Orthographic learning skills and retention of order information in memory among adult good and poor spellers

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INTRODUCTION

Throughout their life, adults continue to encounter new words and have to integrate both spoken and written forms in their lexicon to assure fluent reading and correct spelling. However, little is known about the way poor spellers manage to acquire new orthographic representations.

Also, some studies have highlighted an impairment of serial order processing in dyslexia. On one hand, Szmalec et al. (2011) have demonstrated a specific deficit in long-term learning of serial-order information (namely, the Hebb repetition effect) in dyslexic adults. On the other hand, order STM - which contributes to the development of phonological recoding (Martinez Perez et al., 2012) underlying itself the acquisition of new orthographic forms - has been shown to be impaired in dyslexics (Martinez Perez et al., 2013). Therefore, poor spellers may also exhibit a weakness related to serial order in memory explaining their spelling difficulties.

AIM

1. Determine if poor spellers have less developed capacities to acquire new long-term orthographic representations than good spellers
2. If so, examine whether this difficulty could be explained by a weakness in order STM and/or in long-term learning of serial order information

METHODS

Participants

- 14 good spellers =+1σ at a word dictation task
- 15 poor spellers <-2σ at a word dictation task

matched on age and education

Tasks

1. Orthographic learning task

- 12 inconsistent PW inserted in a text
- Repeated paradigm during 3 weeks

W1 → 1. Silent text reading; 2. PW dictation : immediate assessment

W2, W3 → 1. PW dictation : delayed assessment; 2. Silent text reading; 3. PW dictation : immediate assessment

2. Order and item STM tasks (Majerus et al.,2006)

- **Digit serial order reconstruction task**
  - Digits 1-9 ; 4 lists by length (from 6 to 9)
  - Number of items correctly replaced
- **Single nonword delayed repetition task**
  - 60 single NW to repeat after a filled delay
  - Number of NW correctly repeated

3. Hebb learning tasks (Szmalec et al., 2011)

- **Verbal auditory & visual Hebb conditions**
  - 2 lists of 9 nonsense syllables
  - 30 sequences : 1 Hebb x10; 20 fillers
    - → listened then repeated in auditory cond.
    - → read then pointed in visual cond.
- **Visuospatial Hebb condition**

Corsi-like visuospatial immediate serial recall

RESULTS

Comparison of performance between good and poor spellers

	Poor spellers Mean (SD)	Good spellers Mean (SD)	Student's t-test *t* (27)	*p*	
Orthographic learning					
W1 - Imm. ass.	4.47 (2.92)	7.93 (2.43)	-3.45	**	
W2 - Del. ass.	2.33 (2.05)	5.00 (3.31)	-2.62	*	
W2 - Imm. ass.	6.80 (3.45)	9.71 (2.16)	-2.70	*	
W3 – Del. ass.	5.33 (3.75)	8.43 (2.77)	-2.51	*	
W3 - Imm. ass.	8.67 (3.61)	10.86 (2.21)	-1.95	*ns*	
STM tasks					
Order STM	139.93 (12.29)	154.21 (8.63)	-3.59	**	↗
Item STM	73.73 (5.56)	80.29 (4.94)	-3.34	**	↘
Hebb learning tasks					
VA - Hebb	51.78 (17.92)	64.52 (22.21)	-1.70	*ns*	
VA - Fillers	38.81 (10.98)	47.22 (13.86)	-1.81	*ns*	
Δ VA (Hebb effect)	12.96 (12.58)	17.30 (13.59)	-0.89	*ns*	
VV - Hebb	44.44 (29.73)	66.59 (26.16)	-2.12	*	
VV - Fillers	31.22 (22.34)	47.46 (19.08)	-2.09	*	
Δ VE (Hebb effect)	13.22 (12.34)	19.13 (12.78)	-1.26	*ns*	
VSP - Hebb	44.25 (16.68)	44.25 (21.87)	-0.01	*ns*	
VSP - Fillers	32.01 (6.44)	34.79 (9.52)	-0.92	*ns*	
Δ VSP (Hebb effect)	12.25 (14.15)	9.46 (21.31)	0.41	*ns*	

Ancova :
- Item STM as covariate : $F(1,26) = 5.44$, $p<.05$
- Order STM as covariate : $F(1,26) = 4.08$, *ns*

DISCUSSION

1. Poor spellers acquire at a slower rate and maintain fewer new long-term orthographic representations than good spellers.
2. Poor spellers show a specific weakness in verbal order STM which could explain their orthographic learning difficulties. Otherwise, they exhibit a similar Hebb repetition effect in all conditions relative to good spellers.

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