Interpretation in neuropsychological assessment

What does interpretation of a neuropsychological test involve?

What you need to consider in interpretation?
What do we mean by interpretation?

- Distinction between testing and assessment: evaluative component to the process of assessment, assigning meaning to the results.
- Requires both:
  - Quantitative interpretation (normative comparisons)
  - Qualitative appraisal based on many factors, including patient’s attitude towards the tests administered and patterns in the errors made.
- Based on analysis and synthesis of multiple lines of converging evidence, and a dynamic process of hypothesis testing and information gathering.
- Tests are just one of the tools used by neuropsychologist during an assessment – they are instruments and can lead or mislead depending on how they are used.
- Need to account for patient variables such as sensory and motor status, fatigue, medication regime and likelihood of drug or alcohol dependency.
Interpretation in neuropsychological assessment

Interpretation is a multistage process:

- Begins with analysis of the information from interview, medical records, behavioural observations and tests.
- Test score profiles are optimally meaningful when interpreted within the context of background information, observed behaviours, and an approach to each problem solving task.
- Hypotheses generated from the test profile should be supported with data from multiple sources.
The following should be considered when interpreting:

- The importance of a conceptual model - should interpret from a theoretical model to try to understand the reasons for peaks and valleys in the cognitive profile, and translating this into pragmatic, meaningful interpretations of strength and weakness.
- Influence of subject specific variables (using background information/medical records/informant report)
- Determining when differences are true and meaningful
- Effects of the interactions of cognitive domains
- Consistency/inconsistency across and within cognitive domains
- Distinguishing contribution of various factors including organic, psychiatric and test taking conditions - that may overlap
- Avoiding erroneous assumptions and errors
Common mistakes in interpretation

- Test scores should never be used in isolation for decision making purposes.
- Cognitive tests are multidimensional and do not represent isolated functions. In other words, there are many reasons a person may fail a particular test.
- Standardised, individually administered tests assess mental functioning under fixed experimental conditions. Strict adherence to standardised procedures is important to ensure comparability of obtained result to normative group, but standardised procedures add to the artificial nature of testing situation (i.e., an examiner is timing, observing, writing notes etc.).
- Awareness of this prevents over-interpreting performance as maximum capacity. Behavioural observations are useful in translating test results into practical recommendations.
Case example - Jane

- Jane, 54 years old, had chemotherapy for breast cancer two years previously.
- Reporting significant memory difficulties i.e. forgetting appointments, forgetting she has said something; difficulties with concentration and focusing; difficulties with word-finding, difficulties taking in information and understanding complex information
- Fatigue
- Reports changes were sudden, after a course of chemotherapy
- Unable to return to work
- All scores within 'normal limits'; VCI/PRI Average; AWMI Average; VWMI Low Average; PSI Low Average; AMI Average; VMI Low Average; DKEFS Average;
- Premorbid – TOPF (Average); Educational history – A – E O’levels and CSE (‘didn’t try’), BTEC, Diploma, City and Guilds, First Class degree Education and Training; work reports/job description data performance manager– high level skills, organizational, planning, problem solving etc
- Test environment cf work environment – ‘wiped out’ after 1.5 hours assessment
  - Often those with chronic fatigue perform similarly on tests by expending additional cognitive effort
  - Well-rested, able to maintain maximum cognitive effort for 1/5 hours, but full working day/week?
  - Distraction free vs busy working environment,
- “whilst the current assessment suggests that Jane is performing within normal limits across most tasks, this is likely to be lower than previous levels of performance, in addition, increased fatigue is likely to have a detrimental affect on cognitive abilities for sustained period. ….it seems likely she will be unable to return to work in such a demanding job role.."
Overinterpretation

Underinterpretation

Underutilisation of base rates

False negatives

Overgeneralisation
Interpretation pitfalls

- Over-interpretation can result from overreliance on salient data such as one dramatic pathological sign, even in with no other unusual evidence.

- Over interpretation of score differences – the difference between 2 scores may be statistically significant but not infrequent
  
  - The base rates of score differences therefore help determine whether an individuals tests performance is clinically meaningful

- e.g. a 10 point difference between scores may be clinically significant if only a small percentage (e.g. 5%) of the population has the difference, but if a large percentage (e.g. 40%) then the difference is not clinically meaningful
Statistical and clinical significance

- When looking at the results of the assessment, you need to think about:
  - Were the results due to chance?
    - Is the result statistically significantly different?
  - Are the results big enough to matter to a patient?
    - Is the result clinically significantly different?

- The result can be statistically significant, but still be too small to be of any practical significance, i.e. such a difference would be seen in quite a high percentage of the population.
Evaluation cognitive impairment – Five Psychometric principles to consider

- **Principle 1:** Low scores are common across all batteries
  - Low scores are common in healthy individuals
- **Principle 2:** Low scores depend on where you set the cutoff score
  - No universal agreement of a low score. Some have fixed definition (i.e. 1 SD below mean, <5\textsuperscript{th} percentile, 2 SD below mean); may be dependant on characteristics of examinee (i.e., average scores if previously superior)
  - Balance of sensitivity/specificity: higher cut-off scores are likely to correctly identify those who have cognitive problems, but are more likely to included those who don't
- **Principle 3:** Low scores depends on the number of tests administered
  - the more tests that are administered and scores interpreted, the more likely it is to find low scores in health adults
- **Principle 4:** Low scores may vary by demographic characteristics of the examinee
  - Demographic variables (e.g. education, ethnicity) are related to the number of low-scores when age-adjusted normative data are used
- **Principle 5:** Low scores vary by level of intelligence
  - Individuals with lower intellectual ability tend to have more low scores
Interpretation pitfalls

- The relationship between amount of information obtained and accuracy is not always positive. Once a certain amount of data is available, additional information does not seem to add any further improvement to judgement.

- When looking at differences between tests, it is important to separate reliable difference from chance. As the number of tests increases, the number of ‘significant’ results which can be expected due to chance will increase (Wedding & Faust, 1989).

- Therefore don’t assume obtaining a low test score is necessarily unusual when multiple tests are considered simultaneously.

- The likelihood of obtaining low scores, when several scores are administered and interpreted – ‘multivariate base rates’ - should be considered
Multivariate Base Rates

- Base rate refers to the prevalence of frequency of an event occurring in a given population.
- Information regarding the rarity or abnormality of test scores is fundamental in interpretation.
- When attention is limited to a single test, this information is immediately available: if an abnormally low score is defined as (for example) one that falls below the 5th percentile, then by definition 5% of the normative population is expected to obtain a score that is lower.
- However, typically in a neuropsychological assessment, many tests are administered.
- Therefore the important question is what percentage of the normative population would be expected to exhibit at least one abnormally low score out of the number of tests administered.
The number of low scores depends on the number of tests administered and interpreted.

### Batteries with varying numbers of subtests

<table>
<thead>
<tr>
<th>Test</th>
<th>Percent of low scores obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAIS-IV Short form (4 subtests)</td>
<td>20%</td>
</tr>
<tr>
<td>WAIS-IV (10 subtests)</td>
<td>40%</td>
</tr>
<tr>
<td>WAIS-IV/WMS-IV (20 subtests)</td>
<td>60%</td>
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Case vignette – James (age 44)

“I will appreciate if you can see this young gentleman with stroke due to a dissection. He has got multiple emotional problems and has difficulty concentrating, particularly when there is a lot of noise or distraction at the same time. He is able to function when he is left on his own in a quiet room without much distraction. In addition, his wife is having trouble managing him as he feels restless, agitated and on a couple of occasions he has also had outbursts without any apparent reason. He also has lost interest in everything. I have discussed this with him and he is happy to be seen by yourself. Unfortunately his wife was not present today as she is at work but would benefit from coming with him during this appointment.”

(Stroke Consultant Physician)
James - Background information

- 44 years old
- Right handed
- No pre/anti natal problems at his birth. No developmental difficulties. No previous physical or mental health difficulties. No significant family history
- Did well at school, got A-C's at O'level, despite missing some time at school due to a broken leg. A levels (Maths, Physics, Chemistry) A – C grades. University – Engineering and Physics (1st)
- Lives with wife and 13 year old daughter. Also has a 23 year old daughter.
- Had a stroke in 18 months ago. Good recovery. Initially some speech problems due to lack of movement in tongue.
- Anxiety over the cause of stroke and worried about likelihood of having another one
- Noted changes in personality – gets frustrated more easily, particularly with wife and daughter
- Returned to work, working in electronics, 5 weeks after stroke. Has managed ok, in a quiet environment and is able to focus on only one task at a time
- Some attentional and memory problems at home – i.e. forgetting conversations.
https://www.researchgate.net/profile/Daniel_Slick/publication/240999326_Psychometric_Foundations_for_the_Interpretation_of_Neuropsychological_Test_Results/links/54de3f460cf2966637855640/Psychometric-Foundations-for-the-Interpretation-of-Neuropsychological-Test-Results.pdf