PROCEDURAL LEARNING IN THE SRTT: SENSITIVITY TO GROUP LEVEL AND INDIVIDUAL DIFFERENCES IN LANGUAGE AND LITERACY

Cátia M. Oliveira, Marianna E. Hayiou-Thomas, Lisa Henderson

University of York

INTRODUCTION

The Procedural Deficit Hypothesis proposes an underlying impairment in the procedural memory system in Dyslexia and Development Language Disorder (DLD) (Ullman et al., 2020).

The Serial Reaction Time task (SRTT) has been used to test this hypothesis; however, findings have been inconsistent, and the reliability of this task has been questioned (West et al., 2018; 2020).

AIMS

1. Compare the performance of the neurotypical and dyslexic groups on the SRTT (empirical study);
2. Examine the stability of procedural learning in the SRTT in neurotypical and dyslexic adults (empirical study);
3. Explore the relationship between procedural learning and language, literacy and attention skills in neurotypical and individuals with dyslexic or DLD (meta-analysis and empirical study);

METHODS

Serial Reaction Time task

- Response time task with an underlying pattern unknown to the participants, 90% of the trials follow sequence A (probable trials) and 10% follow sequence B (improbable trials) (figure 2)
- Procedural learning = Improbable trials – Probable trials

sequence A (90%): 314324213412
sequence B (10%): 431241321423

Figure 1.

Figure 2.

Empirical study

- 62 adults with dyslexia and 56 neurotypical adults with ages between 18 to 35 years old;
- SRTT was measured at 3 time points, one week apart;

Meta-analysis

- 2396 participants from 39 independent studies;
- Participants' ages ranged between 5.2 and 27.7 years, M = 12.69, SD = 5.64;

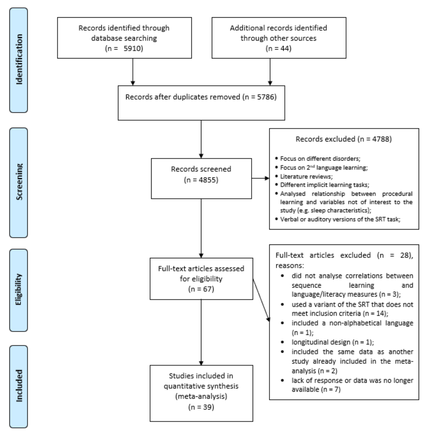

Figure 3.

LIMITED EVIDENCE OF AN ASSOCIATION BETWEEN LANGUAGE, LITERACY AND PROCEDURAL LEARNING ACROSS TYPICAL AND ATYPICAL DEVELOPMENT

@CatiaMOliveira
@L_M_Henderson

cmfo500@york.ac.uk
Lisa-marie.Henderson@york.ac.uk
Emma.hayiou-thomas@York.ac.uk

REFERENCES

Ullman, M. T., Earle, F. S., Walenski, M., & Janacsek, K. (2020). The Neurocognition of Developmental Disorders of Language. *Annual Review of Psychology*, *71*(1), 389–417.

West, G., Shanks, D. R., & Hulme, C. (2020). Sustained Attention, Not Procedural Learning, is a Predictor of Reading, Language and Arithmetic Skills in Children. Scientific Studies of Reading, 00(00), 1–17.

RESULTS

1. Empirical study

Are there group-level differences in procedural learning between adults with and without dyslexia?

- Both TD and dyslexic participants show evidence of procedural learning on all sessions of the three experiments(Improbable RTs > Probable RTs) (Figure 3);
- Split-half reliability varies between low and adequate (.25 – .79) depending on the session (higher on session 3) and higher than across session reliability;
- Test-retest reliability of the SRT task is suboptimal for both groups and all sessions (-.02 – .34)

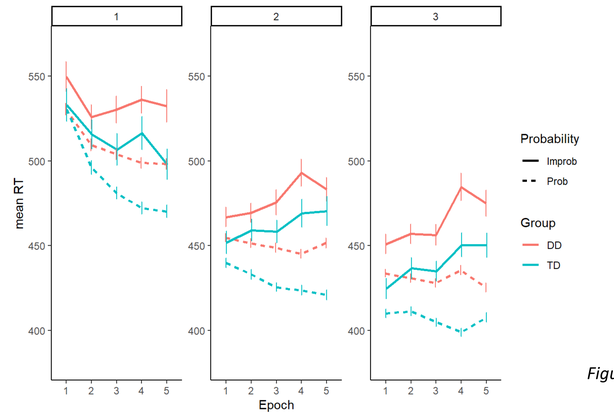

Figure 3.

Individual differences

TD group:
- No sig correlations with any measures of language or literacy;
- Sig association between procedural learning and attention (rs = .34 – .47);

Dyslexic group:
- Sig association between procedural learning and nonword repetition (r = .31) and attention (r = .35);

2. Meta-analysis

- No correlations between procedural learning and language/literacy abilities for any of the groups (ps < .05);
- No difference in the correlations between TD and DLD groups for phonology, grammar (ps < .05) nor between TD and Dyslexic groups for phonology, reading and spelling (ps < .05);

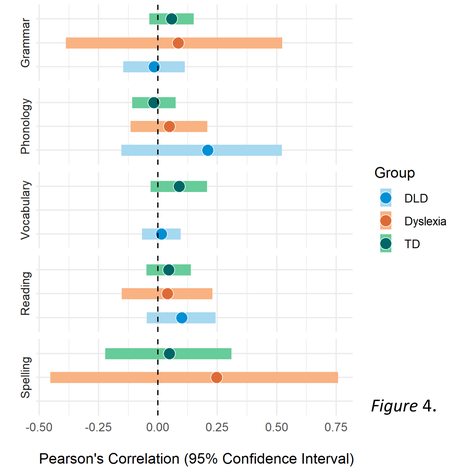

Figure 4.

DISCUSSION

- No support for the Procedural Deficit hypothesis as there were no group differences in procedural learning;
- Only partial support for the Procedural/Declarative model (Ullman et al., 2020) at the individual differences level as no, or small, correlations with language/literacy measures were observed (and these were not consistent across sessions);
- Replicated association between attention and procedural learning (Oliveira et al., 2022);
- The reliability of the SRTT fails to meet psychometric standards (r > .70) in typical and atypical populations;

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