Author's response to reviews

Title: Word Processing differences between dyslexic and control children

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Author's response to reviews: see over
Dear Professor Newmark,

We thank you and the reviewers for the helpful comments on the manuscript. We have made every effort to address all points raised by the reviewers. Please find enclosed our detailed responses to the specific points.

Thank you for considering our manuscript for publication in BMC Psychiatry.

Reviewer Gerd Schulte-Körne

1) *Measurement of handedness*

We added a reference for the handedness measure we used (Oldfield, 1971).

2) *Diagnostic criteria*

We added information on diagnostic criteria in the *Subjects* section (page 8).

3) *Lacking difference between high frequent and pseudowords*

It is true that a lacking difference between pseudowords and high frequent words is unexpected. Nevertheless one must consider three important aspects. 1) Low amplitudes in response to pseudowords might have other causes than low amplitudes in response to high frequent words. High frequent words are easily read - even at much faster presentation rates than the one we used - thus requiring little processing capacity. Given the fact that we used a higher than usual presentation...
rate, a strategy might have developed to not allocate any more resources to the processing of pseudowords once it is detected that no real word was presented. Thus, a pseudoword might “drop out” of the processing cascade once it is detected that no real word is present resulting in lower amplitudes. 2) Behavioural data does not necessarily mirror cortical processes. This is might especially the case, since we found our effects relatively early (~100 ms), far earlier than any behavioural response will occur. 3) Studies comparing pseudoword and word effects mostly mix high and low frequent words in their real word condition. If we averaged our data for high and low frequent words and compared it to pseudowords, we would also find higher amplitudes for words than for pseudowords (in the control children, see fig. 3 in the manuscript).

4) Lacking pseudoword differences between the groups

We added discussion on this point in the discussion section (p. 16).

5) Subgroups based on pseudoword reading performance

We subcategorised the children based on their performance in pseudoword reading and the ZLT and calculated statistics again for MAX amplitude. Good readers resembled control children more than poor readers (see results section page 13,14 and discussion page 17).

6) VWFA area

It is possible to select channels that would represent VWFA activation. In our case, we found effects in our pre-defined occipital channel groups with no HEMISPHERE interaction. Thus there was no necessity to specify the occipital channel group any further. Nevertheless, the effect we found likely contains VWFA activity, since it is located relatively occipital. We would not dare to state, however, that we exclusively saw VWFA activation.

7) More attention required processing LF words

As stated in the discussion we assume that unfamiliar LF words that are processed via the graphophonological route draw more attention than highly familiar HF words or pseudowords in skilled readers. This might explain the frequency drop into the high beta-band for LF words in the control group. Dyslexic children might not
allocate more attention to the processing of LF words, since they do not use the graphophonological route processing LF words. Thus we do not interpret this finding as an attention impairment in dyslexia, but rather as a consequence of a failure activating the graphophonological route.

Reviewer Alice Mado Proverbio

1) Do dyslexic children read at a presentation rate of 1/350 ms?

We do understand this concern. Nevertheless, several aspects speak against dyslexic children being unable to read the words. First of all, children reported that they read the words and also reported words back to us (unfortunately we did not collect this data systematically). Second, if dyslexic children had not been able to read the words, one would have expected control and dyslexic children to also differ in activation for high frequent and pseudowords as well – not only for low frequent words. Third, the work of Rubin and Turano (1992) shows, that skilled readers are able to silently read and comprehend at presentation rates of 1 word per 54 ms. Our presentation rate of 1/350 ms is clearly slower. It is true that dyslexic children are slower than control children in reading –the behavioural data of our study showed this as well. Yet, there is a difference between silent reading and reading aloud. But even if dyslexic children were 2 to 3 times slower reading silently as well, the presentation rate of 1/350 ms would still be adequate. Last, wavelet plots for the temporal channel group covering language areas show low gamma-band activation for both groups of children for all 3 wordclasses (activation in z-values relative to baseline, see fig. 1 below). There are no statistical differences between the groups (although control children seem to show stronger activation for pseudowords). This also indicates that dyslexic children did indeed process the words.

2) Word recognition test

As mentioned above, we unfortunately did not collect the data on word recognition systematically. We agree that this is a flaw and changed it for subsequent studies. Although it being weak evidence concerning the present study, it might be interesting to know that we have used the RSVP stimulation paradigm including a word recognition test (50% test stimuli, 50% matched unfamiliar words) with different groups of subjects so far (including ADHD and control children,
schizophrenic patients). The test in these samples showed that subjects were able to read the words.

3) **VWFA activation?**

We found effects in a pre-defined occipital channel group with no HEMISPHERE interaction. The VWFA is involved in prelexical processing of words and pseudowords, is modality-specific and can be activated without awareness. We would not dare to state, that we exclusively saw VWFA activation. Nevertheless, the effect we found likely contains VWFA activity. We discussed the VWFA in relation to our results, because other authors (Assadollahi & Pulvermüller, 2003, Jobard et al., 2003) found a word frequency effect in occipital regions and interpreted their findings as VWFA activity. Nevertheless, we do not deny that attention processes might also play a role (see discussion page 19).

4) **Study by Johannes et al.; further studies to be mentioned**

The reason why we included the study by Johannes and colleagues is that they were among the few groups who investigated word frequency effects in dyslexia. We therefore considered the study as relevant despite the fact that they found effects in different time windows compared to us. We included results of the study by Mechelli and colleagues in the discussion (see page 34).

5) **ERP and fRMI experiments**

We added more information on the type of experiments mentioned throughout the manuscript.
Figure 1

Temporal channel group