Are children performing better on the digit span backward than forward task? An exploratory analysis

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Introduction

- Memory span is the longest number of items that can be accurately recall
  - Digit span forward (DSF) task: short-term memory measure[1]
    - immediate repetition of digits in serial order
  - Digit span backward (DSB) task: working memory measure[1]
    - immediate repetition of digits in reverse order
- Expected span length: DSF > DSB
- But, the reverse is sometimes observed in individual children
  - e.g., Community SLPs reporting on percentile ranks observed for the Test of Integrated Language and Literacy Skills (TILLS)[3]:

	Case 1	Case 2
DSF	1	6
DSB	42	54

Research Questions:

1) **Could psychometric properties of the digit span subtests account for the observed pattern of performance?**
2) **Do higher scores on the DSB than DSF subtest occur with regularity**
3) **How do these patterns map onto span length?**

Methods

Participants: TILLS normative sample*. 1258 participants, ages 6 to 14yrs

Procedure: TILLS digit span tests: Child immediately repeats presented digit list. Two or 3 trials per list length. Continues until the child incorrectly recalls all lists at a given length

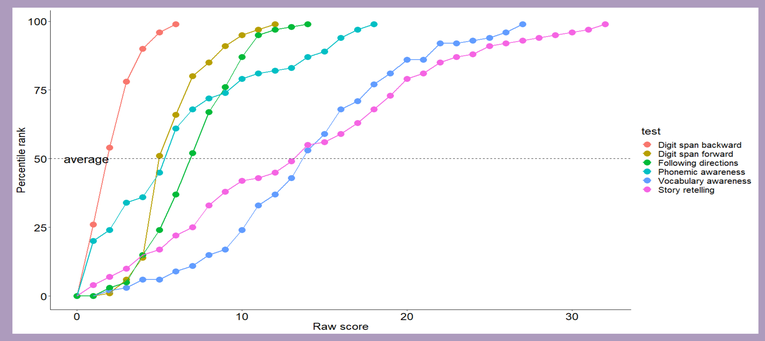
- DSF:
  - Start: 3 digits (6-8yrs) or 4 digits (9+yrs)
  - Max: 8 items
- DSB (backwards recall):
  - Start: 3 digits (6-14yrs) or 4 digits (15+yrs)
  - Max: 7 items

*We thank the authors of the TILLS for providing the normative sample.

Results

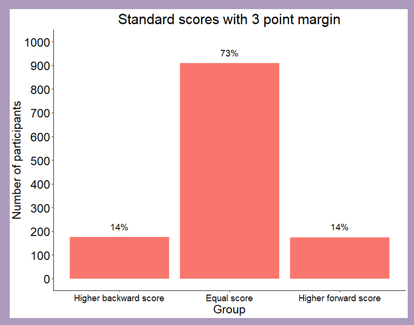
1) Psychometric properties

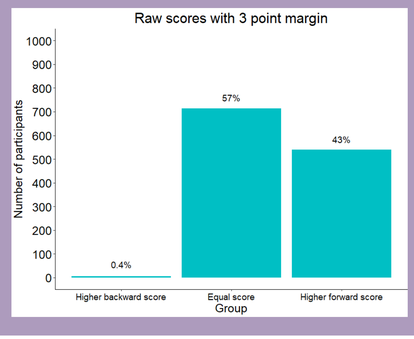
- Fewer total items in the digit span subtests (n = 15) than other TILLS subtests (n ≥ 20; Social Communication has 13 items)
- Less items, more sparsely estimated percentiles
  - A small difference in raw scores = large difference in percentile ranks



2) Subgroup

- Compared DSF & DSB scores for individuals. Examined prevalence of (1) no substantive difference; (2) higher DSF; (3) higher DSB





3) Span length

- We were able to estimate span length for 70 participants
- For 20 participants only, raw score, standard score, *and* percentile rank indicated better performance on the DSB than DSF subtest
- For 17 of those participants, DSF span length was still longer than DSB

Conclusion

- Is this a statistical phenomenon?
  Yes. Perception of DSB > DSF reflects scoring metrics
- Is it common?
  No. Majority of children had Equal score
- Does a "better" DSB = longer span?
  No. DSF span is still longer
  - For example, a 6-year-old with a standard socre of 10 on both tests,
    - DSF: span length of 5 > DSB: span length of 3

Future Directions and Implications

- Clinicians should avoid overinterpreting the data
- Connections between digit span tasks and measures of language

References
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Disclosure Statement: Authors #1 and 2, no conflict of interest

Presented at SRCLD, June 2021