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## Static postural control in children with developmental dyslexia

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### Abstract

The present investigation tries to better understand potential association and causal relationship between phonological and postural impairment due to developmental dyslexia. The study included 50 boys with developmental dyslexia and selected on the basis of their overall reading difficulties, and 42 control boys. Body sway during a quite standing posture eye open and eye closed on a force platform were tested in the two groups of subjects that were between 10 and 13 years of age. Analysis of classical parameters quantifying the centre of pressure (CP) displacements along antero-posterior and lateral axes showed a significant difference between the two groups. Dyslexic children showed on average greater instability, with greater length, variability and mean power frequency of CP displacements with or without vision. Our results demonstrate that postural parameters may discriminate between children with dyslexia and age-equivalent controls.

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# Proprioception oculaire et dyslexie de développement

## À propos de 60 observations cliniques

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## Cognitive demands impair postural control in developmental dyslexia: A negative effect that can be compensated

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### ABSTRACT

Children with developmental dyslexia exhibit delayed reading abilities and various sensori-motor deficits. The way these various symptoms interact remain poorly understood. The objective of this study was twofold. First, we aimed to investigate whether postural control was impaired in dyslexic children when cognitive demands are increased. Second, we checked whether this effect could be reduced significantly by a treatment aiming to recalibrate ocular proprioception. Twelve dyslexic and fifteen treated dyslexic children (>3 months of treatment) were compared with twelve non-dyslexic children in two conditions (mean age:  $11.6 \pm 2.1$ ,  $12.5 \pm 1.5$  and  $10.6 \pm 1.7$  years respectively). In a first condition they maintained balance while fixating a point in front of them. In the second condition the postural task was combined with a silently reading one. Balance was assessed by means of a force plate. Results demonstrated that the mean velocity (i.e. the total length) of the center of pressure (CoP) displacement was increased in the reading task only for the dyslexic group. Interestingly, for the treated children, an inverse tendency was observed: the mean velocity (i.e. the total length) and the surface of the 90% confidence ellipse of the CoP displacement decreased for 13/15 patients and for 12/15 patients respectively, while performing the reading task. Values remained similar to those observed for the control children. Altogether, these results strongly suggest that cognitive demands can impair postural control in developmental dyslexia but this interaction could be normalized. These results sustain the hypothesis of a cerebellar origin for dyslexia.

## Left minineglect or inverse pseudoneglect in children with dyslexia?

Carine Michel<sup>a,b</sup>, Samuel Bidot<sup>a,b,c</sup>, François Bonnetblanc<sup>a,b</sup>  
and Patrick Quercia<sup>c</sup>

This study compared the visuospatial asymmetries in children with dyslexia and healthy children by using the manual line bisection task, and investigated the processing of spatial context with a 'local' cueing paradigm consisting of geometric symbols placed on the extremities of the lines. The performance between healthy children (leftward bias) and children with dyslexia (rightward bias) was significantly different. Furthermore, the bisection mark was shifted in the direction of the unilaterally cued extremities in all children. As children with dyslexia showed a rightward bias in their spatial representation, which did not interfere with local context processing, we proposed the term 'inverse pseudoneglect' to depict their behaviour in line

bisection. *NeuroReport* 00:000–000 © 2010 Wolters  
Kluwer Health | Lippincott Williams & Wilkins.

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**Keywords:** context processing, cueing, developmental dyslexia, neglect, pseudoneglect, space representation

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## Left minineglect or inverse pseudoneglect in children with dyslexia?

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### Abstract

This study compared the visuospatial asymmetries in children with dyslexia and healthy children by using the manual line bisection task, and investigated the processing of spatial context with a 'local' cueing paradigm consisting of geometric symbols placed on the extremities of the lines. The performance between healthy children (leftward bias) and children with dyslexia (rightward bias) was significantly different. Furthermore, the bisection mark was shifted in the direction of the unilaterally cued extremities in all children. As children with dyslexia showed a rightward bias in their spatial representation, which did not interfere with local context processing, we proposed the term 'inverse pseudoneglect' to depict their behaviour in line bisection.

## Integration of proprioceptive signals and attentional capacity during postural control are impaired but subject to improvement in dyslexic children

Patrick Quercia · Laurent Demougeot ·  
Mickaël Dos Santos · François Bonnetblanc

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**Abstract** Children with developmental dyslexia suffer from delayed reading capabilities and may also exhibit attentional and sensori-motor deficits. The objective of this study was twofold. First, we aimed at investigating whether integration of proprioceptive signals in balance control was more impaired in dyslexic children when the attentional

length) of the center of pressure (CoP) displacement in the 85-Hz vibration condition increased significantly more (compared with no vibration) in the dyslexic and the treated dyslexic groups than in the control group, irrespective of the attention task. Interestingly, in the condition without vibration, the attentional performance of treated children

# Developmental dyslexia and vision

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**Abstract:** Developmental dyslexia affects almost 10% of school-aged children and represents a significant public health problem. Its etiology is unknown. The consistent presence of phonological difficulties combined with an inability to manipulate language sounds and the grapheme–phoneme conversion is widely acknowledged. Numerous scientific studies have also documented the presence of eye movement anomalies and deficits of perception of low contrast, low spatial frequency, and high frequency temporal visual information in dyslexics. Anomalies of visual attention with short visual attention spans have also been demonstrated in a large number of cases. Spatial orientation is also affected in dyslexics who manifest a preference for spatial attention to the right. This asymmetry may be so pronounced that it leads to a veritable neglect of space on the left side. The evaluation of treatments proposed to dyslexics whether speech or oriented towards the visual anomalies remains fragmentary. The

## ARTICLE 1

# Dyslexie développementale et vision 1<sup>re</sup> partie

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## Résumé

La dyslexie développementale touche près de 10 % des enfants d'âge scolaire et représente un important problème de santé publique. Son étiologie est inconnue. La présence récurrente de difficultés phonologiques associées à une incapacité à manipuler les sons de la langue et à réaliser la conversion graphème-phonème est largement reconnue.

De nombreuses études scientifiques ont également documenté la présence d'une difficulté spécifique d'apprentissage qui touche principalement la lecture, les mouvements oculaires et la reconnaissance des lettres. Mots clés : lecture, mouvements oculaires, dyslexie développementale, reconnaissance des lettres, difficulté spécifique d'apprentissage.





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## Research in Developmental Disabilities



### Space representation in children with dyslexia and children without dyslexia: Contribution of line bisection and circle centering tasks



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#### ABSTRACT

Line bisection tasks (different space locations and different line lengths) and circle centering tasks (visuo-proprioceptive and proprioceptive explorations, with left or right



# Links between Action and Perception in Developmental Dyslexia



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## Introduction

Developmental dyslexia is a specific, severe and persistent disorder of reading acquisition that appears independent of mental, neurological, visual, hearing or educational deficits (W.H.O., 1993 as cited in Habib, 1997<sup>1</sup>), is frequently observed (Barrouillet et al., 2007<sup>2</sup>) and significantly interferes with school learning and daily living activities (W.H.O., 1993 as cited in Habib, 1997<sup>1</sup>). Despite this term, there remains a poor understanding of the relation between developmental dyslexia and other cognitive and motor disorders which are frequently associated to it (Barrouillet et al., 2007<sup>2</sup> ; Grammaticos & Klees, 2000<sup>3</sup> ; Bosse, 2004<sup>4</sup>).

## Participants and method

18 dyslexics and 18 normo-readers teenagers (mean age = 15.2 ± 1.1 years) were selected from anamnesis, speech therapist and praxis standardized assessments.

### 1) General motor imagery ability ; MIQ-R (Hall & Martin, 1997<sup>11</sup>)

= motor imagery scores for visual and kinesthetic modalities

# The distinctive vertical heterophoria of dyslexics

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**Abstract:** In this study, we looked for the presence of vertical heterophoria (VH) in 42 dyslexic children (22 males and 20 females) aged  $118.5 \pm 12.9$  months who were compared with a control group of 22 nondyslexic children (eleven males and eleven females) aged  $112 \pm 9.8$  months. Dyslexics presented a low-level (always  $< 1$  prism diopter) VH combined with torsion. This oculomotor feature clearly separates the dyslexic group from the normal readers group. It is independent of the type of dyslexia. The essential feature of this VH is a lability that appears during specific stimulation of sensory receptors involved in postural regulation. This lability is demonstrated using a vertical Maddox test conducted under very specific conditions in which postural sensors are successively stimulated in a predetermined order. A quantitative variation

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## **Representational Bias in the Radial Axis in Children With Dyslexia: A Landmarks Alignment Study**

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### **Abstract**

To better identify the distinctive characteristics of space representation in the radial dimension, we have proposed a new paradigm: the landmarks alignment task where two parallel aluminum bars were radially presented. Children had to move a landmark along one bar and place it at the same location as the reference landmark placed by the examiner on the parallel bar. The major interest of this task was its capacity to assess space representation in the radial dimension when considering a spatial landmark that oriented the subject's attention toward the orthogonal dimension. The most important result showed that in the radial dimension children with dyslexia exhibited a forward bias on the left bar, meaning a mental underrepresentation of the leftward peripersonal space and/or a

## What about proprioception in children with dyslexia ?

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### Background

Developmental Dyslexia (DD) is a common learning disorder impairing reading. Its etiology is unknown but several theories (phonological, cerebellar, attentional, magnocellular or proprioceptive) try to account for it [1].

Proprioception is the ability to know, without vision, where the body limbs are in space [2]. Proprioception is not only sensoriality but cognition as well [3]. Based on results showing balance disorders in DD, a relationship between learning disorder and proprioception has been postulated [4].

The aim of our study was to evaluate and compare proprioception in children with and without dyslexia.

### Method

26 children aged 10 to 12 years participated : **DD group** (n=13 ; 11.01 ± 0.93 years) and **typically developing group (TD)** (n=13 ; 11.24 ± 0.80 years).

We used an isokinetic dynamometer (Biodex Medical Systems®) to measure proprioceptive acuity with two different tasks : a **speed**

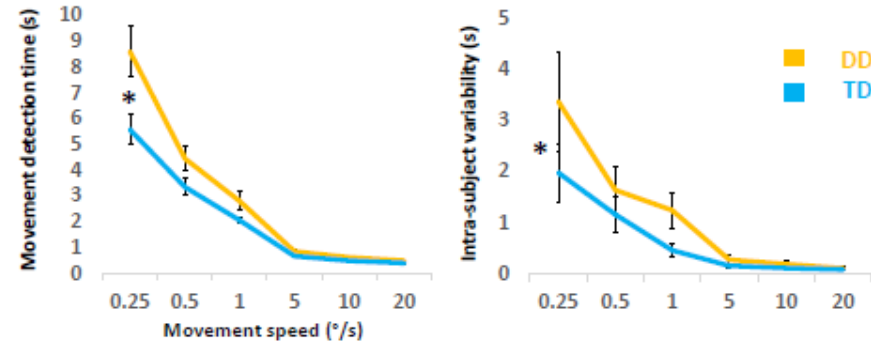
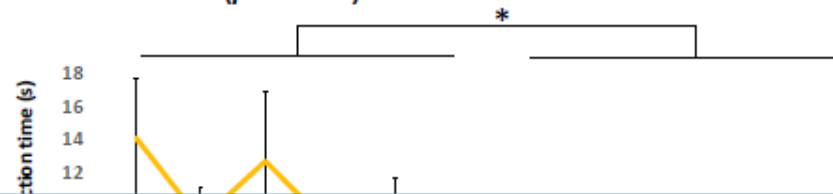


Fig.2. Mean and intra-subject variability of movement detection times for each tested speed (\*  $p < 0.001$  for difference between DD and TD children).

3. A trial analysis revealed significant group x velocity ( $F_{5,26} = 7.51, p < 0.001$ ) and group x trials effects on detection time ( $F_{5,26} = 5.09, p < 0.001$ ). For the DD group, we found an adaptation effect between trials at 0.25°s<sup>-1</sup> ( $p < 0.001$ ).





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### Are changes in the stomatognathic system able to modify the eye balance in dyslexia?



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Dyslexia  
Postural control

#### ABSTRACT


**Objectives:** To clarify the link between eye muscle function and oral information by comparing 21 dyslexic readers (DR) and 14 normal readers (NR).

**Methods:** Changes in vertical heterophoria (VH) were measured using the Maddox Rod Test performed according to oral modifications and postural conditions. The Spearman correlation was used to assess whether reading delay was correlated with the lability index.


**Results:** Overall, 50% of NR children and 81% of DR experienced at least one variation in visual perception

# Children with Dyslexia Have Altered Cross-Modal Processing Linked to Binocular Fusion. A Pilot Study


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*Clinical Ophthalmology*

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**Introduction:** The cause of dyslexia, a reading disability characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities, is unknown. A considerable body of evidence shows that dyslexics have phonological disorders. Other studies support a theory of altered cross-modal processing with the existence of a pan-sensory temporal processing deficit associated with dyslexia. Learning to read ultimately relies on the formation of automatic multisensory representations of sounds and their written representation while eyes fix a word or move along a text. We therefore studied the effect of brief sounds on vision with a modification of binocular fusion at the same time (using the Maddox Rod test).

**Methods:** To check if the effect of sound on vision is specific, we first tested with sounds and then replaced them with proprioceptive stimulation on 8 muscular sites. We tested two groups of children composed respectively of 14 dyslexic children and 10 controls.

**Results:** The results show transient visual scotoma (VS) produced by sensory stimulations associated with the manipulation of oculomotor balance, the effect being drastically higher in

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## Action representation deficits in adolescents with developmental dyslexia

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### Abstract

Developmental dyslexia (DD), a severe and frequent disorder of reading acquisition, is characterized by a diversity of cognitive and motor deficits whose interactions still remain under debate. Although deficits in the automatization of sensorimotor control have been highlighted, internal action representation allowing prediction has never before been investigated. In this study, we considered action representation of 18 adolescents with pure DD and 18 age-matched typical readers.