Encombrement perceptif et codage orthographique chez l'enfant.

Laurie Leibnitz, Stéphanie Ducrot, Sebastiaan Mathôt, Jonathan Grainger

Orthographic coding, visual field asymmetries and crowding in 4-to-6-year-old children

Leibnitz, L.[1,2], Ducrot, S.[2], Mathôt, S.[1], Grainger, J.[1],

[1] Laboratoire de Psychologie Cognitive, CNRS & AMU

[2] Laboratoire Parole et Langage, CNRS & AMU

INTRODUCTION

Orthographic coding and the special status of letters in letter strings

We hypothesize that beginning readers must learn to transform letters as individual objects (i.e., knowledge of the alphabet), into letters as object parts - that is, the constituents of a word. In other words, an initially unfamiliar visual stimulus (the to-be-learned written word) must be transformed into a familiar visual object for rapid efficient reading for meaning. The key to a successful transition here is the development of parallel, independent letter processing, achieved by a bank of location-specific letter detectors (i.e., the first level of processing). This parallel processing of letters involves coding for letter identities and for letter positions (Grainger et Van Heuven, 2003).

Visual field asymmetry

A parafoveal word is better identified in the right visual field (RVF) than in the left visual field (LVF), in skilled readers (Ducrot et al., 2013 ; Riva et Siéroff, 2010 ; Leclercq et Siéroff, 2014). But there is still some debate about when the RVF advantage for words emerges and when it becomes equivalent to the adult level.

Crowding and reading

Spatial extent of crowding for letters is reduced (Grainger et al., 2010 ; Ziegler et al., 2010). For example, crowding can be reduced (i.e., shorter RTs ; better accuracy in visual word recognition) merely with slight increase of inter-letter spacing (Perea et Gomez, 2012 ; Zorzi et al., 2012).

AIM OF THE STUDY

The aim of present study was twofold (1) to assess the development of letter-specific processing, and (2) to examine whether the influence of increased inter-letter spacing affect performances differently in children of different ages.

METHOD

Participants :

Experiment 1

	TEST 1	TEST 2	TEST 3
AGE	5;8	5;11	6;11
GRADE	kindergarten	kindergarten	1st grade

Experiment 2

AGE	11;1
GRADE	5th grade

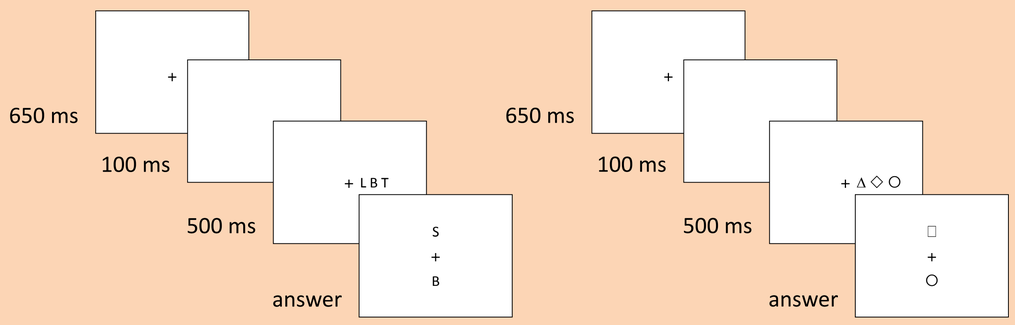
Stimuli :

9 consonants (B, C, D, J, L, M, P, S, T)

9 symbols (→ ◊ ⊠ ♪ ☾ □ ♡ ✡ △)

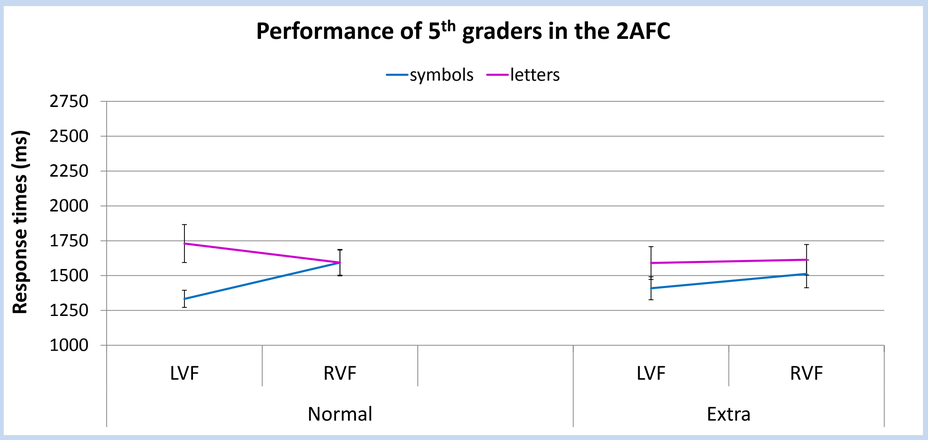
Procedure Two alternative-forced choice (2AFC) Reicher-Wheeler paradigm (Reicher, 1969) :

- Participants saw a target stimulus flanked by two characters from the same category.
- Two characters were presented above and below the point of fixation.
- Participants had to decide which of these two characters had been present in the preceding array.



RESULTS

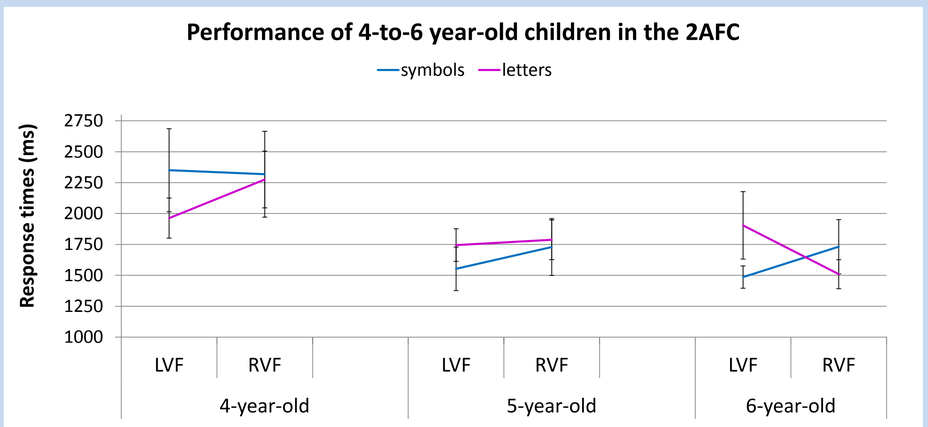
EXPERIMENT 1



Significant stimulus type x VF x crowding interaction [F1(1,15) = 4.265, *p* = .055]

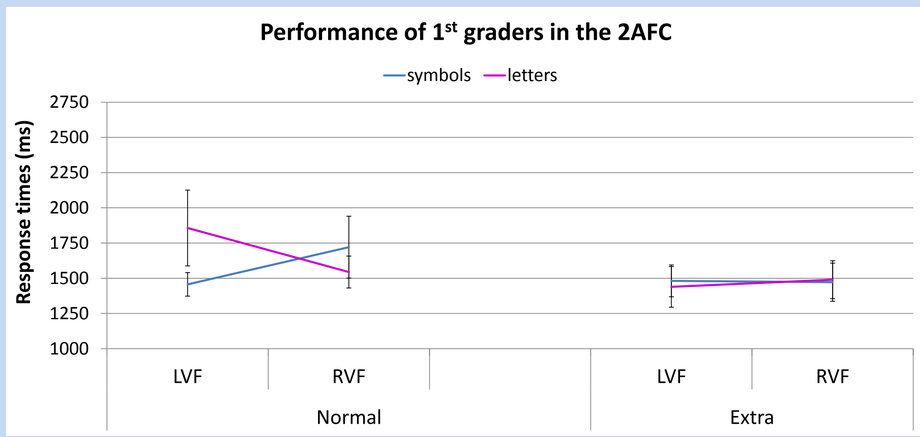
- ***Normal-spaced condition :***
  - significant interaction between the effects of stimulus type and VF [F1(1,15) = 7.169, p =.0172].
  - classical RVF advantage obtained for letter strings (whereas a LVF advantage is found for symbols strings).
- ***Extra-spaced condition :***
  - VF x stimulus type interaction not significant [F<1].
  - lateralization effects observed in the normal-spaced condition diminish (symbols) or disappear (letters) with extra spacing between characters.

EXPERIMENT 2



Significant stimulus type x VF x test interaction [F1(2,52) = 3.07, *p* = .05]

- For all children, letter and symbol strings were not processed in the same way
- Results show a RVF advantage for letter strings.
- The LVF advantage for symbol strings emerges earlier (end of th 2nd Test).
- Note that for 4-year-old children, the results showed a LVF advantage for letter strings.



Significant stimulus type x VF x crowding interaction [F1(1,26) = 4.239, *p* = .0497]

- Clearly, the 1st grade children produced a pattern of results that strongly resembled that of the older children.
- As in Experiment 1, the lateralization effect observed in the normal-spaced condition has disappeared with extra spacing between characters.

CONCLUSION

- Our results argue in favor of an **early development of the RVF superiority for processing letter strings in children** (see Riva & Sieroff, 2010 for similar results with words and with unilateral and bilateral presentations).

  Note that other studies, using only unilateral presentation, did not find an RVF advantage before the age of 10 or 12, but their methods were slightly different (e.g. Forgays, 1953).

  Our results are in agreement with brain-imaging studies that find strongly lateralized activation in reading by the age of 6–7 years (Gaillard et al., 2003).
- The impact of spacing on lateralization suggest that **part of the RVF advantage for letter/word processing might be in fact driven by a LVF disadvantage** caused by increased crowding for letters located in the LVF and flanked by other letters to the left, as predicted by the MRF hypothesis of Chanceaux and Grainger (2012).