

The predictors of reading skills: phonological abilities and verbal short-term memory for serial order

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Introduction

The relationships between verbal short-term memory (STM), phonological awareness and rapid naming, which all have been linked to reading skills, remain unclear. Some authors argued that a common phonological factor underlies these three abilities (e.g., Snowling, 2000) while others suggested that verbal STM capacities predict reading abilities independently of a phonological processing factor (e.g., McDougall, Hulme, Ellis, & Monk, 1994).

The present study used the distinction between item and serial order STM capacities to better understand the associations between verbal STM, phonological processes and reading acquisition. According to recent STM models (Burgess & Hitch, 1999; Majerus & D'Argembeau, 2011), item STM requires access to underlying phonological and semantic representations while STM for serial order reflects a language-independent system.

Methodology

Participants

N = 127 children

- Mean age : 9.6 years old
- Recruited in fourth-grade classrooms
- Native French speakers
- Nonverbal IQ (Raven's Colored Progressive Matrices) and receptive vocabulary (EVIP) at or above 85
- Age-appropriate reading scores (Alouette-R)

Material

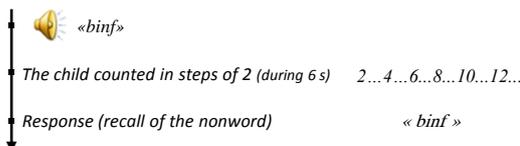
Nonword reading (30 items)

Rapid Automatized Naming (RAN) of objects

Phonological awareness (phoneme blending task of the BELEC battery)

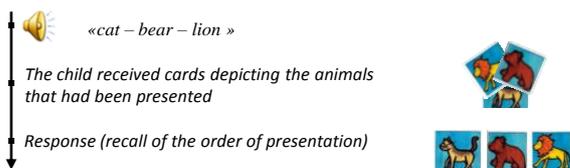
Item STM

- 30 monosyllabic nonwords
- Single nonword delayed repetition



Serial order STM

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



Aim

Is verbal STM for serial order a specific and independent predictor of reading skills ?

Results

1. Partial correlations (vocabulary knowledge and nonverbal intelligence partialled out)

	1.	2.	3.	4.
1. RAN	–	-.09	-.22*	-.06
2. Phonological awareness		–	.32***	-.04
3. Item STM			–	.18*
4. Serial order STM				–

2. Factor loadings for explanatory analysis with varimax rotation

	Factor 1	Factor 2
RAN	-0.48	0.20
Phonological awareness	0.76	0.35
Item STM	0.77	-0.24
Serial order STM	0.11	-0.91

Item STM task taps phonological processes while order STM was a capacity independent from phonological processes

3. Unique contribution in accounting for nonword reading accuracy

	ΔR^2	β
EVIP	.020	.16
RCPM	.000	-.00
Phonological awareness	.014	.13
Item STM	.080	.30***
Serial order STM	.055	.23**

Order STM predicted reading skills independently of item STM and phonological measures

* $p < .05$ ** $p < .01$ *** $p < .001$

Discussion

The distinction between item and serial order STM capacities allows us to reconcile the mixed findings that have been reported in the past concerning the relationship between verbal STM and reading skills. The present study shows that order STM is a capacity independent from phonological processes and is a specific determinant of decoding reading skills in fourth-grade children. At the same time, the present study shows that item STM task taps phonological processes, and hence the association between item STM measures and reading development is explained to a large extent by the common reliance on phonological processes.

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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.
 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.
 McDougall, S., Hulme, C., Ellis, A., & Monk, A. (1994). Learning to read: The role of short-term memory and phonological skills. *Journal of Experimental Child Psychology*, 58(1), 112-133.
 Snowling, M. (2000). *Dyslexia*, 2nd ed. Oxford: Blackwell Publishing.