Language and Working Memory Token Test

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Introduction

- **Working memory supports language processing** in complex ways[1,2]
- **Language knowledge** in long-term memory **impacts language performance**[3]
- **Working memory and language processing are separable**[4,5] but **correlated** [6,7]
- To **understand their relationship**, we need to **investigate** the **effects of working memory** and **language knowledge on language performance**
- One **promising tool** addressing this relationship is **Modified Shortened Token Test**[1] **based on Shortened Token Test**[8]

Aim

- Addressing the limitations of the previous tests by **creating a systematic assessment tool, the Language and Working Memory Token Test (LWMTT)** to:

a) **Ensure** that there was **a variety of semantic** and **syntactic structures**
b) **Create additional subtests** to provide **better estimates of working memory** and **linguistic abilities**

Methods

- **Potential colors, shapes, size, shades, and action words based on:**
  - Age of acquisition (AoA)[9]
  - word frequency and
  - concreteness of words[10]
- **Grammatical structure analysis based on:**
  - Sentence clausal structure, function, sentence developmental level, and AoA of the grammatical structures embedded in the sentences were determined
- **Foil design randomly placed based on:**
  - Command, the size, color, shade and position of the foils were determined, and target tokens were placed

Methods

The **LWMTT** was designed **systematically to impose increasing loads on working memory** or **language processing**. This systematic assessment tool **could help to assess potential working memory and language demand**.

Result: LWMTT

- **Online test:** 120 items
- **Visual aspect:**
  - **6 shapes:** Square, circle, triangle, rectangle, diamond, star
  - **2 Sizes:** Small, large
  - **6 Colors**: Yellow, red, green, black, blue, white
- **Parts:**
  - **Working memory section: 7 subtest** – varying in length
  - **Linguistic abilities section: 8 subtests** – varying in linguistic complexity
- **Commands are audio recorded** and available by clicking on the speaker button
- It would take approximately **30 minutes to complete LWMTT**

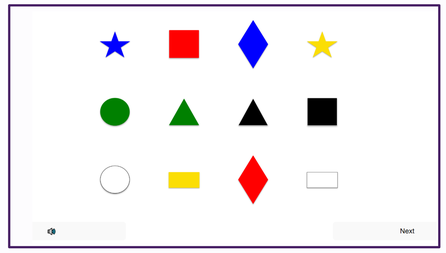

Figure 1. Language and Working Memory Token Test (Subtest 1 – Item 3)

Result: Table.1 - Summary of Working Memory Section

Select	Sentence Function	Elements Involved	Example of a command in the Subtest	N of Words	N of Items
1	Imperative/ Simple S	Object	Click a circle. (1 shape)	3	8
2	Imperative/ Simple S	Color + object	Click the blue circle. (1 shape)	4	8
3	Imperative/ Simple S	Size + Color + object	Click the large black triangle. (1 shape)	5	8
4	Imperative/ Simple S	Color + object + conjunction	Click the white star and the yellow rectangle. (2 shapes)	8	8
5	Imperative/ Simple S	Shade + Color + Object + conjunction	Move the dark green circle and the light red square. (2 shapes)	10	8
6	Imperative/ Simple S	Size + shade + color + object + conjunction	Click the small dark red rectangle and the large light blue triangle. (2 shapes)	12	8
7	Imperative/ Simple S	Size + shade + color + object + conjunction	Click the small dark yellow square, the large dark yellow triangle and the large light green circle. (3 shapes)	17	8

Result: Table.1 - Summary of Working Memory Section

Select	Sentence Function	Elements Involved	Example of a command in the Subtest	N of Words	N of Items
8	Imperative/ Simple S General Spatial prepositional	Color + object + preposition	Move the black circle near the red square. (2 shapes)	8	8
9	Imperative/ Compound S	Object + conjunction	Click a rectangle and move a circle. (2 shapes)	7	8
10	Imperative/ Complex S (Relative clause "that")	Object + preposition	Click the diamond that is far from the circle. (2 shapes)	9	8
11	Imperative/ Complex S (subordinate conjunction clause with omission of contractible copula)	Object + conjunction	Move a circle, before clicking a diamond. (2 shapes)	7	8
12	Imperative/ Complex S Conditional (Present Perfect)	Object + conjunction	After you have clicked a diamond, move a circle. (2 shapes)	9	8
13	Imperative/ Complex S Conditional (Passive structure)	Object + preposition + conjunction	If a diamond is located far from a star, click a square. (3 shapes)	12	8
14	Imperative/ Compound – Complex Conditional	Object + preposition + conjunction	If a circle is far from a diamond and a star is beside a circle, click a square. (5 shapes)	18	
15	Imperative/ Compound – Complex Conditional (Passive structure)	Object + preposition + conjunction	If a diamond is placed next to a square, click a circle and move a star. (4 shapes)	16	8

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