

Relationship between serial order short-term memory and reading skills : Evidence from a study with dyslexic children

Martinez Perez Treacy ^{ab}, Majerus Steve ^{ab}, Poncelet Martine ^a

^a Fund of Scientific Research FNRS, Belgium ^b University of Liege, Belgium

Introduction

Reading has been linked to verbal short-term memory (STM) capacity. However, the nature of this relationship remains controversial, since verbal STM, like reading, depends upon the complexity of underlying phonological processes. To further our understanding of this relationship, the present study explored the nature of the STM deficits in dyslexic children by using the distinction of item and serial order information in STM.

In typical verbal STM tasks, such as word span, the phonological and lexico-semantic characteristics of the items of the memory list (item information) as well as the sequential order in which the items are presented (serial order information) have to be stored. According to recent STM models (Burgess & Hitch, 1999; Majerus & D'Argembeau, 2011), retention of verbal item information depends directly upon the quality of underlying phonological and semantic representations. On the other hand, retention of **serial order** information appears to reflect a **language-independent** system.

Hence, if there is a fundamental STM deficit in dyslexia which is not to be explained by the poor phonological abilities that characterize dyslexia, then difficulties in serial order STM should be observed in dyslexic children, in addition to item STM impairment.

Aim

Do dyslexic children present with specific difficulties for STM for serial order information ?

Method

Participants

22 dyslexic children (D)

- Mean age : 10.2 years
- Diagnosis of dyslexia
- Reading age : at least 18 months below their chronological age (Alouette)
- Phonological processing impairment (phonological awareness, RAN)

22 CA control children (CA)

- Matched on age, gender, nonverbal reasoning and receptive vocabulary
- No history of dyslexia
- Age-appropriate reading scores

22 RA control children (RA)

- Matched on gender and reading age (Alouette)
- No history of dyslexia
- Age-appropriate reading scores

Materials

Verbal STM for item information

- 30 monosyllabic nonwords
- Single nonword delayed repetition

«mab»
 The child repeats the nonword and counts in steps of 2 (during 6 s) mab...2...4...6...8...10...
 Response (recall nonword) mab

Verbal STM for serial order information

- Auditory lists of animal names (3 to 7 items) – 4 trials per length

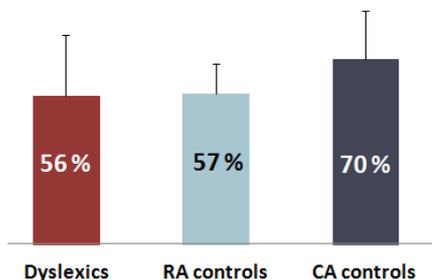
«cat – bear – lion»
 The child receives the cards
 Response (Recall order)

Results

Verbal STM for item information

Group effect - $F(2,63)=4.05, p<.05$
 $D = RA < CA$

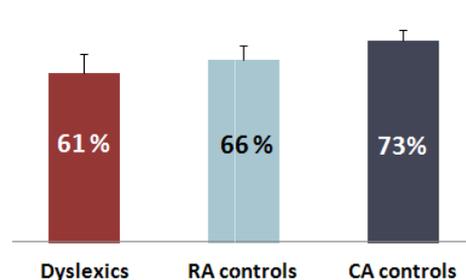
ANCOVA (covariate = STM for serial order) : same results



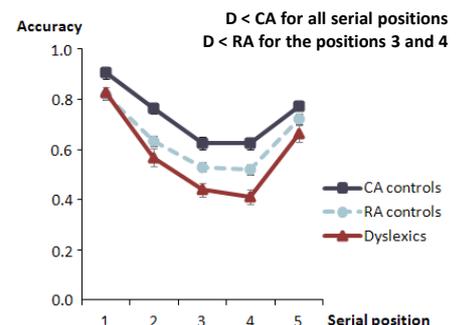
Verbal STM for serial order information

Group effect - $F(2,63)=28.5, p<.001$
 $D < RA < CA$

ANCOVA (covariate = STM for item) : same results



Group effect - $F(2,63)=23.4, p<.001$
 Serial position effect - $F(4,252)=136.7, p<.001$
 Interaction effect - $F(8,252)=2.5, p<.05$



Discussion

These results highlight a severe impairment of STM for serial order information in dyslexia which is not a consequence of poor phonological processes.

A recent study showed that serial order STM capacity measured in children at kindergarten age is a robust and independent predictor of reading decoding abilities one year later (Martinez Perez, Majerus, & Poncelet, 2012). In relationship with the functional role of order STM in the acquisition of long-term oral lexical representations (Gupta, 2003), the STM for serial order could also be involved in the acquisition of long-term orthographic representations.

19th Annual Meeting
 Society for the
 Scientific Study of
 Reading

Montreal
 July 11-14 2012

CORRESPONDING AUTHOR

Martinez Perez Treacy
 University of Liege - Department of Psychology
 B33, Boulevard du Rectorat 3
 4000 Liege - Belgium
 Email address : Treacy.MartinezPerez@ulg.ac.be

Burgess, N., & Hitch, G. (1999). Memory for serial order: A network model of the phonological loop and its timing. *Psychological Review*, 106(3), 551-581.
 Gupta, P. (2003). Examining the relationship between word learning, nonword repetition, and immediate serial recall in adults. *Quarterly Journal of Experimental Psychology: Human Experimental Psychology*, 56A, 1213-1236.
 Majerus, S., & D'Argembeau, A. (2011). Verbal short-term memory reflects the organization of long-term memory: Further evidence from short-term memory for emotional words. *Journal of Memory and Language*, 64(2), 181-197.
 Martinez Perez, T., Majerus, S., & Poncelet, M. (2012). The contribution of short-term memory for serial order to early reading acquisition: Evidence from a longitudinal study *Journal of Experimental Child Psychology*, 111, 708-723