What is neuropsychology?

- Study of the structure and function of the brain as they relate to specific psychological processes and behaviors.
- Clinical evaluations or scientific research.
- Goals:
  - **Diagnosis**: What damage happened to the brain?
  - **Description**: What are the cognitive, behavioral, or emotional consequences of this damage?
  - **Tracking**: Observing patient performance over time to track improvement or deterioration and effect of treatment.
Different avenues of testing

- **History Taking** – gathering medical history of a patient and his/her family. Is there a historical determinant of the behavior?

- **Interviewing** the patient and family or friends.

- **Neuropsychological testing** – to supplement anecdotal evidence, performance on standardized tests can be compared to “normal” group averages.
Advantages of Neuropsych Testing

- **Standardized:** repeatable instructions and tasks
- **Norms are available:** comparison to find out how “abnormal” test results are for someone with a given age, sex and IQ.
- **Intensive:** multiple measures for each domain allow for rich characterization of cognitive or behavioral deficits
- **Sensitivity:** Tests can be designed to be sensitive to subtle deficits as well as subtle enhanced abilities
- **Specificity:** Tests can be designed to be very domain-specific e.g. language, visuospatial skill, etc
Measuring the quality of a test

- **Receiver Operating Characteristic (ROC) Curve**
- **Higher Area Under the Curve (AUC) = better test**

![ROC Space Diagram](image)

- Perfect Classification:
  - 100% sensitivity
  - 100% specificity

- Better
- Worse

![ROC Curve Diagram](image)

ROC curve, AUC: 0.90
Issues: Reliability of Measurement

- Does the measurement procedure give the same accurate measurement EACH AND EVERY time?
- Can be thought of as measurement consistency

Types of Reliability

<table>
<thead>
<tr>
<th>INTERNAL</th>
<th>EXTERNAL</th>
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<tr>
<td>(extent to which a measure is consistent within itself.)</td>
<td>(the extent to which a measure varies from one use to another.)</td>
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<td>split-half method: measures the extent to which all parts of the test contribute equally to what is being measured.</td>
<td>test re-test: measures the stability of a test over time.</td>
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<td>Inter-rater: to the degree to which different raters give consistent estimates of the same behavior</td>
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Issues: Validity of Measurement

- Does your test assess what you actually intend it to assess?
- Validity is essentially the truthfulness of measurement.

Types of Validity

<table>
<thead>
<tr>
<th>CONTENT-RELATED (appropriate content)</th>
<th>CRITERION-RELATED (relationship to other measures)</th>
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<td>face validity: does the test appear to test what it aims to test?</td>
<td>concurrent validity: does the relate to a existing similar measure?</td>
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<td>construct validity: does the test relate to underlying theoretical concepts?</td>
<td>predictive validity: does the test predict later performance on a related criterion?</td>
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Reliability and Validity

Reliable but not valid

Valid but not reliable

Neither valid nor reliable

Both valid and reliable
Example: Learning and memory

- Rey Auditory Verbal Learning Test (RAVLT) – developed in the 1940s.

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- Now write down as many as you can remember in any order!
### Example: Learning and memory

- **Now compare your answers!**

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- **What parts of your brain do you think are involved?**
Example: Language assessment

- **Boston Naming Test** – Kaplan, Goodglass, and Weintraub 1983.
- 60 line drawings. Simple goal: name the object.
- Objects range in difficulty. A score below 45 in an adult is considered a deficit (possible anomic aphasia).
- What parts of the brain do you think are involved?
Clock Drawing Test

Instructions:

Draw a clock as a circle with all of the numbers on it.

Place the arms at 10 past 11.
Another example - moderate AD
Another example - severe AD

10 past eleven
Example: Executive functioning

- **Stroop Task** – developed by John Stroop 1935.

- Goal: name the color, **DO NOT READ** the word!

![Stroop Task Colors](image)

- Normally challenging, but near impossible if you have damage to what parts of the brain?
Example: Visuospatial abilities

- **Rey-Osterrieth Complex Figure** – Rey and Osterrieth 1941.

- Take out a piece of paper and copy this figure:

What parts of the brain do you think are involved?
Example: Visuospatial Recall
AD Patient - Immediate Recall
AD Patient - Delayed Recall
Back to Rey-O

Get another sheet of paper and reproduce the complex figure you saw previously (the one with the bowling ball), to the best of your abilities.

Are the same brain areas involved as before?
What happens with no hippocampus?
Can you pick which one of the choices at the bottom is the correct missing item?
What brain areas may be involved?
Wisconsin Card Sorting Test

Rules:
Shape
Color
Number

Sort according to unspoken rule; examiner changes the rule often. Patient only receives correct/incorrect feedback. Can patient adapt to new rule?
## How many words do you remember?

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Malingering - Faking mental disorders

- Faking a disorder or a deficit

- For legal and financial reasons - sometimes people fake a deficit in order to collect insurance payments or to fraudulently obtain narcotics.

- There are specific tests designed to catch malingering and they’re based on the fact that malingerers don’t know what real deficits look like - Often they show too much loss of function.

- E.g. hallucinations are external (i.e. not “in the head”). “I hear voices in my head” is usually a telltale sign of malingering.
Example: Test of Memory Malingering

- Examinee shown 50 line drawings (3 seconds each).

- Test is two-alternative forced-choice recognition.

- Normal adults will score ~100%

- Brain damaged patients may score anywhere between 50 and 100%

- Anyone scoring **BELOW chance (<50%)** is showing a consistent bias and is likely faking the deficit