Week 7

- Tuesday:
  - KW28, O2 : Neuropsychological Assessment
- Thursday:
  - NP Tests: The WAIS-4 IQ Test

O2 and KW28 : Neuropsychological Assessment

Overview of NP Assessment

- Goals
  - determine kind/location of brain pathology
    - *less common now due to Neuroimaging*
  - diagnose disease based on behaviors
    - *e.g. Alzheimer's Dementia*
  - establish baseline functioning before intervention
    - *e.g. before neurosurgery, lateralization of function*
  - distinguish between *organic* and *functional* disorders
  - diagnosis
  - track rehabilitation
  - research
    - *e.g. drug research to treat Alzheimer's*
    - *TBI from sports injuries*

Organic vs. Functional

- Organic
  - *root word "organ"*
  - impairments are due to biological problems in the Brain, e.g. disease or injury
- Functional
  - problems are "purely psychological" - no evidence of dysfunction or damage of brain tissue

Trends in NP Assessment

- Functional imaging
  - largely replaced use of NP to identify brain area(s) affected
- Computerized tests & cognitive neuroscience
  - most NP tests are old (1850s) and predate neuroscience
  - newer tests under development
- Money : insurance & managed care
  - USA healthcare system's problems
  - NP assessments are expensive ($2000+)

NP Assessment Protocol

- Referral
  - typically from MDs (neurologists, psychiatrists), Clinical Psychologists (PhDs) or therapists (Masters-level)
- Clinical Interview
- NP testing
  - 3 or more hours
  - issues of motivation, cooperation, fatigue
- Interpretation of results
- NP Assessment Report
  - current status
  - diagnosis
  - prognosis
  - recommendations

Approaches to NP Assessment

- Quantitative vs. Qualitative...
- Fixed vs. Flexible Battery...

Quantitative vs. Qualitative

- Quantitative :
  - uses standardized tests
  - statistical analysis of data
  - "normal" functioning compared with normative data tables
  - can be administered by Psychometrist
    - often with a BA or BS degree!
- Qualitative :
  - administered by trained neuropsychologist
  - informal, results interpreted on the fly
  - "Only Luria can do Luria's assessment"
  - approach seen more in Neurology than Neuropsychology

Fixed vs. Flexible Battery

- Fixed :
  - All patients get same battery of tests
  - Pros: standardized, able to catch subtle problems
  - Cons: slow, expensive, lack of detail in some results
- Flexible :
  - tests given based on patient's status
  - interesting performance on one test : choice of a different test
  - Pros: faster, more detail in certain areas
  - Cons: may miss subtle issues

Neuropsychological Tests

- Hundreds exist
- How to choose?
  - Fixed vs. Flexible approach
- Common tests...

Fixed Batteries

- Halstead-Reitan
  - WAIS plus additional tests of memory, learning, motor and sensory skills
  - Approx 6 hours to administer
- Luria-Nebraska
  - Luria had a flexible battery based on theory of pluripotentiality (multiple brain systems could compensate to do the same tasks)
  - Had poor psychometrics. Test battery was improved and standardized at U. Nebraska
  - Approx 24 hours(!) to administer

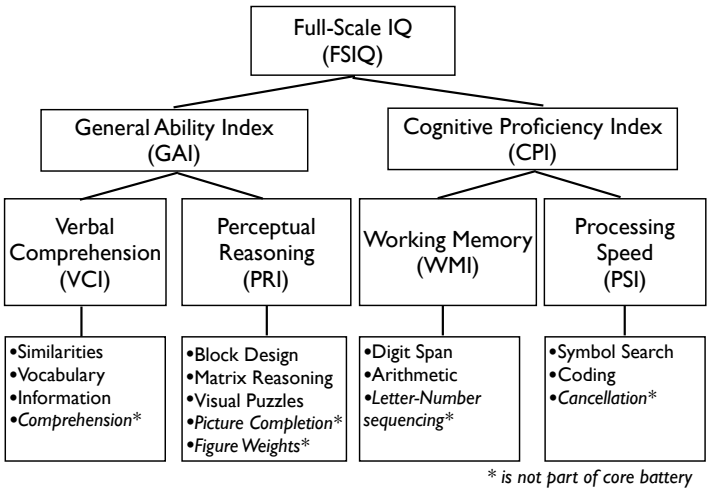
Halstead-Reitan Battery

- Full WAIS IQ Test
- Additional tests:
  - Category test
  - Grooved pegboard
  - Rhythm
  - Speech comprehension
  - Finger tapping
  - Trail making
  - Grip Strength
  - Sensory-perceptual exam

IQ Tests

- Wechsler Adult Intelligence Scale (WAIS)
- What does it measure?

WAIS-4



* *is not part of core battery*

Gardner's 8 Intelligences

- logical-mathematical (*)
- verbal-linguistic (*)
- spatial (*)
- musical
- bodily-kinesthetic
- naturalist
- interpersonal
- intrapersonal

NP Test Areas

- Abstract reasoning / comprehension
- Activities of Daily Living (ADLs)
- Attention
- Emotional
- Executive Control
- Language
- Memory
- Motor
- Problem Solving
- Orientation
- Reasoning
- Sensation/Perception
- Visuospatial

Issues with NP Assessment

- Every NP test requires multiple ability areas & brain systems
  - example: HRB grooved pegboard...
- Sensitivity & Specificity…
- Defining Normality & Abnormality…
- Estimating Premorbid functioning…
- Individual differences & Norms…
- Effort & Malingering…

HRB: Grooved Pegboard

Grooved Pegboard

- What abilities required?
  - verbal comprehension
  - memory
  - executive functioning
  - emotional
  - motor
  - sensory
  - others…?

Sensitivity vs. Specificity

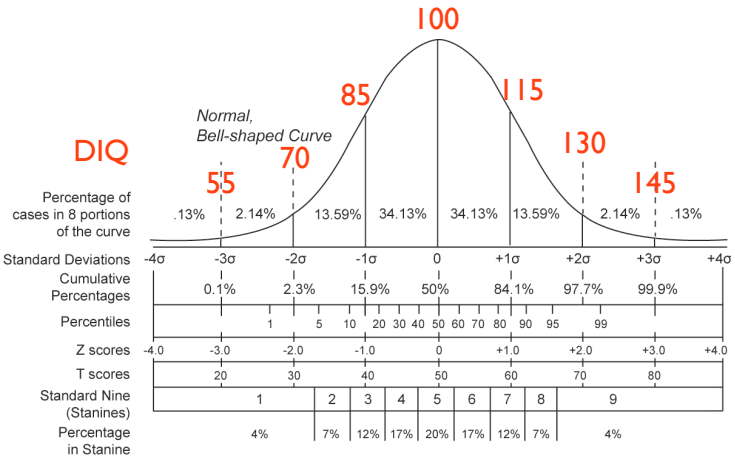
- Sensitivity:
  - can a test measure detect a dysfunction?
- Specificity:
  - does a low score on a test indicate general, or specific problem?

- Example:
  - very poor performance on Grooved Pegboard test
  - sensitive : to general dysfunction
  - specific ? to what?

Interpreting Scores

- What is "abnormal"
- Basic Definitions
  - test score that is statistically very low compared to *expected score*
  - test score that is in the *impaired range*

Normal Curve: Standard Scores



Standard Scores

	Z scores	IQ scores	T scores	Scaled Scores
Mean	0	100	50	10
SD	1	15	10	3
1 SD below the mean	-1.0	85	40	7
2 SD below the mean	-2.0	70	30	4

Defining "Impairment"

- One Standard Deviation below the Mean
  - below 15%ile
  - Z score of -1.0 or lower
  - IQ score of 85 or lower

- Two Standard Deviations below the Mean
  - below 3%ile
  - Z score of -2.0 or lower
  - IQ score of 70 or lower
    - common definition of "Mental Retardation"

Premorbid Ability

- Interpretation to "expected score"
- Rarely have pre-test data
- Methods:
  - use statistical normative data
    - corrections:
      - age, gender, amount of education, ethnicity, language
  - informal - estimate by career, family members, work samples, etc.
  - Tests that are insensitive to brain damage
    - over-learned information
- Problems:
  - normative data - often lacking
  - individual differences

Individual Differences

- Many factors influence "normal" performance
- Genetics: Age, Gender, Ethnicity
- Environment :
  - language
  - education
  - career
  - family
  - etc.

Effort & Malingering

- Motivation & Effort are known to affect test performance
- Reasons for low effort?
  - attention, money, release from obligations…
- Detecting Malingering
  - Hiscock's Forced Choice Digit Memory test

FCDMT

- Normal scores: 100%, even in severely amnesic patients
- Malingering scores : often 50% or lower
- Lower than 50%?
  - logically...

Review

- Goal of NP testing: Assess functioning of all brain systems
- Quantitative vs. Qualitative
- Normal Curve / Standard Scores
- Definitions of Impairment
- Issues
  - lack of premorbid testing
  - demographic confounds
  - individual differences
  - effort, malingering
- Flexible vs. Fixed Battery
- Halstead-Reitan
  - WAIS + Other tests

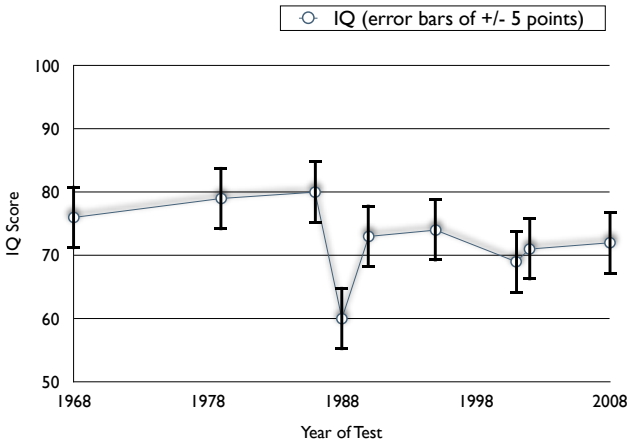
Wechsler Adult Intelligence Scale (WAIS)

Mar 2014 - Supreme Court: Hall v. Florida

- Atkins v. Virginia (2002) : Supreme Court : "Death is not a suitable punishment for a mentally retarded criminal"
- Freddie Lee Hall
  - "mentally retarded" according to teachers, psychiatrists, psychologists, lawyers
  - unable to cook, clean, dress or bathe himself regularly
  - in 1978 w/an accomplice raped / murdered a 21 year old pregnant woman
- Definition of Mentally Retarded: IQ of 70 or below
- IQ Test margin of error ± 5 points
- Q: can execution decision hang on imprecise test scores?

- Test scores...

Freddie Lee Hall's IQ Test Scores



Hall vs. Florida: Supreme Court (2014)

- Supreme court held that a strict "70 or below" cutoff can not be used.
- Must consider other evidence

- Example:
- "Hall's trial counsel in the Hurst case testified that Hall could not assist in his defense because he had "a mental ... level much lower than his age," that at best Hall's understanding was similar to counsel's four- year-old daughter, and at worst counsel "could not communicate with [Hall] at all."

Wechsler Scales

- WAIS-4 : Adult Intelligence Scale (2008)
  - Evolved from Wechsler-Bellevue Intelligence Scale (1937)
  - Designed for Adults
  - Focus on multiple abilities - not a single "g"

- Other Wechsler tests:
  - WISC-4 : Intelligence Scales for Children
  - WPPSI-3 : Preschool and Primary Scale

Intelligence: How many Factors?

Researcher	# of Factors	Comment
Binet	multiple	for practical reasons, only measured 1
Spearman	1 g	acknowledged other smaller factors (S_i)
Thurstone (et. al)	2 g_f, g_c	fluid vs. crystallized
Sternberg	3	analytic, creative, practical
Gardner	8	"multiple intelligences" (MI) theory

David Wechsler: how many Factors?

- "[…]Spearman's theory of general intelligence (g) was too narrow. [It is] an effect rather than a cause[…] Non-intellective factors, such as personality, contribute to the development of each person's intelligence."

Cognitive / Info Processing 1

- **What is required to correctly answer a single item on an IQ test?**
  - Verbal comprehension: understand the instructions you hear or read
  - Short term memory: remember the instructions
  - Long term memory: retrieve answer or procedure
  - Working memory: juggle inforamation, do calculations, etc.
  - Judgement / Reasoning : decide between competing answers
  - Attention / Concentration: remain focused on task

Cognitive / Info Processing 2

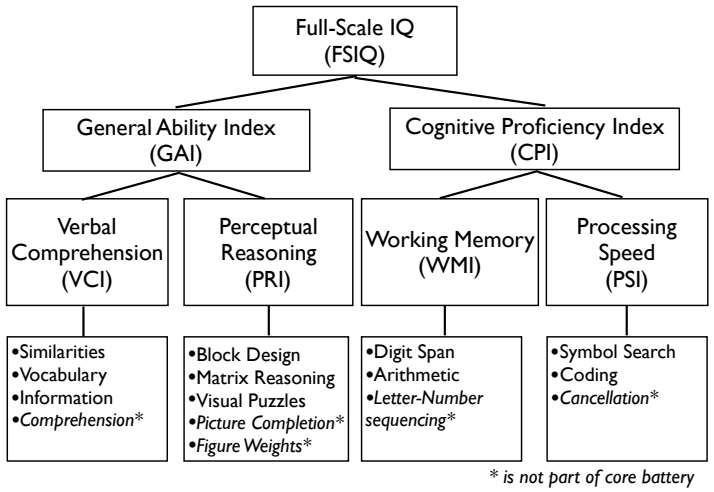
- Verbal skills: give reply with voice
- Motor skills: respond with hand
- View response of examiner: praise? criticism?
- Meta cognition: judge performance, adjust strategy accordingly

- Cognitive science believes many of these to be independent processes subsumed by independent brain systems

WAIS-4 Changes

- New "General Ability Index" (GAI)
  - GAI less sensitive to brain disorders, giving estimate of pre-morbid functioning
  - Reduced reliance on Working Memory and processing Speed
  - "Theoretically, the GAI represents and individual's overall cognitive ability, if working memory and processing speed abilities were similar to verbal and non-verbal abilities"
- New "Cognitive Proficiency Index" (CPI)
  - measure of working memory & processing speed

WAIS-4



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WAIS-IV General Ability Index (GAI)

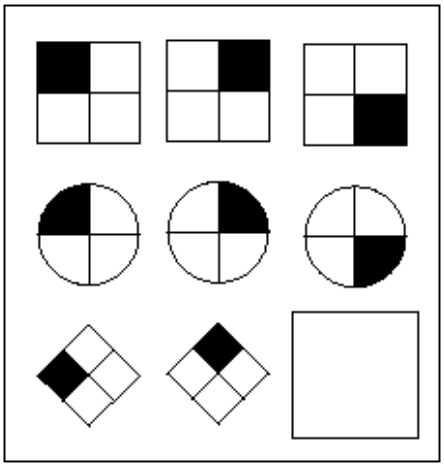
- Verbal Comprehension Index (VCI)
  - Vocabulary
  - Similarities
  - Information
  - **Comprehension*
- Perceptual-Reasoning (PRI)
  - Block Design
  - Matrix Reasoning
  - Visual Puzzles
  - **Picture Completion*
  - **Figure Weights*

WAIS-IV Vocabulary, Similarities, Information

- Vocabulary
  - "What is a guitar?"
- Similarities
  - "In what way are an apple and a pear alike?"
- Information
  - "How far is it from New York to Paris?"
- Comprehension
  - "Why is food often sold in sealed containers?"
    - 1 point : to keep it clean
    - 1 point : to keep it fresh
    - 1 points : to make it easy to transport

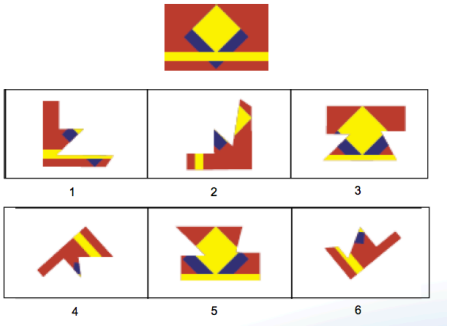
WAIS-IV: Block Design

WAIS: Matrix Reasoning



WAIS-IV: Visual Puzzles

Which 3 of these pieces go together to make this puzzle?



WAIS-IV Cognitive Proficiency Index (PCI)

- Working Memory Index (WMI)
  - Digit Span
  - Arithmetic
  - **Letter-Number Sequencing*
- Processing Speed Index (PSI)
  - Symbol Search
  - Coding
  - **Cancellation*

WAIS-IV Arithmetic & Letter-Number Sequencing

- Arithmetic
  - "How many 45-cent stamps can you buy for a dollar?"
- Letter-Number Sequencing
  - "Repeat Q-1-B-3-J-2 in numerical and alphabetical order"
    - ex. "123, BJQ"

WAIS : Digit Symbol Coding

WAIS-4

- Which of these tests are completely "pure" measures of an ability?
  - Verbal / language issues?
  - Cultural bias?
  - Motivation?
  - Expectancy effects?
  - Strategy : speed vs. accuracy?

Multiple Intelligences

- The WAIS-4 tests multiple *dimensions* of intelligence, but this is not the same thing as *multiple intelligences*
- Which of Gardner's 8 intelligences are actually measured by the WAIS-4?

Gardner's 8 Intelligences

- logical-mathematical (*)
- verbal-linguistic (*)
- spatial (*)
- musical
- bodily-kinesthetic
- naturalist
- interpersonal
- intrapersonal

WAIS-Review

- IQ Test covers some areas
  - logical-mathematical (*)
  - verbal-linguistic (*)
  - spatial (*)
- Misses many specific forms of intelligence:
  - musical
  - bodily-kinesthetic
  - naturalist
  - interpersonal
  - intrapersonal
- Misses many abilities altogether:
  - e.g. Learning & Memory
- NP testing attempts to cover these missing areas