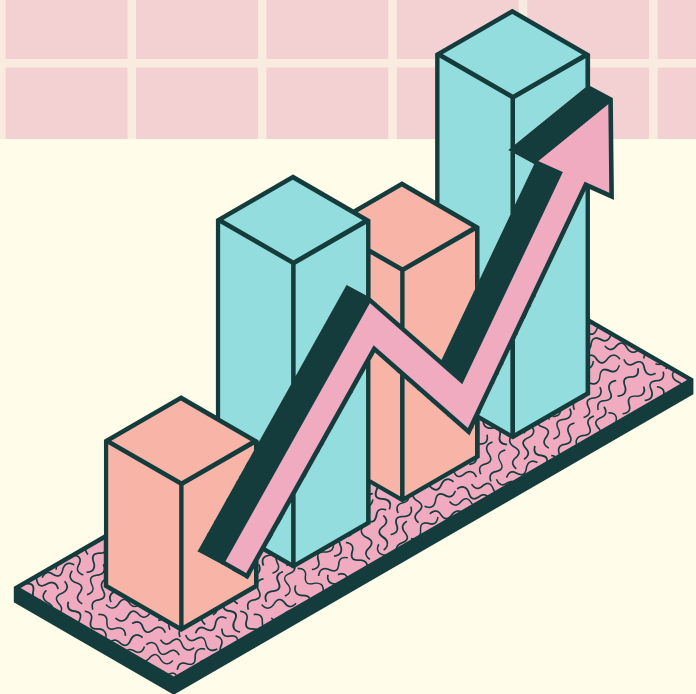
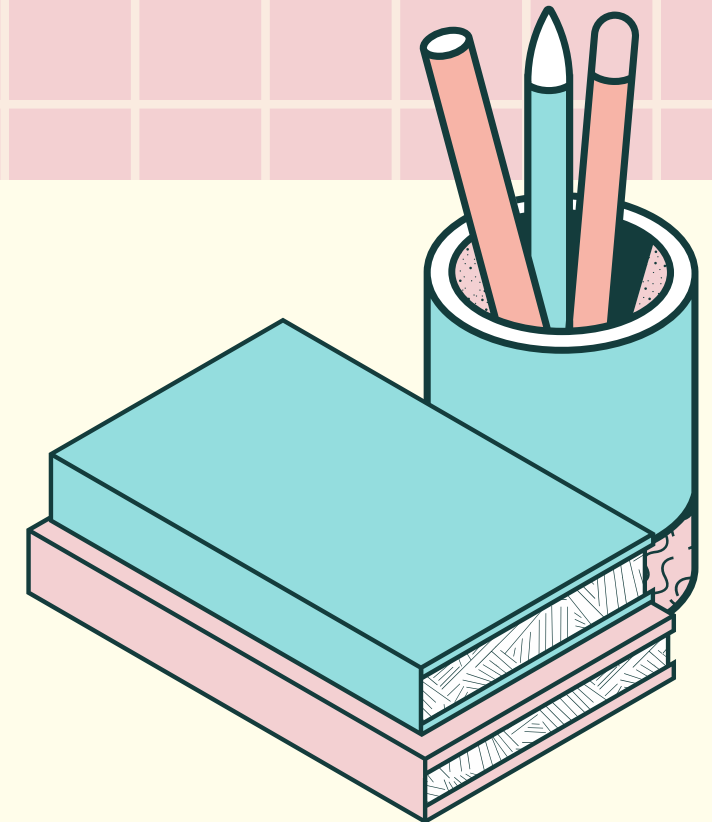


# **USING DATA VISUALIZATION TO IMPROVE ASSESSMENT FEEDBACK**



**Presentation by: Nat Baptist-Mohseni  
& Michelle Blumberg**



# TODAY'S AGENDA



- ① **Overview of Neuropsychological Assessment**
- ② **Purpose of Feedback**
- ③ **Benefits & Challenges**
- ④ **Feedback Factors**
- ⑤ **The NeuroFeedback Formula©**

# WHAT IS A NEUROPSYCHOLOGICAL ASSESSMENT?

- **Used to assess for a range of cognitive skills and mental functioning**
- **Domains commonly assessed include:**
  - **Intellectual functioning**
  - **Memory & learning**
  - **Attention & processing speed**
  - **Executive functioning**
  - **Visuospatial processing**
  - **Language**
  - **Mood & personality**



# WHAT IS A NEUROPSYCHOLOGICAL ASSESSMENT?



**Determine a diagnosis**



**Detection of cognitive change**



**Identify strengths  
& weaknesses**



**Treatment planning**



**Recommendations**

# WHO RECEIVES A NEUROPSYCHOLOGICAL ASSESSMENT?

## Children & Adolescents

- Difficulties in school
- Learning disabilities
- ODD/behavioural
- ADHD & ASD
- Brain injury

## Young & Emerging Adults

- Life transitions/difficulties with post-secondary education
- ADHD
- Anxiety, depression, etc.
- Brain injury

## Adults

- Undiagnosed mood or cognitive disorders
- Brain injury
- Early onset neurodegenerative disease

## Older Adults

- Aging & the brain
- Mild cognitive impairment
- Neurodegenerative disease
- Brain injury
- Medical-induced cognitive change

# COMPONENTS OF A NEUROPSYCHOLOGICAL ASSESSMENT

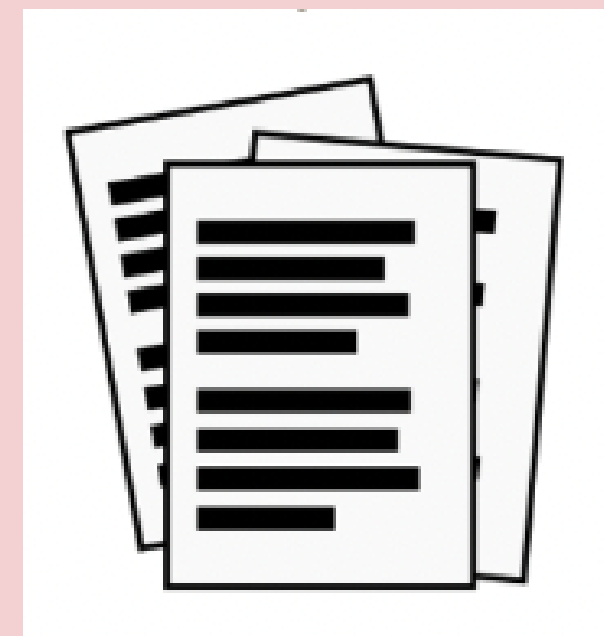
## Clinical Interview



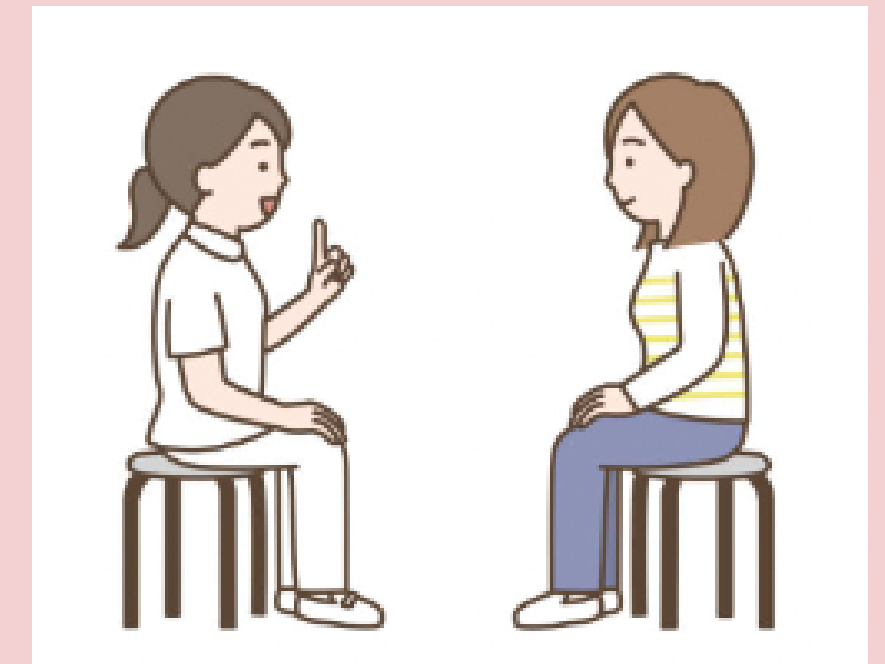
## Cognitive Testing



## Report



## Feedback



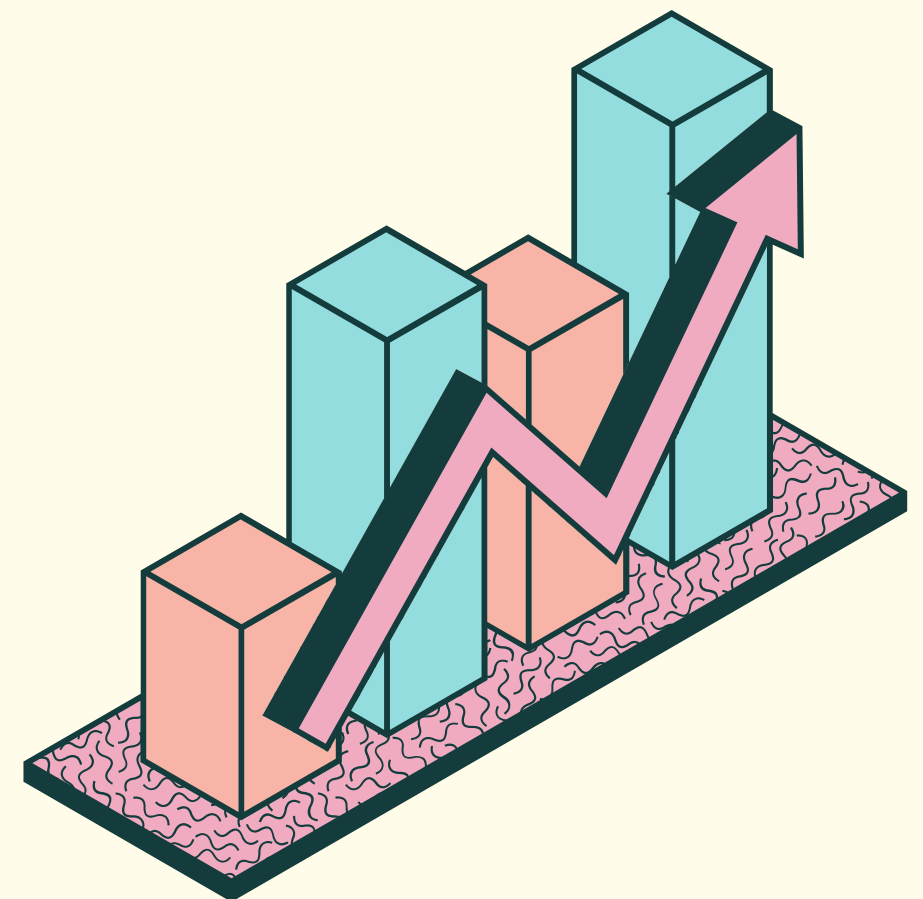
## Raw Data

- Unaltered score - how much of a test the examinee answered correctly
- Needs to be converted to depict a score relative to normative sample

## Standard Scores

- Derived from raw scores within a distribution of scores
- Describes the difference of the raw score from the sample mean, expressed in SD units
- Standard score of 100 = average

# NEUROPSYCH SCORES



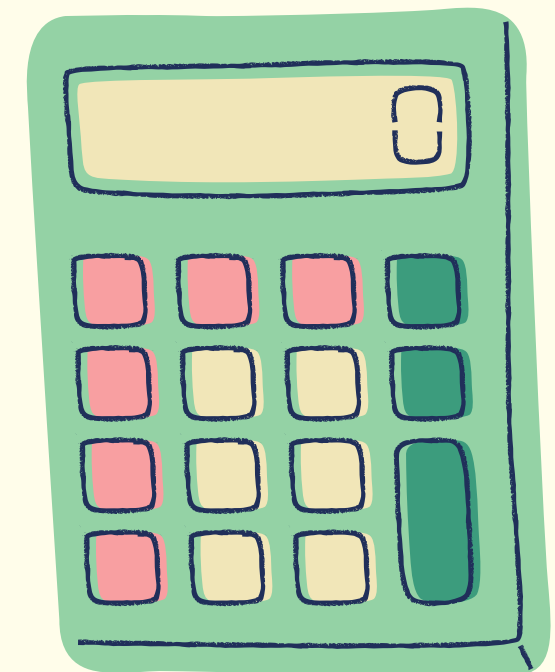
## Z Score

- Standard score
- Has a mean of zero, SD of 1
- Typically converted into percentiles for reports

## T-Score

- Another standard score
- T-score of 50 = average
- Commonly used across many tests

# NEUROPSYCH SCORES





## Percentile

- Represents percentage of scores in sample lower than obtained score
- Attached to descriptor (e.g., 'high average')

## Scaled Score

- Many tests based on scaled scores
- Indicates performance on subtest
- Range of 0-19

# NEUROPSYCH SCORES



**TODAY'S  
FOCUS:**

**FEEDBACK**



# WHAT IS FEEDBACK?



- A conversation between clinician and patient where there is communication of neuropsychological assessment results (Gruters et al., 2022)
- Goal:
  - To facilitate the understanding of results and related implications for later functioning
  - Provide support to patients and family members
  - Answer questions or concerns
- Ethical guidelines state that a psychologist must undertake a reasonable attempt to explain the results of their assessment to patients (American Psychological Association, 2017)

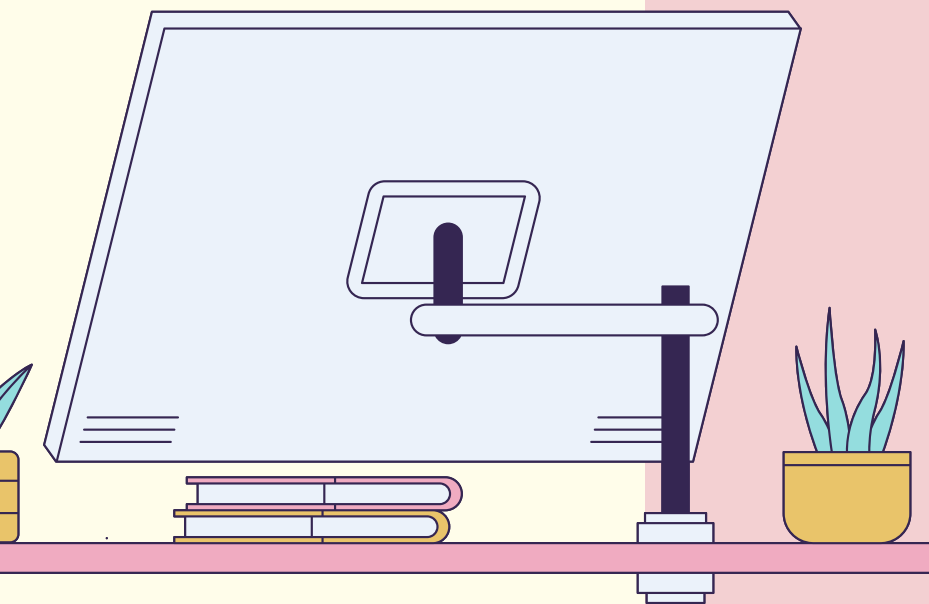
# FEEDBACK: THE CONTENT

- 1. Review of the purpose and goals for assessment (with a focus on the referral question & patient/family goals)**
- 2. Review of testing and each cognitive domain explored**
  - Speak to both strengths and weaknesses/frank impairment observed on testing**
- 3. Diagnosis if relevant and information surrounding diagnosis\***
- 4. Recommendations and relevant referrals**

*\*Timing of diagnosis communication varies depending on context, purpose of assessment and patient goals/concerns*

# FEEDBACK TODAY

- **Who**: Patient (& sometimes family members/caregivers)
- **Duration**: Typically anywhere from 30 - 90 minutes, patient-dependent
- **Delivery Format**:
  - In-person, videoconferencing
  - Information delivered verbally
  - Recommendations and a summary document are also provided
    - Summary outlines all domains (strengths & weaknesses) that were spoken about



# BENEFITS

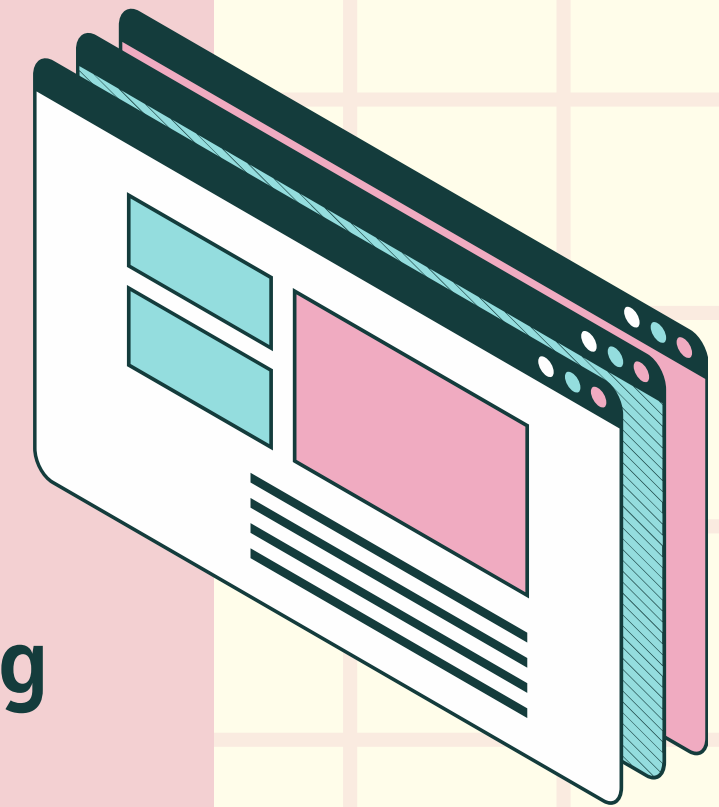
- Can foster hope
- Improves QoL
- Provides clarity within patient's referral history
- Increases recommendation adherence
- Provides clarity for family & caregivers

# CHALLENGES

- Anxiety
- Miscommunication between clinicians vs patients & family
- Low retention
- Readability & complexity (e.g., too much jargon, overcomplicating summaries, etc.)
- No standardization

**SO WHAT?**

# VISUALIZATION MEETS FEEDBACK

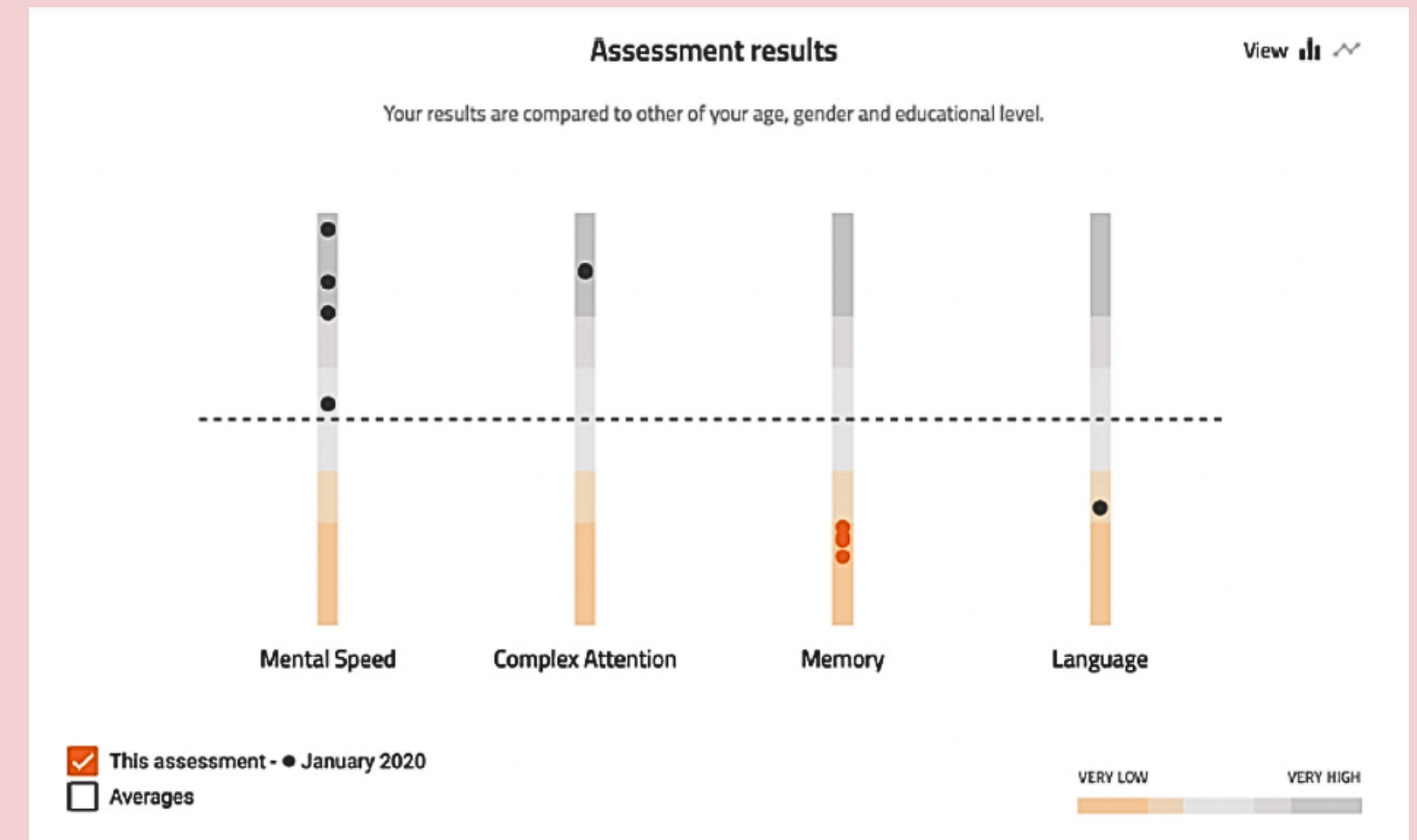


- There is evidence to suggest visual aids are effective for communicating findings across other fields in healthcare:
  - Visual aids enhance the recall of spoken medical instructions (Houts et al., 1998; 2001)
  - Visual aids improved the understanding of medical instructions, especially when a combination of written, visual, and verbal instructions were used (Katz et al., 2006)
- To our knowledge, there exists no standardized approach to using visual aids for neuropsychological feedback
  - ...and the literature is lacking



# GRUTERS ET AL., 2021

- Web-based visual tool for test results to:
  - Increase the understanding of neuropsychological performance
  - Increase information retention
  - Support communication during feedback sessions
- Visual tool was co-created with patients, family members, neuropsychological experts



## What does this mean in your daily life?

### Mental speed and complex attention

- Your mental speed is good
- You can switch your attention very well when doing multiple things

### Memory

- Learning new information costs a lot of effort
- Repeating information is less helpful

### Tips

- Use figures as a memory aid
- Write things down

# GENERAL FEEDBACK LIMITATIONS

**1**

**No evidence of retention improving**

**2**

**No follow-up of effectiveness of tool**

# **TOOL STRENGTHS & LIMITATIONS**

**1**

**Visualization too complex in some cases**

**2**

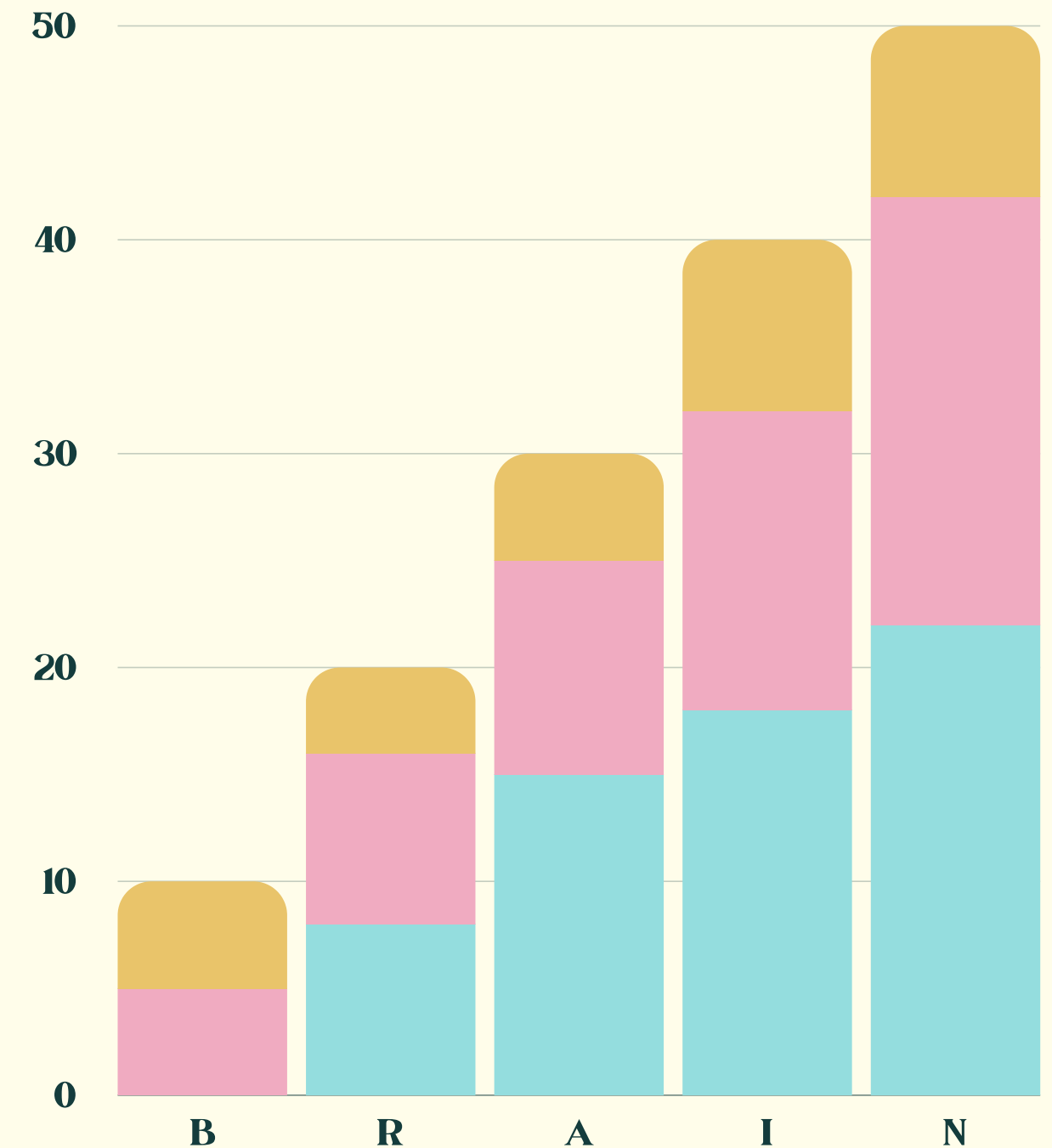
**Want to simplify the summary**

**3**

**Great recommendations to supplement  
visualization**

# OUR AIM

1. Create an accessible visualization of cognitive results to supplement the feedback process
2. Create separate patient/family member & clinician visualizations
3. Incorporate:
  - a. Cultural considerations
  - b. Accessibility
  - c. Diagnosis complexity



# **CULTURAL DIVERSITY CONSIDERATIONS**

- **English as a second language**
- **Use of translators/adaptions to explanations**
- **Adaptive testing measures**
- **Perceptions of testing and diagnostic processes**

# ACCESSIBILITY

- **Vision and hearing**
- **Intellectual disorders**
- **Cognitive decline (e.g., neurodegenerative patients)**

# DIAGNOSIS

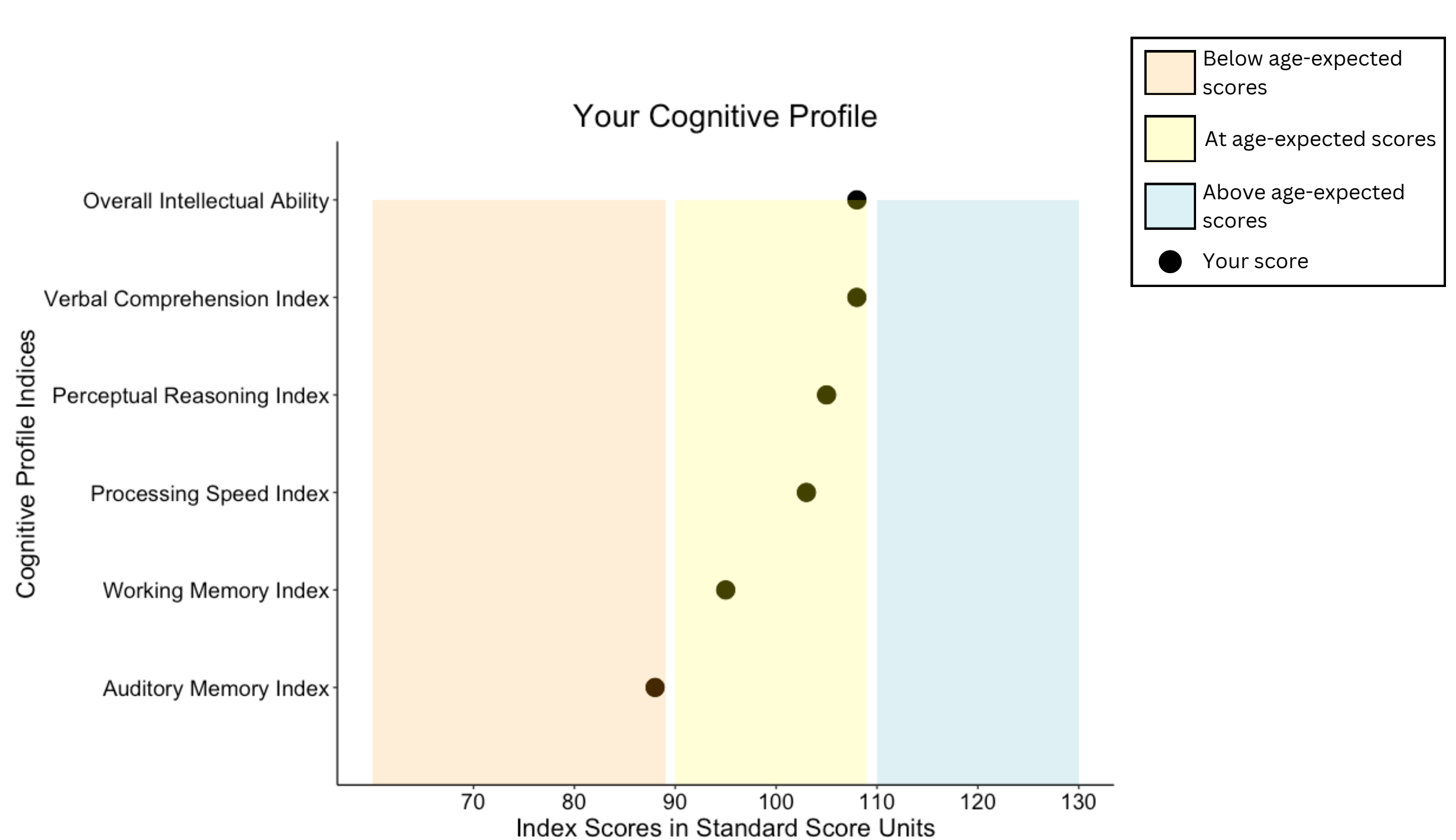
- **Not one-size-fits-all**
- **Comorbidity**
- **Symptomology (influence on feedback process, e.g., memory loss)**

**OUR TOOL**

**The NeuroFeedback Formula ©**



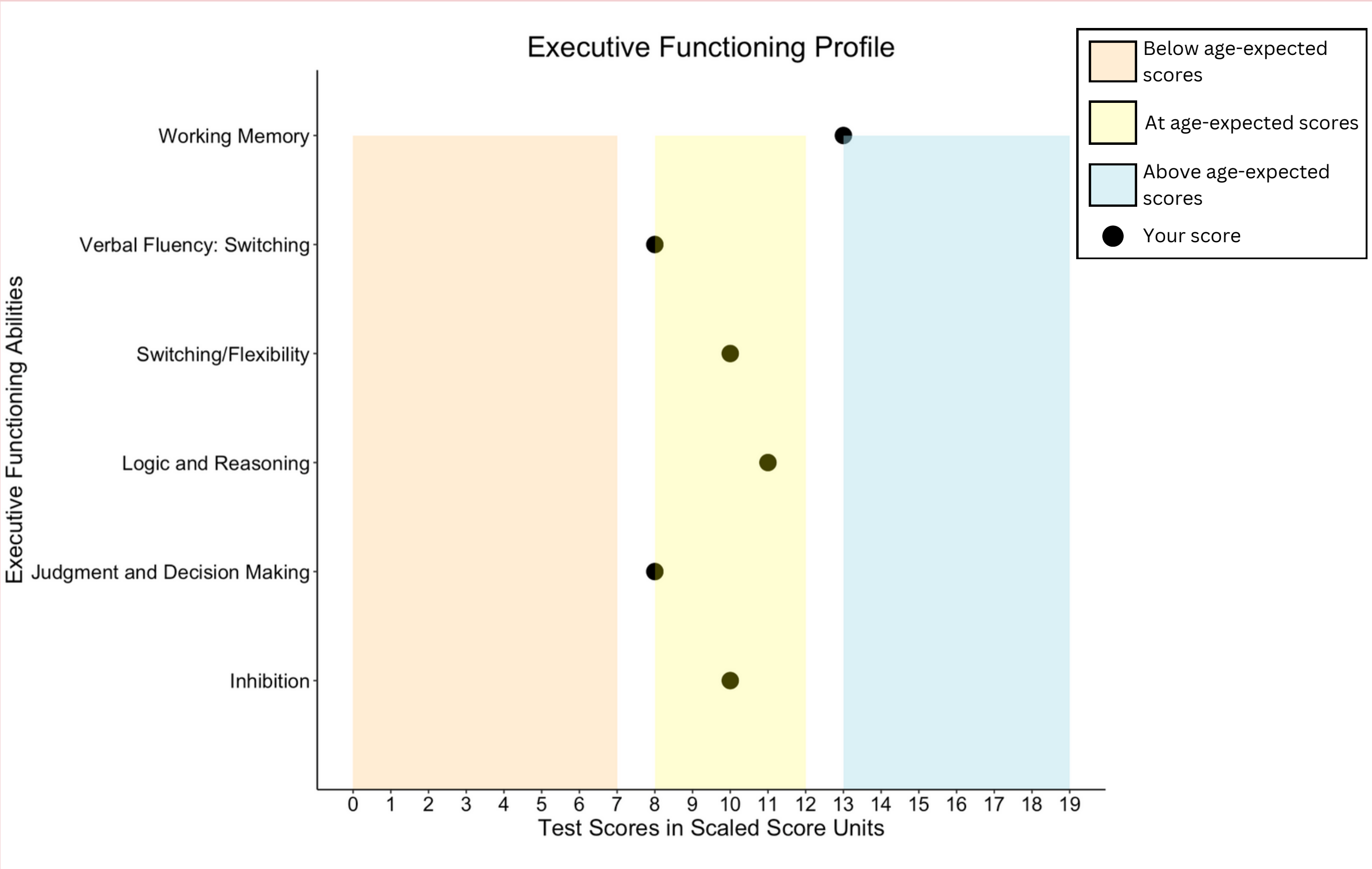
# THE CASE OF E.L.



## Considerations:

- Vision: E.L. is colour-blind, so red and green are avoided
- A legend is provided for orientation & guidance
- They are fluent in English and general intellectual functioning is high average, so original terms are maintained
- Auditory memory is below expectations for age, and so it is important to have a written summary attached to this visual profile

# THE CASE OF K.G.



### What does this mean?

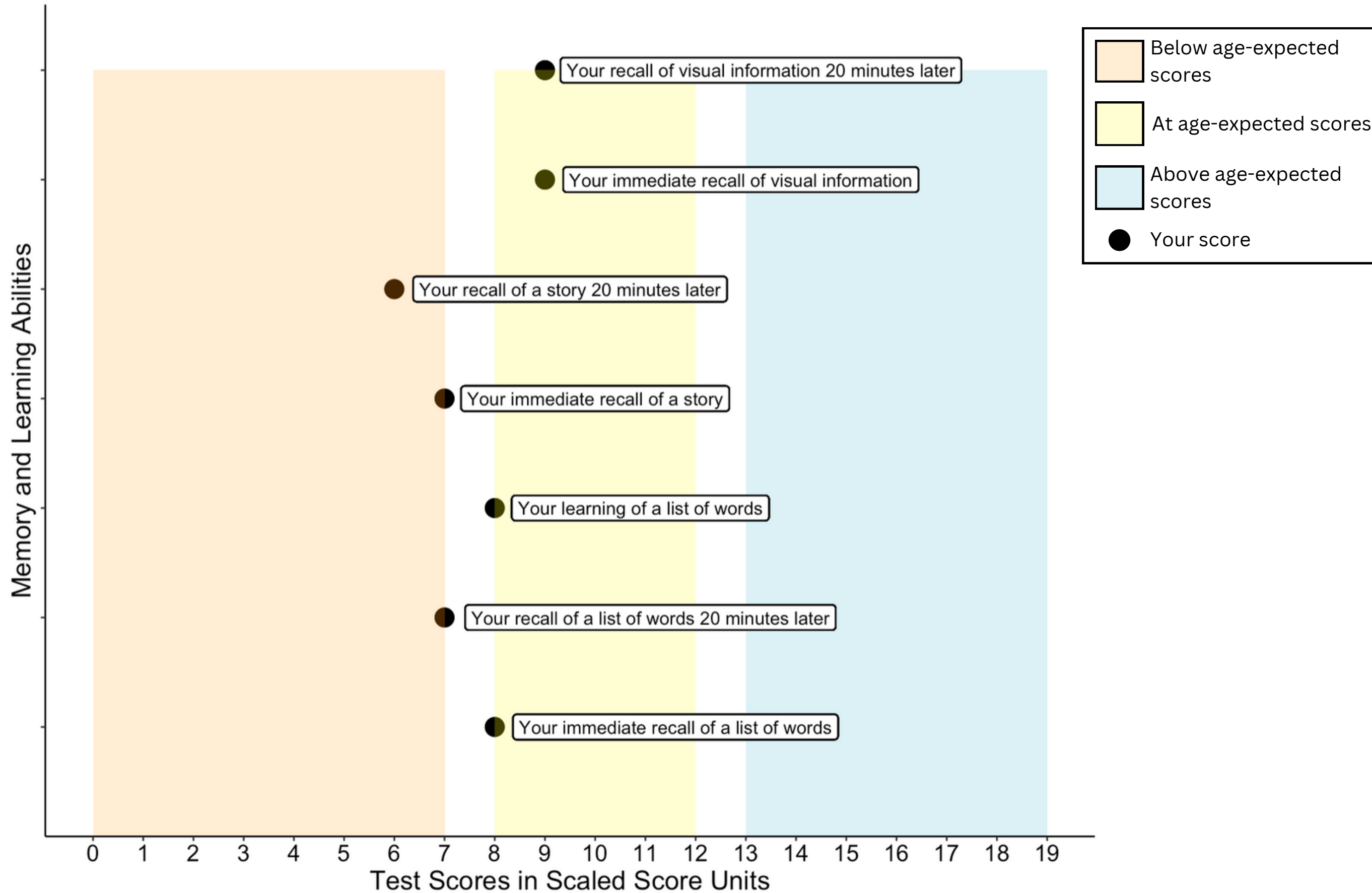
- You are able to multi-task without difficulties
- You are able to use judgement and reasoning to make decisions or problem solve, but may make some mistakes while doing so
- You are able to manage or stop inherent or prepotent responses to complete other goals
- You are strong in your ability to keep track of information mentally

### Tips & Tricks!

- It may be extra helpful to minimize distractions while trying to complete tasks
- If you run into trouble with problem solving, try referring to external resources (e.g., a family member) or by recording your thought process

# THE CASE OF R.A.

## Memory and Learning Profile



### What does this mean?

- You are generally able to encode (or take in) new verbal or visual information
- You may have some trouble retrieving learned information from your memory after some time has passed
- Repeating information is not the most helpful for your memory


### Tips & Tricks!

- Record or write down information so you can refer to it later
- Elaborating on information by making it meaningful to you may help with remembering it later

# QUALITY ASSURANCE

## Examples:

1. I understand my assessment results
2. I have unanswered questions about my results
3. It is easy to understand my cognitive profiles

| Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree  |
|-------------------|----------|---------|-------|---|
| 1                 | 2        | 3       | 4     | 5  |

# FUTURE DIRECTIONS

1. Hire a data scientist/engineer/quant student to create a machine learning version of the NeuroFeedback Formula ©
2. Hire translators
3. Include an audiovisual version to account for visual considerations (e.g., individuals with vision difficulties)



**QUESTIONS?**

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