HAL
open science

Vision, Attention and Reading : Identifying preschool children at risk for reading difficulties

Marie Vernet, Stéphanie Ducrot, Laurie Leibnitz, Yves Chaix

To cite this version:

Marie Vernet, Stéphanie Ducrot, Laurie Leibnitz, Yves Chaix. Vision, Attention and Reading : Identifying preschool children at risk for reading difficulties. 6th conference of the Association for Research in Neuroeducation, Jun 2018, Paris, France. hal-02900799

HAL Id: hal-02900799

https://hal.science/hal-02900799v1

Submitted on 16 Jul 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Aix*Marseille université

Vision, Attention and Reading : Identifying preschool children at risk for reading difficulties

Vernet, M. [1] , Ducrot, S. [1] , Leibnitz, L. [1] , & Chaix, Y. [2,3]

[1] Laboratoire Parole et Langage, CNRS & AMU
[2] ToNIC, Toulouse NeuroImaging Center, Université de Toulouse, Inserm, UPS, France; Children's Hospital
[3] Purpan University Hospital, Toulouse, France

UMR 7309 • CNRS • AMU PAROLE ET LANGAGE

cnrs

Introduction

Oculomotor skills in reading

To read, eyes have to make **saccades and fixations** to overcome its anatomo-functional constraints (i.e., decreased visual acuity with eccentricity and crowding effect; *Leibnitz & al., 2016*). **Attention** plays a crucial role in overcoming these constraints by :

- Making the letters prominent in **foveal vision**
- Attenuating information in **parafoveal vision**
- Participating in **ocular guidance**

With the training, **oculomotor skills** become more efficient :

- **Increase in the landing position accuracy** of the saccade towards the left-center of the word (Preferred Viewing Location; *Rayner, 1979;* Optimal Viewing Position; *O'Regan & al., 1984*)
- **Decrease in the number of regression saccade**.

This improvement in oculomotor capacity is related to an **increase of the accuracy and the speed of reading**. Therefore, the **oculomotor skills directly affect the reading skills**.

What about learning ?

It is well known that reading instruction requires efficient phonological skills. However, many studies have shown the major involvement of **visual-attentional** and **perceptual-motor skills** in **reading skills**. Longitudinal studies have shown the involvement of these skills as necessary preliteracy skills from **kindergarten** on the **future reading skills** of these children *(Franceschini & al., 2012; Bellocchi & al., 2017)*.

Aim of the study

Using a **longitudinal study**, the aim was to determine whether it is possible to **predict** the future **reading skills** in kindergarten children from **oculomotor skills**.

Method

Participants

30 children from two different French public schools
→ Normal or corrected-to-normal vision

	Time 0	Time 1
Age (mean)	5;7	6;10
Grade	Kindergarten	1st Grade

Material

DEM-test *(Richman and Garzia, 1987 ; Richman, 2015)*
- **Oculomotor skills** and **naming number skills**

Alouette-R *(Lefavrais, 1967, 2005)*
- **Reading skills**

Speeded naming subtest - NEPSY-II *(Korkman, Kirk and Kemp, 2012)*
- **Naming skills**

Procedure

Time 0 - Kindergarten | **Time 1 - End of the 1st grade**

DEM-test
Children had to **name the numbers**, first on the **vertical** boards and then on the **horizontal** number board.

Mesures
Vertical time (VT)
Horizontal time (HT)
Errors (E)
Ratio (R) → HT/VT

Alouette-R
Participants had to **read** a maximum of words from a grammatically correct but **meaningless text** in 3 minutes.

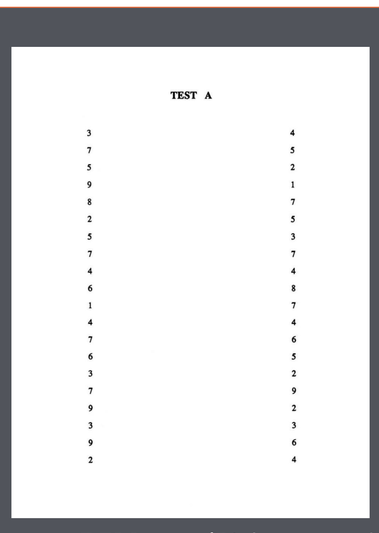
Mesures
Words read (M)
Errors (E)
Words read correctly (C)
Reading accuracy (CM)

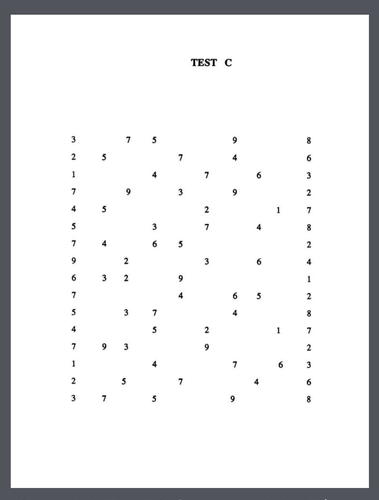
DEM-test
Children had to **name the numbers**, first on the **vertical** boards and then on the **horizontal** number board.

Mesures
Vertical time (VT)
Horizontal time (HT)
Errors (E)
Ratio (R) → HT/VT

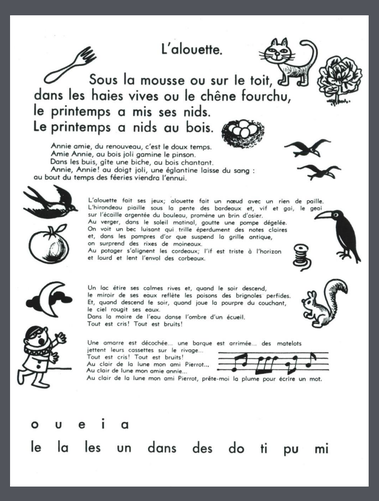
Speeded naming
Participants had to **name the shape, color and size** of items and from 7 years old, children also had to name a sheets of **numbers and letters** presented in lines.

Mesure
Naming accuracy (N)

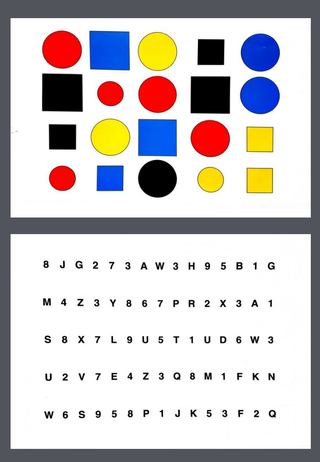




DEM-test *(Richman and Garzia, 1987 ; Richman, 2015)*



Alouette-R *(Lefavrais, 1967)*



Speeded naming - NEPSY-II *(Korkman, Kirk and Kemp, 2012)*

Results

Link between oculomotor skills in kindergarten and reading skills in grade 1

Results of linear regression analysis
Reading accuracy according to the DEM-test measurements

	Reading precision *CM - Z-score*		
	ΔR^2	β	t
VT *Z-score*	0,370	0,558	4,249***
HT *Z-score*	0,334	0,485	3,946***
E *Z-score*	0,178	0,320	2,694*
Ratio *Z-score*	-0,012	0,198	0,805

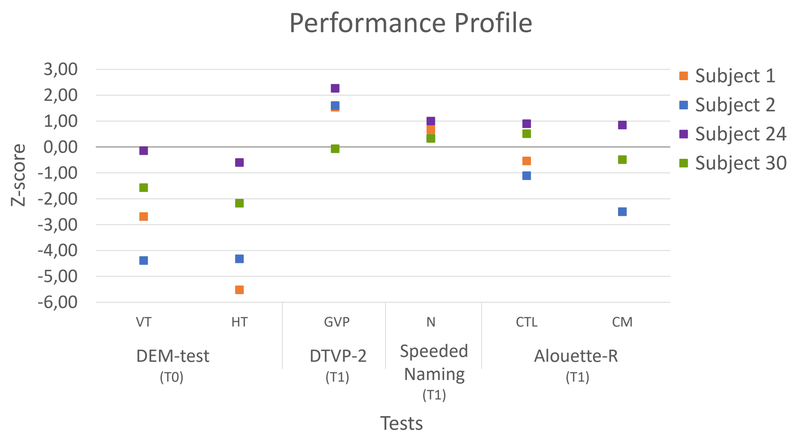
** : p<.05 ; ** : p<.01 ; *** : p<.001*

- VT predicted 37% of reading accuracy
- HT predicted 33% of reading accuracy
- Errors predicted 18 % of reading accuracy

⇨ **Oculomotor skills are predictors of learning to read**

Case Study

We identified **4 children** with difficulties with at least one DEM-test result **below the -1.65 standard deviation** threshold. We examined their profile more precisely from **DEM-test, Alouette-R, speeded naming test** and **DTVP-2**[1]data.



The reading accuracy deficit of children 1 and 2 is related to

- Oculomotor deficit outcomes.
- Other measures are not affected for any children.

⇨ **Oculomotor skills influence reading accuracy. Therefore, the reading difficulties can be predicted by the DEM-test.**

[1] *The Developmental Test of Visual Perception – Second Edition (Hammill, Pearson & Voress, 1993) : it measures visual perception and visual-motor integration skills. GVP = General Visual Perception. MRP = Motor-reduced Visual Perception. VMI = Visual-Motor Integration.*

Conclusion and perspectives

- Our results argue in favor of the **major role of the oculomotor skills in the reading skills and learning to read** *(see Muneaux & Ducrot, 2014 for a review)*. More precisely, these results show that the **oculomotor skills** in kindergarten predict the reading accuracy outcomes one year later.
- The DEM-test is an easy-to-use pencil paper tool for highlighting children's oculomotor skills. This research yielded **new normative data** from a sample of kindergarten children, which today has only been done in a population of Chinese children *(Xie & al., 2016)*.
- Finally, a **computerized version** of the DEM-test on a tablet, generating an **automatic diagnosis**, would allow a faster and more precise diagnosis. **Support modules** may be proposed depending on the child's problem profile.

Early identification and care for future reading difficulties in preschool children

Development of remediation tools for reading difficulties

Setting up oculomotor training at the school to promote learning to read