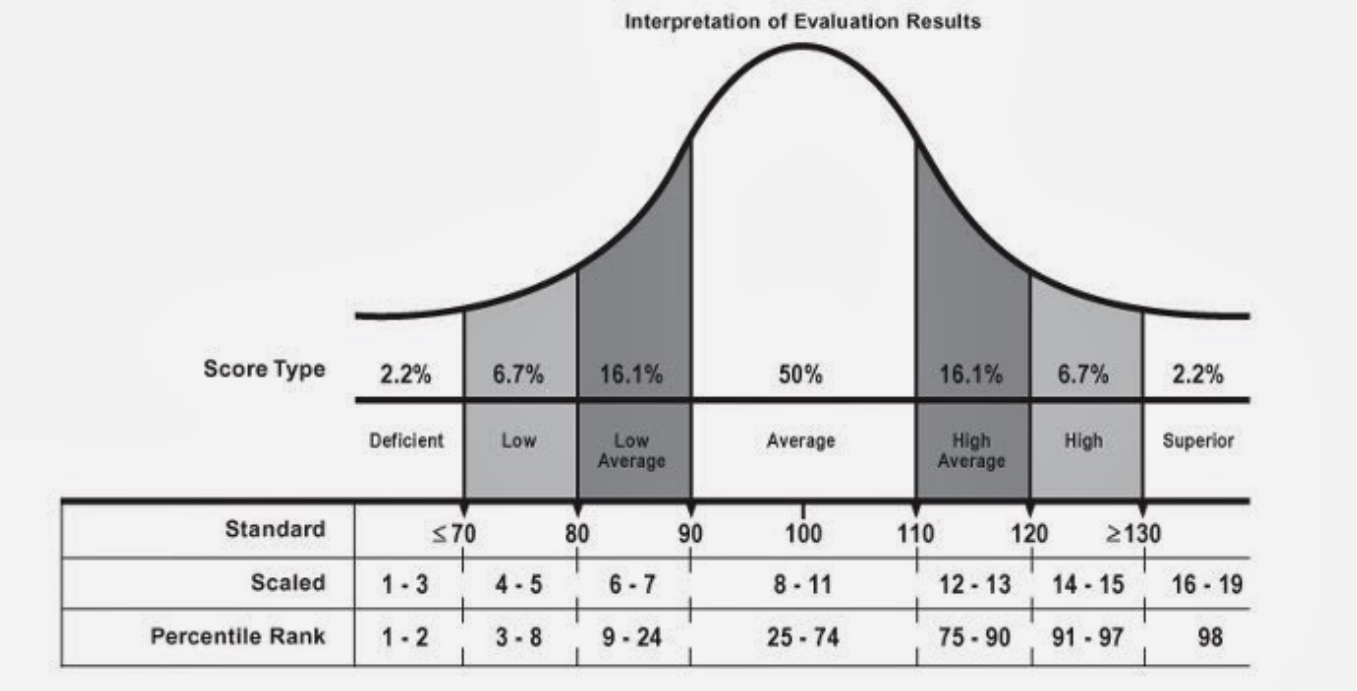


Assessment

- Exam length
  - Outpatient
    - ½ to full day
  - Inpatient
    - 2 hours for inpatient

Assessment

- Test Score
  - Raw
  - Normed
- Normed
  - Age
  - Demographic
    - Age
    - Gender
    - Race/Ethnicity
    - Education
    - Premorbid IQ



Neuropsychological Evaluation

Patient's Name: *Paula Smith*
Date of Birth: xx/xx/1975
Date of Assessment: xx/xx/2015
Education: B.A. in English
Occupation: *Government contractor*

Procedures Administered:

Clinical Interview, Wechsler Adult Intelligence Scale (3rd edition), Wide Range Achievement Test (4th edition) Word Reading, Spelling, and Math Computation subtests, Boston Naming Test, Word List Generation (guided by initial letter and by meaning), Bakker-Brandt Naming Test, Token Test, Hopkins Verbal Learning Test – Revised, Brief Visuospatial Memory Test – Revised, Logical Memory Subtest of WMS-III, Faces Subtest of WMS-III, Hopkins Board, Brief Test of Attention, Stroop Color-Word Test, Trail Making Test, Grooved Pegboard Test, Edinburgh Handedness Inventory, Personality Assessment Inventory, and Quality of Life in Epilepsy.

Introduction:

Paula Smith is a 39 year-old, right-handed, married, Caucasian woman who was referred for neuropsychological evaluation by Dr. Gregory Bergey, of the Johns Hopkins Epilepsy Center in the Department of Neurology. Ms. *Smith* has a history of complex partial seizures with occasional secondary generalization. This evaluation was performed in the context of her presurgical workup.

Brief History:

Ms. *Smith* was born in and raised in XXXX, VA. Her mother is a 65 year-old retired sales representative who is generally healthy. Her father is a 65 year-old attorney who is generally healthy. Ms. *Smith* has a brother and two sisters with whom she is close. There is no family history of epilepsy.

Ms. *Smith* attended Boston College and graduated in 1998 with a degree in English. After graduation, she enrolled in Teacher Corps. She taught 10th and 11th grade in an impoverished public high school. After two years, she returned to the DC area, and has worked as a *government contractor*.

Ms. *Smith* lives with in XXXX, VA her husband. He is a healthy 41 year-old who works for the Department of Defense. Together they have a 2 ½ year-old son and a 1 year-old daughter. When she is not working, Ms. *Smith* spends most of her time with her children. She also enjoys exercising.

Ms. *Smith* has a history of complex partial seizures that date back to 2000. She has been tried on numerous antiepileptic medications, and she is currently taking Onfi, Trileptal, and Vimpat. Although this combination of medications has been most successful, she still has 1-2 complex partial seizures a month. Several seconds before her seizures, she "feels weird and as if something is not right." She also often hears a repetitive phrase about America. During her seizures, she has altered awareness and speaking difficulties. Her seizures typically last for 30 seconds; however, she sometimes remains confused for up to 30 minutes after the seizure. Her brain MRI scan in July 2014 was normal. Her PET scan (November 2014) revealed bilateral temporal lobe hypometabolism. VEEG in July 2014 captured 13 seizures, which indicated onsets in the left posterior and left anterior temporal regions.

Ms. *Smith* sustained a head injury in a MVA when she was 3 years old. She was unsure if she lost consciousness. She denied the use of tobacco or illicit drugs. On special occasions, Ms. *Smith* will have an alcoholic beverage.

Ms. *Smith* denied having any history of a psychiatric disorder, though she met briefly with a mental health professional at age 11 or 12 when her parents divorced. Currently, she frustrated about not being able drive, and is concerned about the effect of her seizures on her children. The thought of neurosurgery for her epilepsy is concerning for her.

Interview Behavior and Mental Status:

Ms. *Smith* arrived on time with her husband to the evaluation. She was well groomed with shoulder length black hair. She was casually dressed in a black puffer coat (which she kept on), blue jeans, and running shoes. She ambulated normally and displayed no abnormal movements. Her conversational language and memory for autobiographical events appeared to be entirely normal. However, she appeared anxious throughout the evaluation. Her face was often blushed, and she was fidgety. During testing, Ms. *Smith* remained friendly and pleasant.

Test Results:

Test	Functions Assessed	Score	%ile for Age	Comments
Wechsler Adult Intelligence Scale (3rd edition)	Psychometric intelligence	Similarities = 11 Arithmetic = 13 Digit Span = 17 Information = 11 L/N Sequencing = 18 Picture Completion = 11 Digit Symbol Coding = 13 Block Design = 13 Symbol Search = 16 Verbal Comprehension Index = 105 Perceptual Organiz. Index = 111 Working Memory = 136 Processing Speed = 125 Verbal IQ = 119 Performance IQ = 115 Full Scale IQ = 119	63 84 99 63 >99 63 84 84 98 63 77 99 95 90 84 90	High average global intellect; very superior working memory and superior processing speed
Wide Range Achievement Test (4th edition)	Basic academic skills	Word Reading = 103 Spelling = 107 Math Computation = 121	58 68 92	Superior computational ability
Boston Naming Test	Visual confrontation naming	51/60	12	Normal recognition; trouble finding names of lower-frequency items
Word List Generation	Guided by initial letter Guided by meaning	FAS = 53 (22, 12, 19) Animals = 24 Supermarket = 39 Tools = 9	81 68 99 16	Normal
Bakker-Brandt Naming Test	Auditory and visual confrontation naming	Auditory Naming = 13/20 Auditory Recognition = 7/7 Visual Naming = 18/20 Visual Recognition = 1/2	14 37	Slightly impaired naming of environmental sounds
Token Test	Ability to follow instructions	40/44	24	Intact
Hopkins Verbal Learning Test-Revised	Learning, recall, and recognition of a word list	Trials 1-3 = 32 (8, 12, 12) Delayed Recall = 12/12 Recog. = 12 hits, 0 false-positive	82 ≥82 ≥73	Exceptional auditory-verbal and visuospatial learning and memory.
Brief Visuospatial Memory Test-Revised	Learning, recall, and recognition of geometric designs	Trials 1-3 = 32 (10, 10, 12) Delayed Recall = 11/12 Recog. = 6 hits, 0 false-positive Copy = 12/12	88 76 >16 --	
Logical Memory Subtest of WMS-III	Learning and memory of a text passage	Logical Memory I = 54/75 Logical Memory II = 31/50 Percent Retained = 82% Recognition = 26/30	84 75 50 50	

Test	Functions Assessed	Score	%ile for Age	Comments
Faces Subtest of WMS-III	Learning and memory of faces	Faces I SS = 14 Faces II SS = 10	91 50	
Hopkins Board	Naming: learning and memory of items and their spatial location	Object Naming = 9/9 Trials to Criterion = 3 Errors to Criterion = 1 Item Recall = 9/9 Location Recall = 9/9	>16 66 66 ≥76 ≥65	Normal
Brief Test of Attention	Auditory divided attention and working memory	20/20	≥74	Exceptional auditory working memory
Stroop Test	Processing speed and inhibition of prepotent responses	Word T = 50 Color T = 50 Color/Word T = 55 Interference T = 54	50 50 69 66	
Trail Making Test	Visual scanning, mental tracking, and graphomotor speed	Part A = 30", 0 errors Part B = 36", 0 errors	51 88	
Grooved Pegboard Test	Manual speed and dexterity	Dominant (right hand) = 64" Nondominant hand = 66"	45 54	Normal
Edinburgh Handedness Inventory	Self-report assessment of handedness	Total = +60		Predominantly right handed
Personality Assessment Inventory	Self-reported symptoms of psychopathology	Inconsistency T= 43 Infrequency T = 47 Neg. Impression Mgmt T = 47 Pos. Impression Mgmt T = 61 Somatic Concerns T = 65 Anxiety T = 62 Anx. Related Disorders T = 55 Depression T = 57 Mania T = 36 Paranoia T = 36 Schizophrenia T = 62 Borderline Features T = 45 Antisocial Features T = 41 Alcohol Problems T = 41 Drug Problems T = 42 Aggression T = 37 Suicidal Ideation T = 51 Stress T = 48 Nonsupport T = 37 Treatment Rejection T = 55 Dominance T = 29 Warmth T = 56	24 38 38 86 93 88 69 76 08 08 88 31 18 18 21 10 54 42 10 69 02 73	Ms. *Smith* has major concerns about her health and physical well-being, but does not display somatization behavior. She complains of difficulties with attention and focusing her thoughts, leading to a minor elevation on the "schizophrenia" scale; she does not have psychotic experiences (except ictally) and has normal social attachments. She acknowledges that she is frequently tense and anxious, and tends to be extremely submissive in interpersonal interactions.
Quality of Life in Epilepsy	Self-reported quality of life related to epilepsy	Seizure Worry T = 46 Overall Quality of Life T = 53 Emotional Well-being T = 50 Energy/Fatigue T = 43 Cognitive T = 51 Medication Effects T = 46 Social Function T = 34 Total T = 43	33 61 52 23 55 36 05 26	Ms. *Smith*'s seizures prevent her from driving, and also limit her socially and vocationally.

Summary, Formulation, and Recommendations:

Paula Smith is 39 year-old woman who has had seizures since 2000. They appear to be arising from left temporal regions. Ms. *Smith* has about one to two seizures a month that prevent her from driving and interfere with her social and occupational functioning.

This neuropsychological evaluation reveals a woman of high average global intellect who performed normally across most cognitive and motor tests. In fact, she had exceptional working memory and processing speed, information-processing domains often affected in persons with epilepsy taking medications. In addition, she had exceptionally strong auditory-verbal as well as visual-spatial learning and memory (immediate and delayed). However, Ms. *Smith*'s auditory and visual confrontation naming were both lower than expected. Together, these findings strongly suggest to us that her brain is maximally dysfunctional in the left lateral neocortex rather than the left mesial/limbic areas. Recording from brain surface electrodes, as is planned, would likely be particularly helpful for seizure onset localization. Ms. *Smith* is probably at increased risk for noticeable memory decline from a conventional left temporal lobectomy/hippocampectomy.

Ms. *Smith* describes herself as generally anxious, but is understandably concerned about her health and the prospects of neurosurgery. If she wants to learn about the experiences of other patients who have undergone surgical treatment for epilepsy, the nurses in the Epilepsy Center might facilitate the contacts. Although her anxiety not suggestive of a psychiatric disorder, she may benefit from some short-term counseling.

If Ms. *Smith* proceeds to surgery, neuropsychological re-evaluation is recommended 6 to 12 months postoperatively to assess for any cognitive or emotional changes.

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Antonio N. Puente, Ph.D.
Fellow in Medical Psychology

This patient was personally seen by me. A credentialed psychology associate assisted with test administration, but the clinical interpretations and decisions are entirely mine. Dr. Puente and I jointly prepared this report. The total time required for this evaluation – including record review, interview and mental status examination, test administration, scoring and interpretation, and report preparation – was 8 hours [CPT 96116 (1 hr.), 96118 (1 hr.), and 96119 (6 hrs.). ICD-9: 345.41

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Jason Brandt, Ph.D., ABPP(CN)
Professor of Psychiatry and Behavioral Sciences
Professor of Neurology
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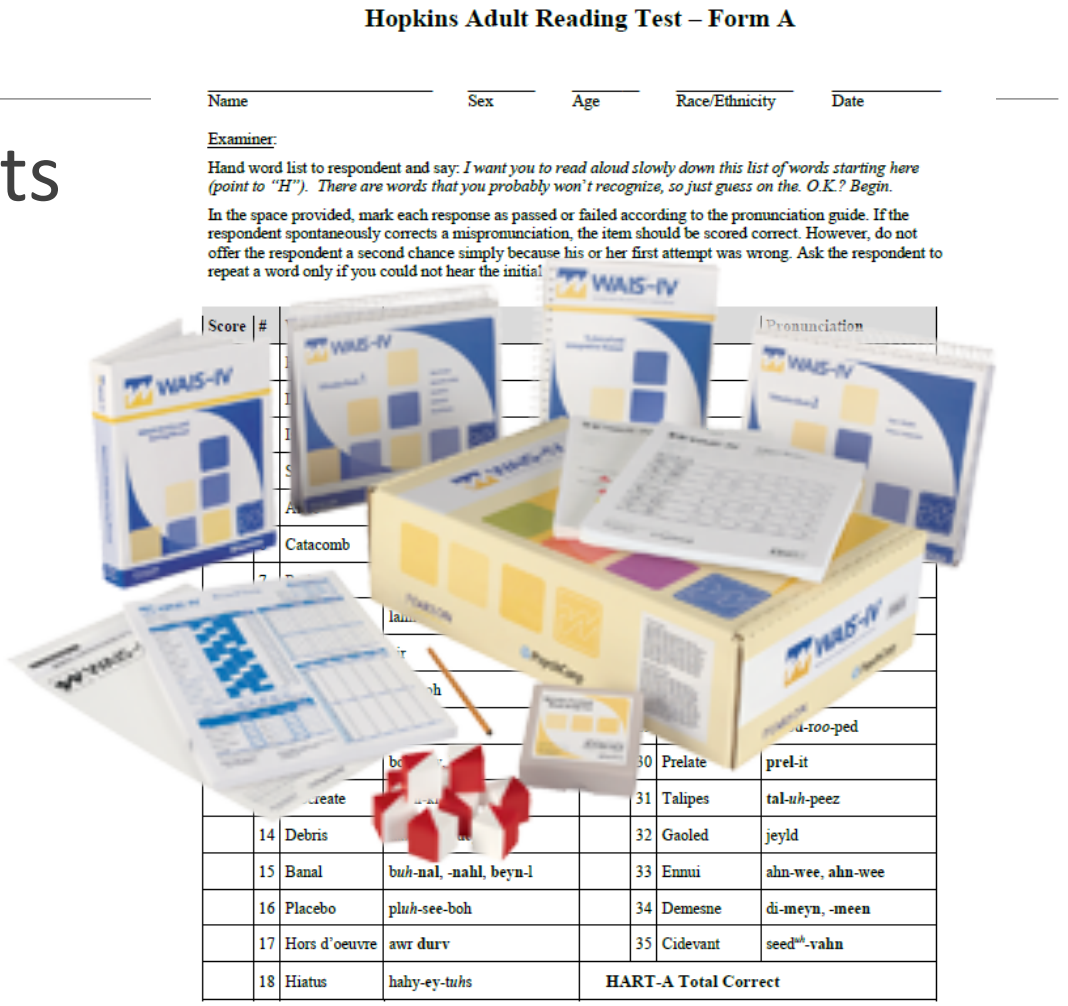
Assessment

- Comprehensive Battery of tests
  - IQ
    - Premorbid IQ
      - HART
    - Current IQ
      - WAIS-IV



Hopkins Adult Reading Test – Form A

Name _____ Sex _____ Age _____ Race/Ethnicity _____ Date _____

Examiner:

Hand word list to respondent and say: *I want you to read aloud slowly down this list of words starting here (point to "H"). There are words that you probably won't recognize, so just guess on the. O.K.? Begin.*

In the space provided, mark each response as passed or failed according to the pronunciation guide. If the respondent spontaneously corrects a mispronunciation, the item should be scored correct. However, do not offer the respondent a second chance simply because his or her first attempt was wrong. Ask the respondent to repeat a word only if you could not hear the initial

Score	#		Pronunciation			
		Catacomb				
						-roo-ped
		reate		30	Prelate	**prel-it**
				31	Talipes	**tal-*uh*-peez**
	14	Debris		32	Gaoled	jeyld
	15	Banal	**buh-nal, -nahl, beyn-l**	33	Ennui	**ahn-wee, ahn-wee**
	16	Placebo	**pluh-see-boh**	34	Demesne	**di-meyn, -meen**
	17	Hors d'oeuvre	**awr durv**	35	Cidevant	**seed^{ah}-vahn**
	18	Hiatus	**hahy-ey-*tuhs***	**HART-A Total Correct**		

Test Battery

- Motor
  - GPT
  - TMT
  - WAIS-IV

Test Battery

- Attention
  - Simple auditory attention
    - Digits Forward
  - Working Memory
    - Digits Backward

1, 2, 5, 3…

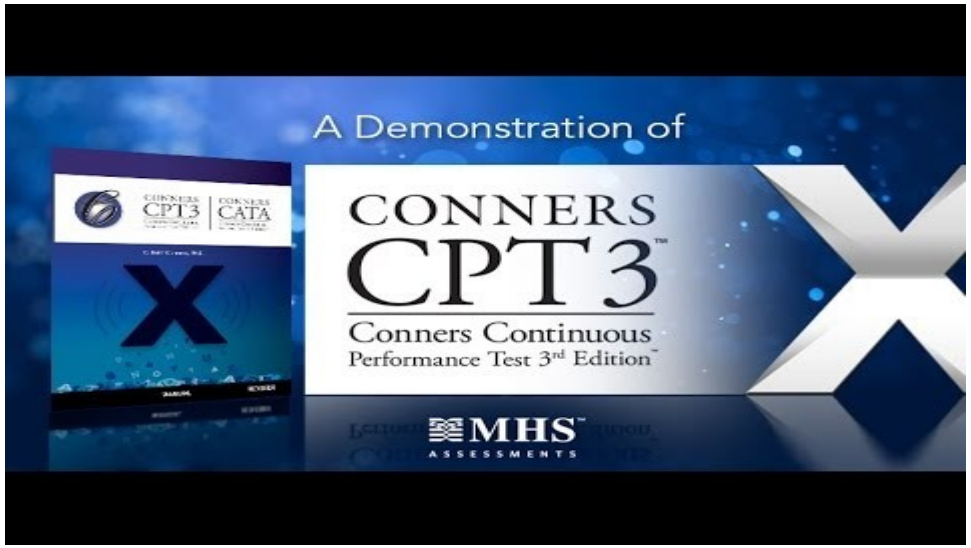
Test Battery

- Attention
  - Divided auditory attention
    - BTA

1, B, 7, C…

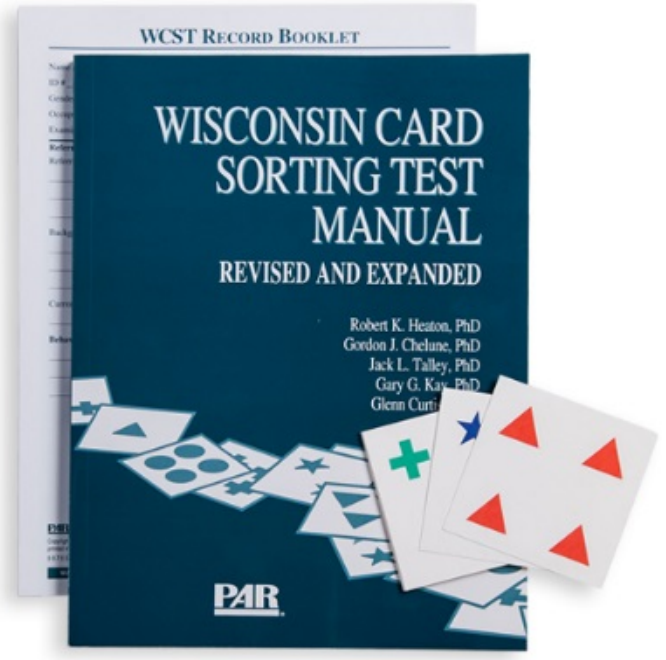
Test Battery

- Attention
  - Sustained Visual Attention



Executive Functions

- WCST



Executive Functions

Stroop

Executive Functions

Tower test

- D-KEFS

Language

Verbal Fluency

- Letters
- Categories

F, A ,S

Language

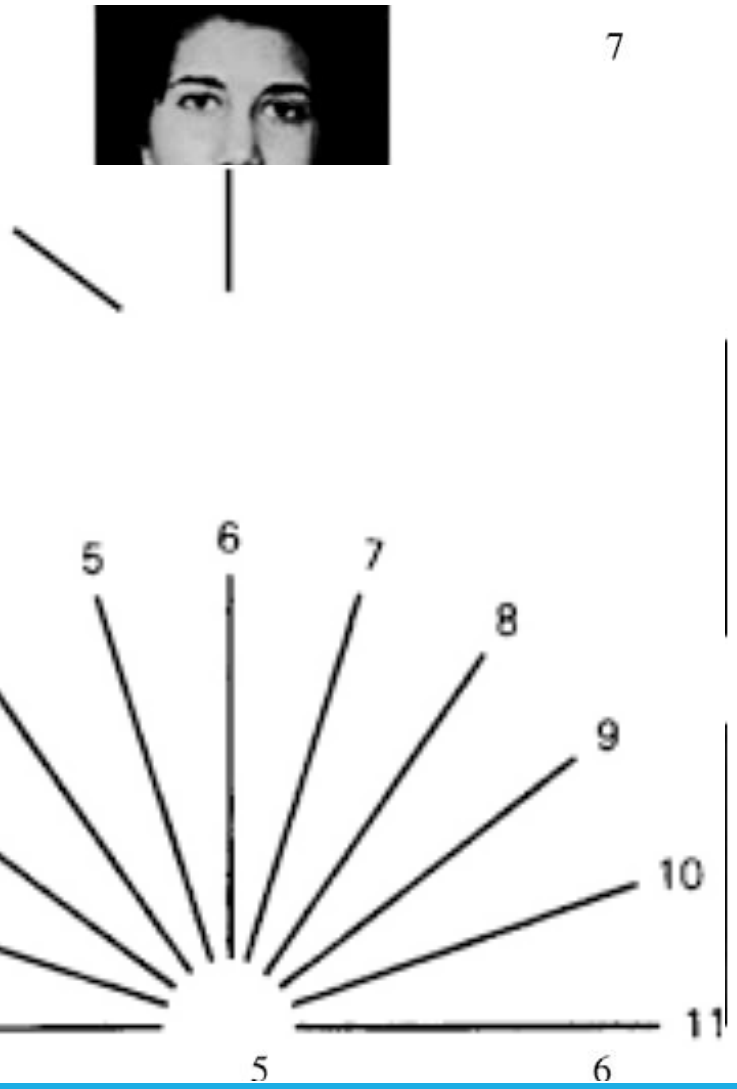
Naming

- Confrontation Naming
- Auditory Naming

The planet we live on?

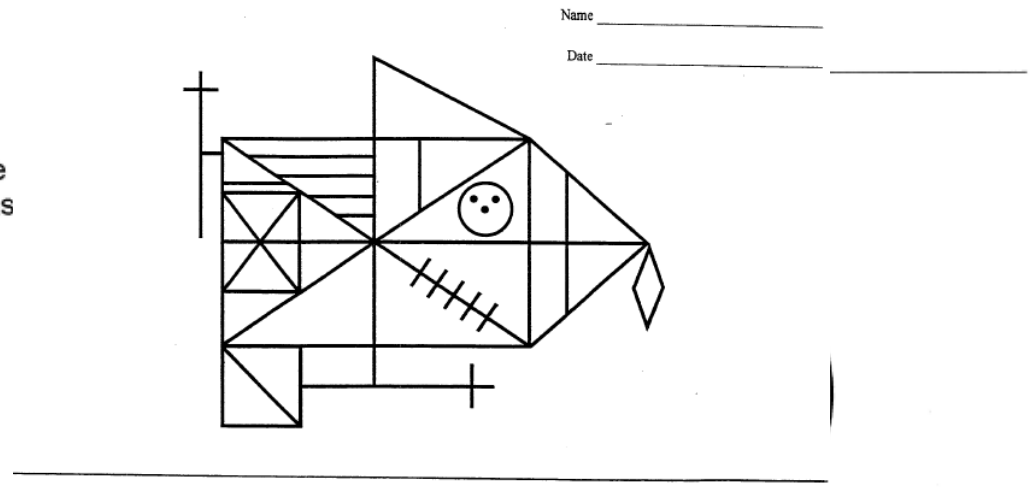
Visuospatial abilities

- Perception
  - Judgement of Line Orientation
  - Benton Faces



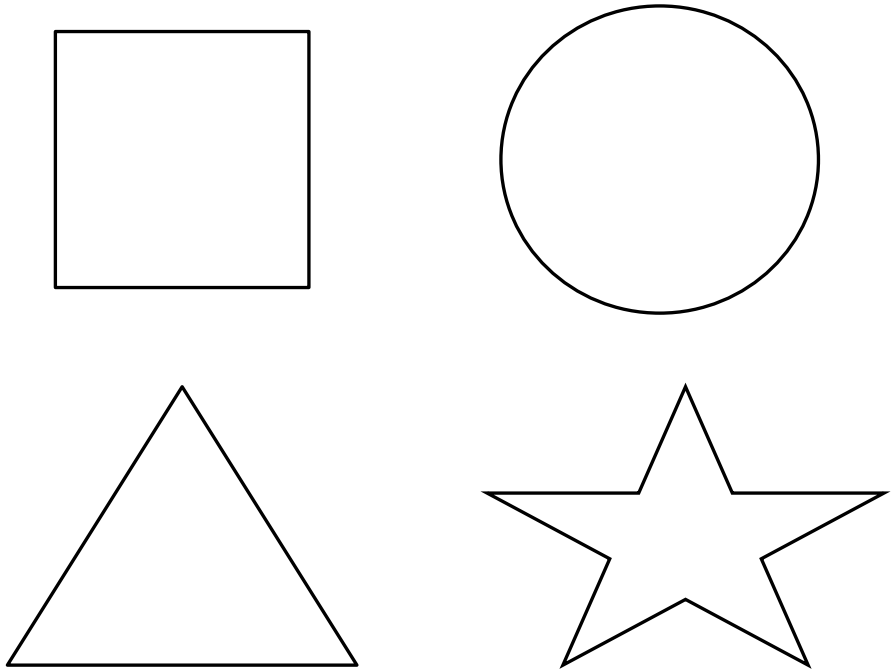
Visuospatial abilities

- Construction
  - Clock Drawing
  - Rey-CFT



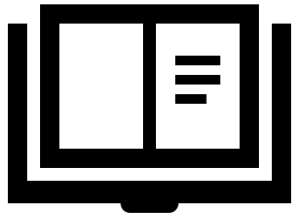
Test Battery

- Memory
- Visuospatial
  - Designs
    - BVMT-R
  - Faces
    - WMS-III Faces



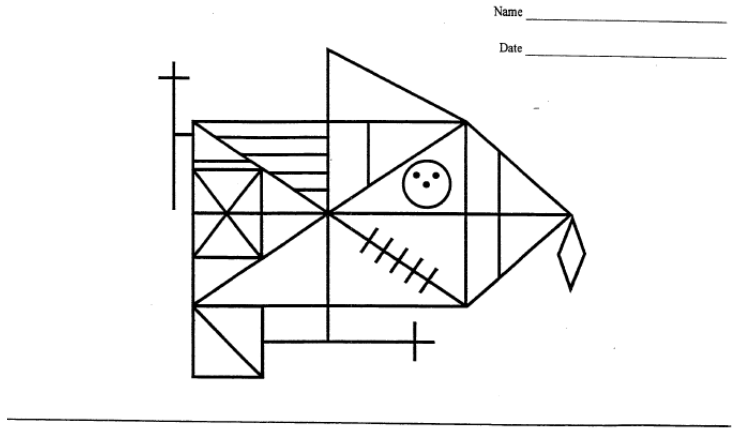
Test Battery

- Memory
- Auditory-verbal
  - HVLT-R/RAVLT
  - Logical Memory



Neuropsychology and Epilepsy

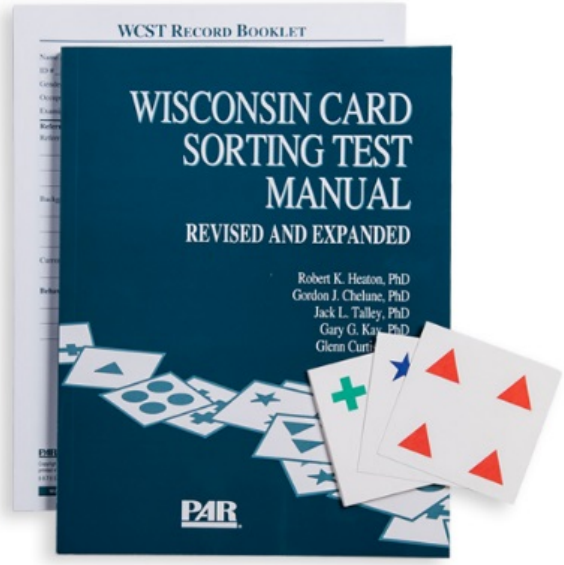
- Factors that test performance
  1. Lesion
     - Mesial temporal lobe structures
       - New learning and memory deficits
     - Right parietal
       - Visuoperceptual and constructional deficits
     - Left parietal
       - Visuospatial, reading, writing, and calculation



Factors that test performance

1. Lesion
   - Prefrontal
     - Executive dysfunction
       - Problem solving, mental flexibility, planning, and letter guided verbal fluency
   - Occipital lobe
     - Visual-perceptual deficits

TRAIL MAKING TEST



Factors that test performance

2. Seizure frequency
   - Greater frequency = greater cognitive impairment
     - Intractable
       - Temporal lobe epilepsy
         - Progressive temporal and extratemporal damage

Factors that test performance

3. Seizure severity
   - More severe = greater cognitive impairment
     - More episodes of status epilepticus
     - Primary generalized tonic-clonic vs complex partial seizures
     - Multiple seizure types vs single seizure type

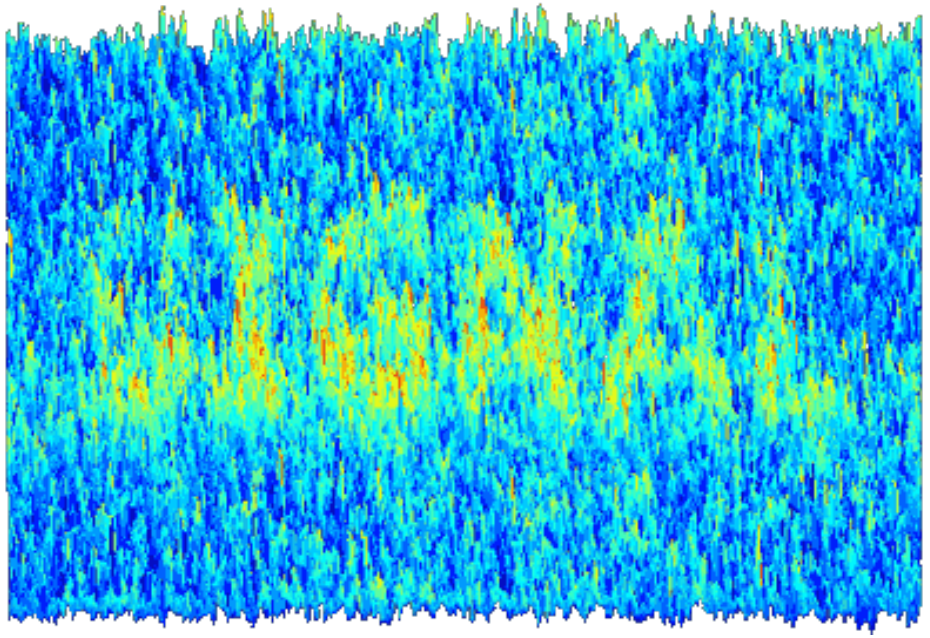
Factors that test performance

4. Age of Onset
   - Earlier age of onset
     - Worse neuropsychological performances

Factors that test performance

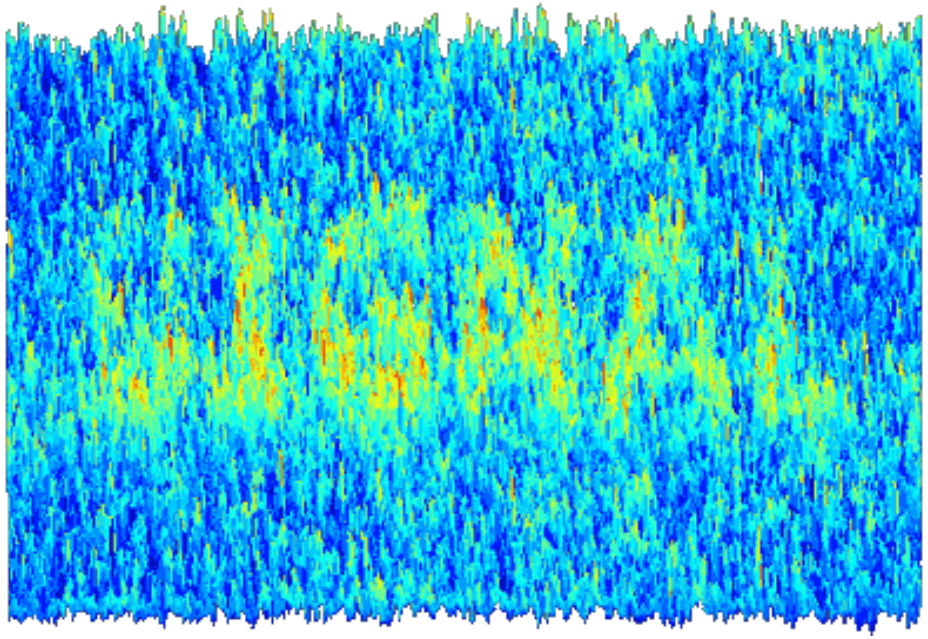
5. Noise

- Antiepileptic drugs (AEDs)
  - ↓ seizure likelihood ↓ neuronal excitability
    - Attention and processing speed
  - Dose dependent
  - Older AEDs
    - Topamax



Factors that test performance

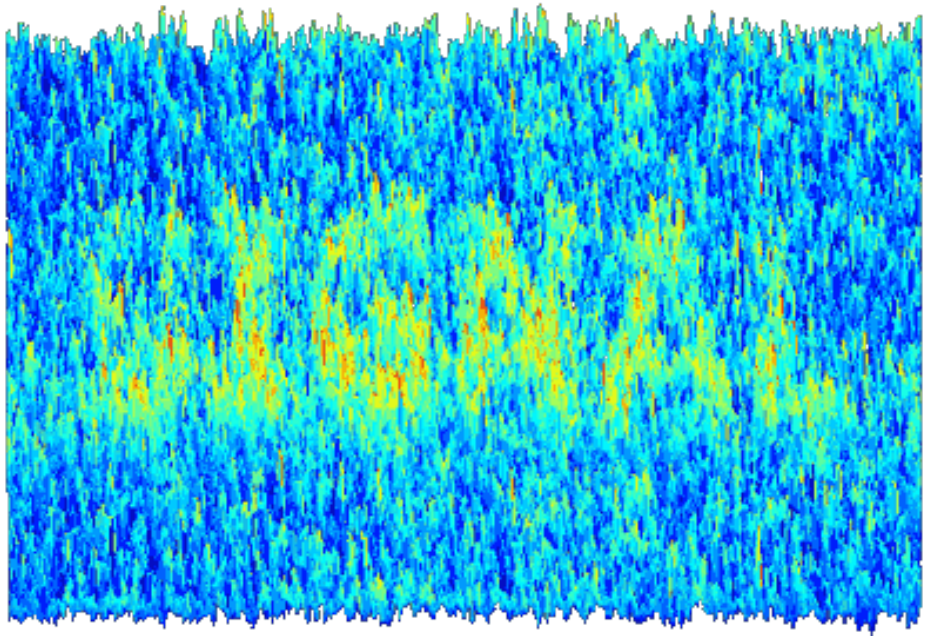
5. Noise
   - Transient cognitive impairment
     - Subclinical epileptiform discharges
   - Postictal
     - Brief vs prolong delay
       - ~20 minutes vs 24 hours
         - Seizure type
         - Complex partial seizure
           - 24 hrs



Factors that test performance

5. Noise

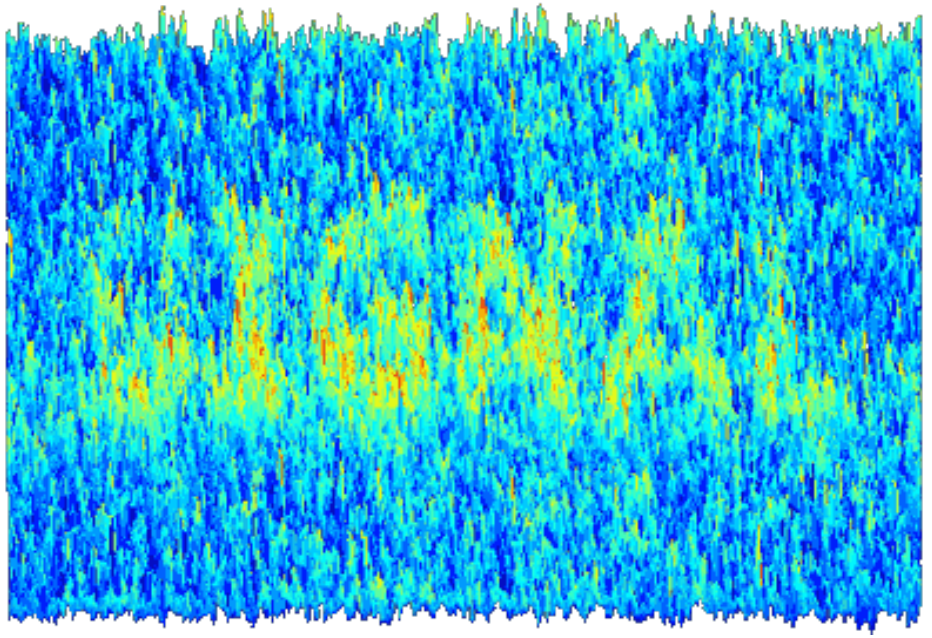
- English language
- Non-English speaker
- Fluent English bilinguals ↓ than English monolinguals on tests of language



Factors that test performance

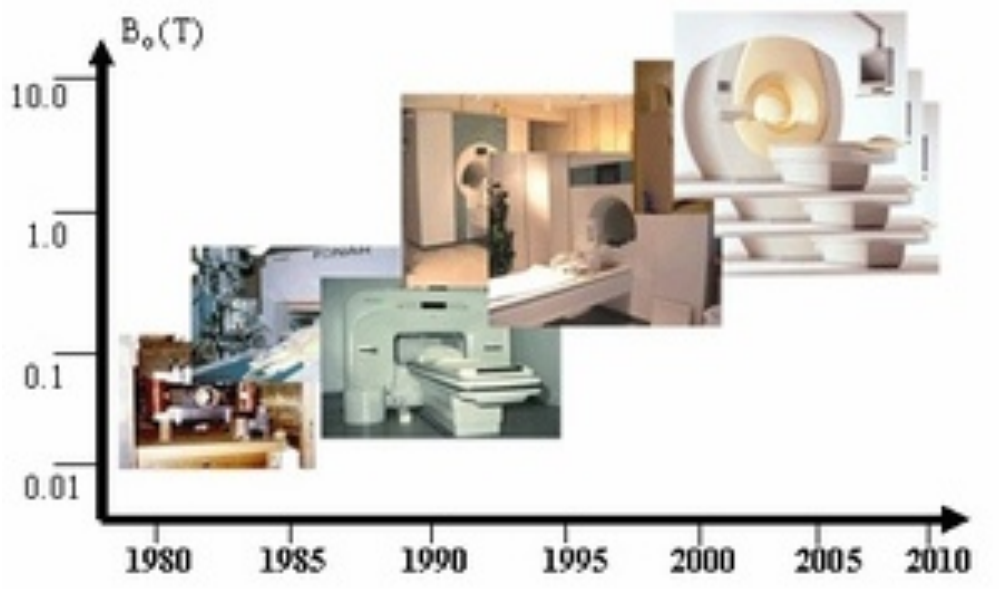
5. Noise

- Motivation/Effort
  - Qualitative and quantitative measurement



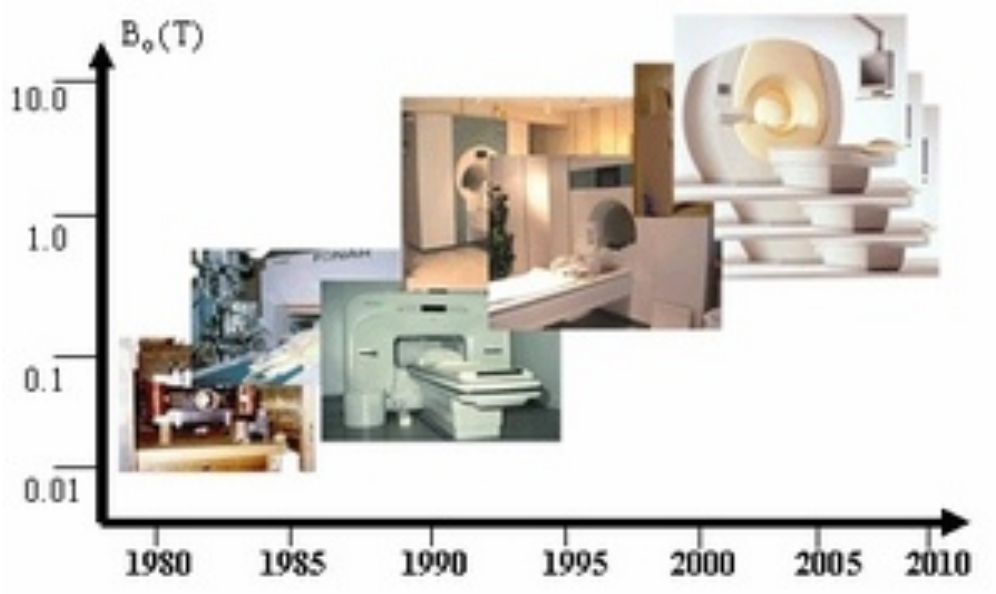
Pre-surgical planning

- Lateralization and Localization
- Costs vs benefits



Lateralization and Localization

- Lateralization
  - 66-73%
- Localization
  - Influencing factors
    - Known seizure focus?
      - Location
        - Temporal
        - Diffuse

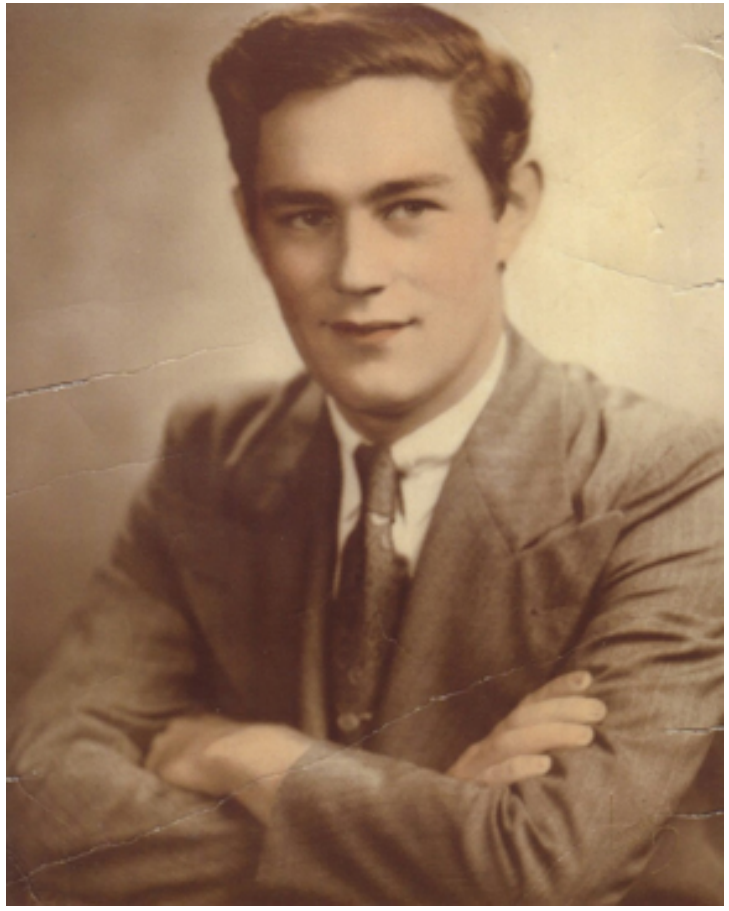


Pre-surgical planning

- Costs vs benefits
  - Seizure control vs cognitive impairment
- Seizure control
  - Focal deficit
    - Consistent with EEG and MRI
    - Seizure relief
- Postoperative cognitive impairment?
  - Prediction of Memory Loss and Language impairment

Prediction of Memory Loss

1. Memory performance
   - Material specific
     - Verbal > nonverbal
   - Relative to seizure focus/area to be resected
     - Left (dominant) > right
     - Left temporal lobectomy
       - ~60% of pts have verbal memory decline
     - Right temporal lobectomy
       - ~20 – 25% of pts experience non-verbal memory decline



Prediction of Memory Loss

2. Presence of MTS
   - Seizure focus or contralateral
- Poor Candidate if:
  1. Normal verbal memory
  2. Seizure focus is not MTS and is L medial temporal lobe

Prediction of Language impairment

1. Language performance
   - Relative to seizure focus/area to be resected
   - Dominant much more likely to decline
     - Acute aphasia few days/weeks postoperatively
     - Left temporal lobectomy
       - 25 to 40% of pts will have anomia
         - Mild verbal IQ decline (4-5 pts)

Prediction of Language impairment

2. Temporal lobe epilepsy
   - Type of surgery
     - Traditional resection vs laser ablation
     - 19 (laser) vs 39 (traditional) pts
     - 10 vs 22 dominant
     - 0/10 vs 21/22 declined

Better object recognition and naming outcome with MRI-guided stereotactic laser amygdalohippocampotomy for temporal lobe epilepsy

*†‡Daniel L. Drane, *†David W. Loring, §Natalie L. Voets, *Michele Price, ¶Jeffrey G. Ojemann, *#Jon T. Willie, **Amit M. Saindane, ‡Vaishali Phatak, *Mirjana Ivanisevic, ††Scott Millis, *†Sandra L. Helmers, ‡¶John W. Miller, *†Kimford J. Meador, and *#Robert E. Gross

Epilepsia, 56(1):101–113, 2015
doi: 10.1111/epi.12860

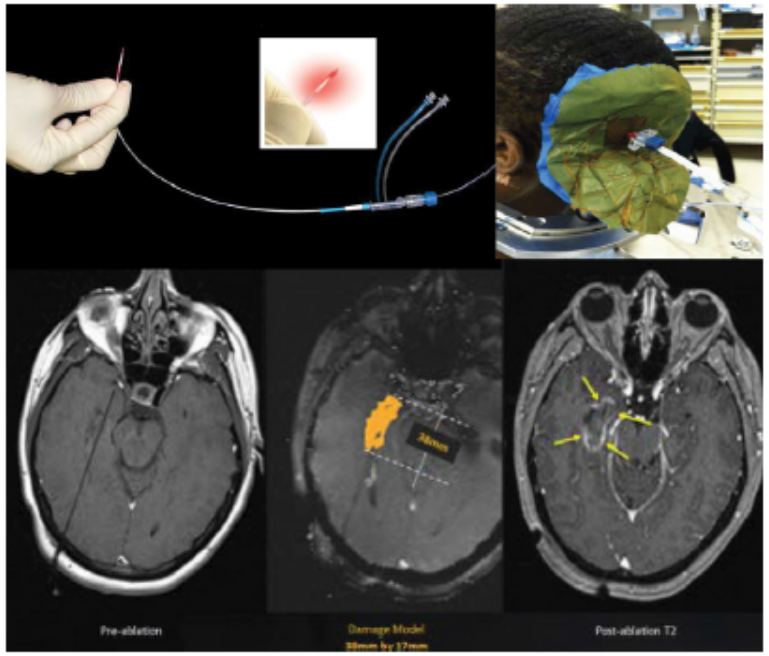


Figure 1.
Depiction of the optical fiber, the ablation process, and pre- and postablation MRI images in an axial plane.
Epilepsia ©ILAE

Cognitive Outcome

- Focal deficit consistent with EEG and MRI
- THAT focus is proposed for surgical resection
  - Seizure Control likelihood increases
  - Cognitive decline less likely
    - Increased likelihood for cognitive gains
      - Attention and processing speed
  - Post-operative cognitive assessment
    - ~1 year

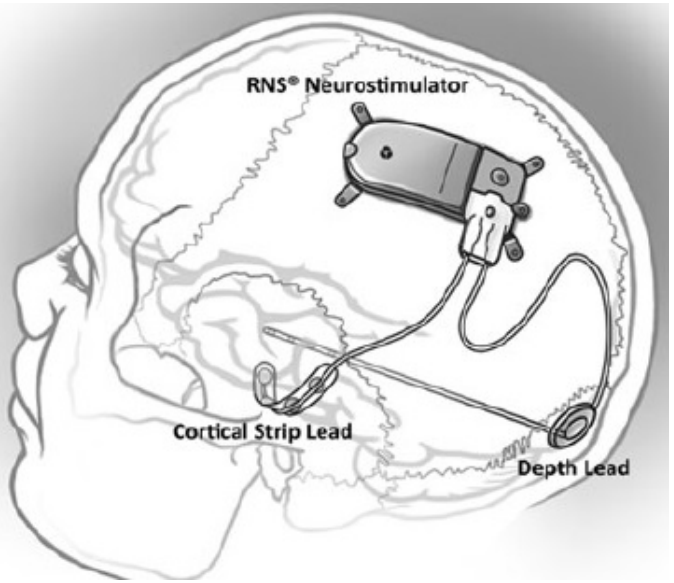
Pre-surgical planning

- Poor surgical candidate?

Differential neuropsychological outcomes following targeted responsive neurostimulation for partial-onset epilepsy

*David W. Loring, †Ritu Kapur, ‡Kimford J. Meador, and †‡Martha J. Morrell

Epilepsia, 56(11):1836–1844, 2015
doi: 10.1111/epi.13191



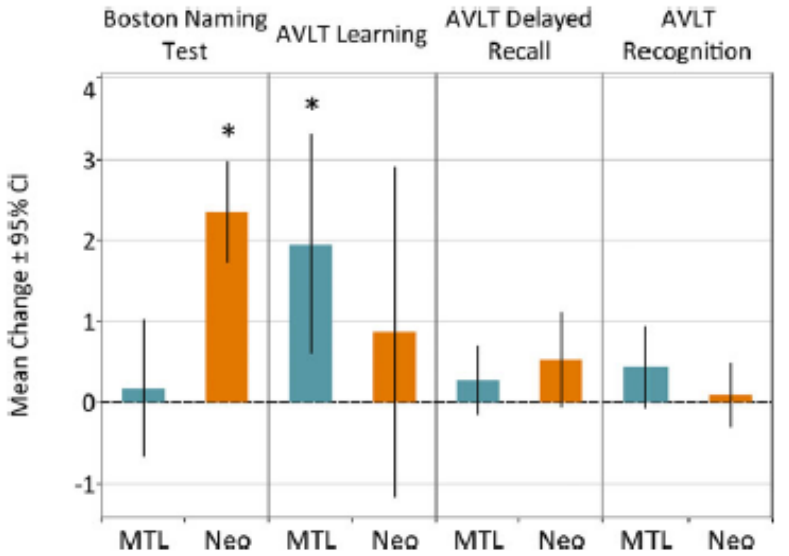


Figure 3.
Primary outcomes, change from baseline through 2 years by region of seizure onset. Bars represent the GEE-modeled average change from baseline naming and memory function at 2 years for MTL and neocortical patients. Error bars represent the 95% confidence interval. An asterisk (*) denotes a statistically significant change ($p < 0.05$) from baseline. An increase in score is in the direction of improvement. AVLT, Rey Auditory Verbal Learning Test; MTL, mesial temporal lobe; Neo, neocortical.

Conclusions

- What factors influence test performance in epilepsy?
  1. Lesion
  2. Seizure Frequency
  3. Seizure Severity
  4. Age of Onset
  5. Noise

Conclusions

- Utility in Epilepsy
  - Who is considered a “good” surgical candidate?
    1. Focal deficit that is consistent with imaging and area proposed for resection
       - Seizure control increases
       - Cognitive decline decreases

Thanks for Listening!

Questions?