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

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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 lexicosemantic 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

Verbal STM for serial order information
- Auditory lists of animal names (3 to 7 items) – 4 trials per length

Results

Verbal STM for item information

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

Verbal STM for serial order information

Group effect - F(2,63)=23.4, p<.001
D < RA for the positions 3 and 4

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.


