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**

Issues: Reliability of Measurement

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

<table>
<thead>
<tr>
<th>Types of Reliability</th>
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<tr>
<td><strong>Internal</strong>: (extent to which a measure measures what it is supposed to measure)</td>
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<td><strong>Split-half</strong>: (extent to which the first half of the test correlates equally to what is being measured)</td>
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<td><strong>Stability</strong>: (extent to which a measure measures the stability of a test over time)</td>
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<td><strong>Intercorrelation</strong>: (to what extent different forms of a measure assess different attributes 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:

- Content-related: Does the test assess what it is intended to assess?
- Construct-related: Does the test measure the characteristic or trait it is supposed to measure?
- Criterion-related: Does the test predict or correlate with the criterion of interest?

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.
  
  | DRUM | PARENT | NOSE |
  | CURTAIN | MOON | TURKEY |
  | BELL | GARDEN | COLOR |
  | COFFEE | HAT | HOUSE |
  | SCHOOL | FARMER | RIVER |

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

- Now compare your answers!

  DRUM      PARENT      NOSE
  CURTAIN   MOON        TURKEY
  BELL       GARDEN    COLOR
  COFFEE     HAT        HOUSE
  SCHOOL    FARMER     RIVER

- 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

Example: Executive functioning

- Stroop Task – developed by John Stroop 1935.
- Goal: name the color, DO NOT READ the word!

- red  blue  red  blue
- green  red  green  red
- yellow  blue  yellow  blue
- red  yellow  red  yellow
- green  red  green  red
- blue  blue  blue  blue
- yellow  green  green  yellow
- red  red  red  red
- green  yellow  green  yellow

- 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?
Matrix Reasoning Test - Easy
Can you pick which one of the choices at the bottom is the correct missing item?

Matrix Reasoning Test - Moderate
What brain areas may be involved?

Wisconsin Card Sorting Test
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?

**DRUM**  **PARENT**  **NOSE**
**CURTAIN**  **MOON**  **TURKEY**
**BELL**  **GARDEN**  **COLOR**
**COFFEE**  **HAT**  **HOUSE**
**SCHOOL**  **FARMER**  **RIVER**

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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.

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**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.