

SPECIFIC CONTRIBUTION OF SHORT-TERM MEMORY FOR SERIAL ORDER INFORMATION TO EARLY READING ACQUISITION: A LONGITUDINAL STUDY

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

^aFund of Scientific Research FNRS, Belgium ^bUniversity of Liège, Belgium

INTRODUCTION

Early reading acquisition skills have been linked to verbal short-term memory (STM) capacity (Gathercole et al., 1993). However, the nature of this relationship remains controversial, since STM, like reading acquisition, depends upon the complexity of underlying phonological representations.

In typical STM tasks, such as digit span, the participant has to store at the same time the identity of items (« item » information, which has been shown to depend on the quality of underlying phonological representations) and their order of presentation (« serial order » information). Retention of serial order information is a fundamental aspect of STM and has been shown to be independent of the quality of phonological representations (Majerus et al., 2006).

If there is a fundamental association between reading development and STM capacity, than we should be able to observe an independent association between reading development and order STM capacity.

METHODOLOGY

Participants

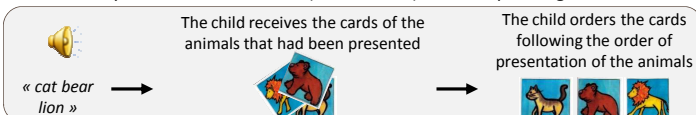
- 50 pre-readers (mean age : 5.8 years)
- Native monolingual French speakers
- No history of oral and speech motor difficulties

Procedure

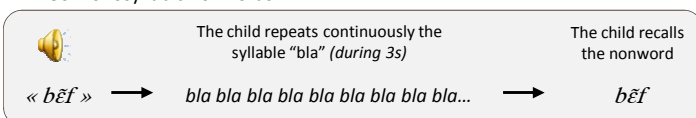
- Longitudinal design : kindergarten (T1) – 1st grade (T2)

Tasks at T1

- Vocabulary (EVIP, a French adaptation of the PPVT)
- Nonverbal intelligence (Raven's Colored Progressive Matrices)
- Pre-reading level (Letter knowledge)
- Phonological awareness task
- RAN object task
- Order STM task
 - Serial order reconstruction task
 - Auditory lists of animal names (2 to 7 items) - 6 trials per length



- Item STM task
 - Single nonword delayed repetition
 - 30 monosyllabic nonwords



Tasks at T2

- Nonword reading task

RESULTS

Which of the two STM measures and the phonological awareness measure at T1 is the strongest predictor of nonword reading performance at T2 ?

T1	T2- Nonword reading	
	β	p
Phonological awareness	.28	<.05
Item STM	.20	ns
Order STM	.28	<.05

Do phonological awareness and order STM measures still account for independent variance in reading abilities when we control for nonverbal intelligence, vocabulary and letter knowledge ?

T1	T2- Nonword reading			
	ΔR^2	B	SE B	β
1. Nonverbal intelligence	.07	1.0	.54	.27
2. Vocabulary	.00	.07	.19	.59
3. Pre-reading level	.05	8.9	5.0	.24
4. Phonological awareness	.08	.15	.06	.32*
5. Order STM	.08	.43	.18	.32*
4. Order STM	.09	.45	.19	.33*
5. Phonological awareness	.08	.15	.06	.31*

DISCUSSION

The present results not only confirm that phonological awareness is a strong predictor of reading, as already shown by many previous studies, but they further highlight the specific role of STM for order in reading acquisition.

To become an expert reader, children must first develop the decoding reading procedure, and only after, they will progressively develop the lexical reading procedure. We hypothesize that order STM is most specifically required during the decoding reading process.

The distinction between short-term storage for item and order information could also be essential in order to understand the well-documented verbal STM impairment in dyslexia.

Address for correspondence : Martinez Perez Trecy
University of Liège - Departement of Cognitives Sciences
B33, Boulevard du Rectorat 3 - 4000 Liège - Belgium
Email : Trecy.MartinezPerez@ulg.ac.be

References

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- Majerus, S., Poncelet, M., Greffe, C., & Van der Linden, M. (2006). Relations between vocabulary development and verbal short-term memory: The relative importance of short-term memory for serial order and item information. *Journal of Experimental Child Psychology*, 93(2), 95-119.