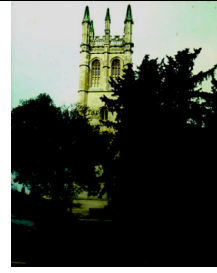


Dyslexia International,
Open Online Forum, November 13, 2008

Professor John Stein,
Magdalen College,
Oxford University, UK



Visual Basis of Dyslexia

Supported by The Dyslexia Research Trust (www.dyslexic.org.uk),
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My standpoint on dyslexia comes from my training as a neurophysiologist. I am interested in the visual side of dyslexia - primarily in movement and the visual control of attention.

Magnocellular Theory of Dyslexia

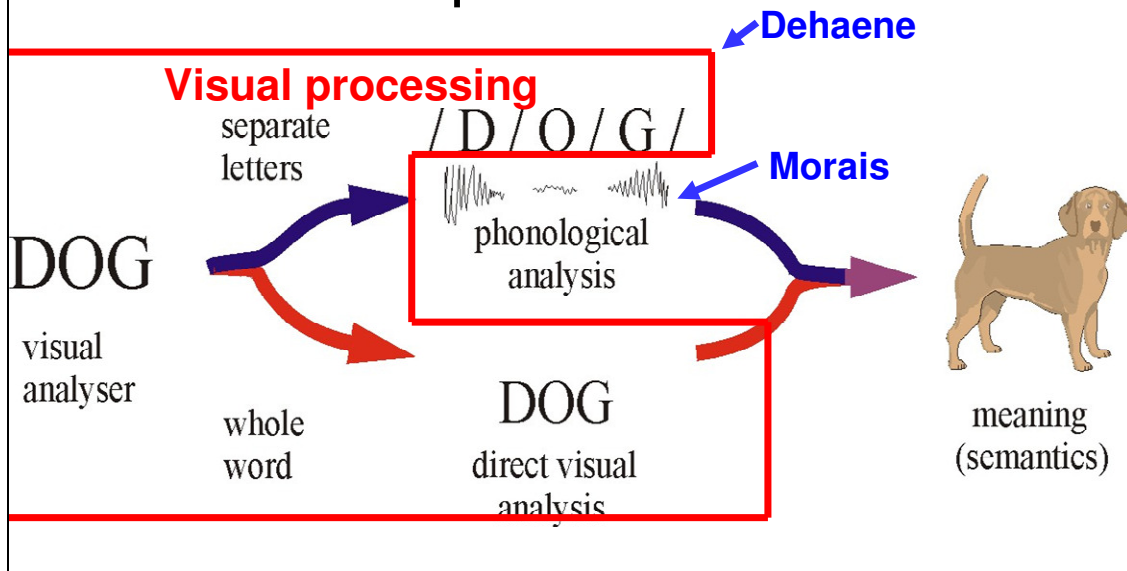
- Dehaene talked mainly about visual word form area and how it develops in children
- Morais described the phonological theory of dyslexia
- Stein does not dispute either of these, but looks for underlying genetic/neurophysiological explanation for deficits
- Magnocellular theory

A particular theory which I and others are responsible for is the magnocellular theory of dyslexia which does not in any way disagree with what Professors Dehaene and Morais have been talking about.

Since I come from a more biological background I am looking for underlying genetic and physiological explanations for the deficits and I, like Professor Morais, do not want to make a distinction between dyslexia and poor reading.

My starting point is that reading is primarily a **visual** process.

Reading is primarily a visual process



In this diagram the paths for visual processing are shown enclosed within the red box. You can see that a vast amount of the processing involved in reading is in fact visual.

We think it terms of two kinds of pathways, in one of which where we have to translate the separate letters in the word dog into their sounds - 'd' spells 'd', 'o' spells 'o' etc, and so by this phonemic mechanism, this sub-lexical process as it is called, we come to the meaning of the word 'dog'. But there is also in practiced readers a direct visual route, or lexical route, where we see the word 'dog' and we go immediately to its meaning without having to go through the phonological path. That is only true for words that are in our visual vocabulary.

Now to do any of these things we need to have good control of our visual attention in order to direct our attention to the letters in the word, from which we acquire good eye control for reading.

Visual attention & eye control for reading

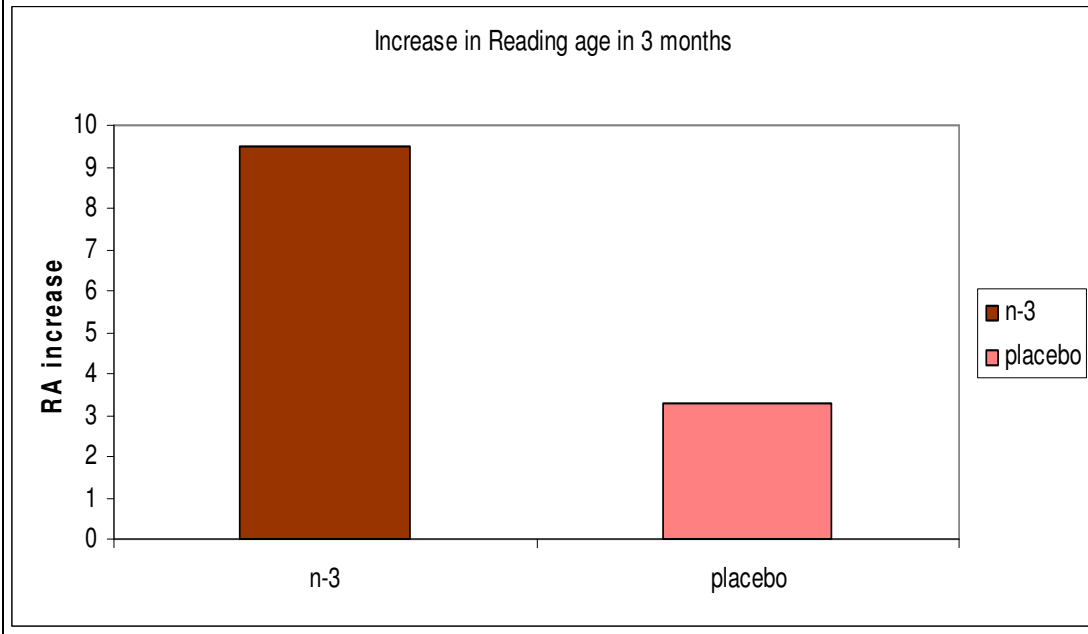
- Directed by magnocellular system
- Visual and auditory magnocellular systems impaired in dyslexics
- Causes unstable attention and eye control
- Due to genetic, immunological and nutritional vulnerability
- Can be alleviated by visual, auditory, nutritional treatments

There are in fact both visual and auditory magnocellular systems. We and others have shown that they are impaired in many, if not all, dyslexics. What happens is that the impairment means that children - and adults - have an unstable ability to direct their attention and therefore their eye control. We know that it is due to a combination of a number of things, none of which are exclusive but all of which are important.

As I am sure you are all aware there is a very high heritability of dyslexic problems. There is an association with an immunological problem. We and others have also shown there is a nutritional issue.

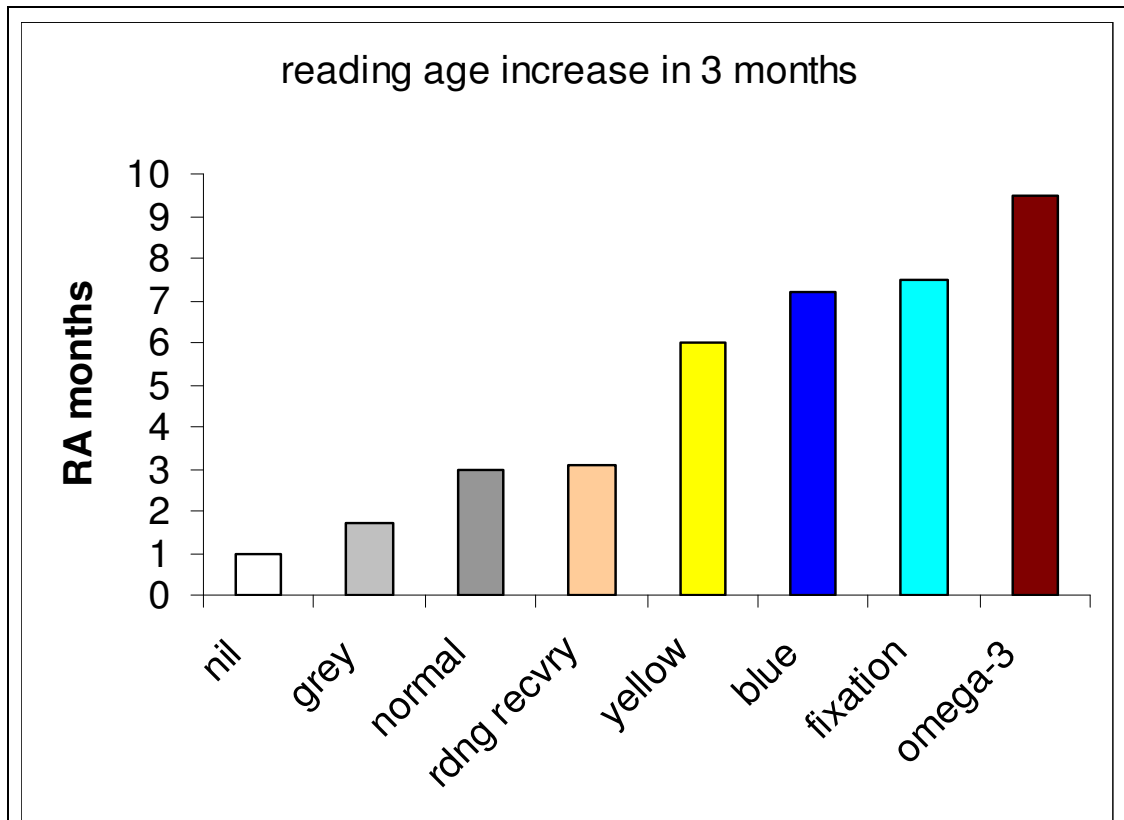
When understand the magnocellular basis of these problems we can alleviate these difficulties with fairly simple auditory, visual or nutritional means.

Durham study - Omega 3 EPA supplements helped dyspraxic children to improve their concentration and their reading (RCT – Richardson & Montgomery)



A particularly interesting study was carried out by my colleagues Alexandra Richardson and Paul Montgomery in Durham, in a randomised control trial, in which children were given fish-oil Omega 3 EPA supplements. These were actually dyspraxic children, not dyslexics, but this improved their concentration and their reading. Those who received the active principle are shown in the brown bar; after three months they improved their reading age by nine months whilst those who received the placebo improved over the same time by the average of what you would expect of everybody, namely three months. This was a highly significant difference.

What this suggests is that the magno-cellular system is impaired in many of these children and they were helped by simply giving omega-3 supplements



Finally, more about the basis of magno-cellular deficits – although some people would say not all dyslexics have magno-cellular deficits.

I want to compare treatments derived from the magno-cellular theory with other methods.

We start with dyslexics who are not given any special treatment at all. As you know, they will go backwards. In three months, instead of increasing their reading age by three months, will only increase it by about one month, You can achieve the same improvement by the technique known as reading recovery, which is really a phonological system which requires one-to-one phonological treatment. What I show in the four bars on the right are very simple treatments which we have introduced, such as wearing deep yellow or deep blue spectacles, fixation exercises, or the omega 3 treatment. In various groups of children you can see that these kinds of treatment improve matters more than the treatments shown on the left.

So my plea is to consider all these possibilities. I am not saying they will help every child but they should be thought about. In particular the visual problems of reading should be taken into account.