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## Eye-Movement and Reading Strategy Changes Following Treatment in a Case of Acquired Alexia

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### Background

Reading impairment, known as alexia, frequently co-occurs with damage to the language areas of the brain in aphasia. Text-based reading treatments, such as Multiple Oral Rereading (MOR; Tuomainen & Laine, 1991) and Oral Reading for Language in Aphasia (ORLA; Cherney, Merbitz, & Grip, 1986) have been used successfully to improve reading fluency in individuals with acquired alexia (see Cherney, 2004 for a review), but the mechanisms behind improvements are not well understood.

Eye-tracking methods are a potentially useful tool for investigating mechanisms of recovery in alexia, as fine-grained indices of on-line processing can be obtained without requiring a verbal response from the individual. This study investigated the efficacy of text-based reading treatment in an individual with alexia, and examined whether eye-movements changed as a result of treatment.

### Method

JM, a 42 year-old male 9 years post-onset presented with anomic aphasia and surface alexia. Text-reading treatment comprising ORLA procedures during clinical sessions and daily homework (following MOR procedures) was implemented. Behavioural (single-word/text reading) and eye-tracking (sentence reading) assessments were conducted pre-treatment, post-treatment and at six-month follow-up.

### Results

*Behavioural measures.* After 12 weeks of treatment, large and medium-large effect sizes were observed for rate ( $d = 13.4$ ) and accuracy ( $d = -4.5$ , reflecting a decrease in number of errors/100 words) of reading practiced passages. Reading rate on the *GORT-4* (Wiederholt & Bryant, 2001) also improved significantly following treatment [ $F(2,14)=4.371, p < .05$ ]. While single word reading accuracy was maintained, patterns changed to resemble phonological alexia. Namely, fewer phonologically plausible errors and an increase in frequency, imageability and lexicality effects were observed.

*Eye-tracking measures.* Eye-movements differed significantly pre-treatment relative to post-treatment and follow-up [ $F(2,70)= 18.604, p<0.001$ ], although in the opposite direction of what was expected. Number of fixations, regressions and fixation durations increased following treatment. However, JM's initial fixation position on words shifted from the beginning of the word towards the "preferred viewing position" (slightly left of center), consistent with that observed in individuals with phonological alexia (Schattka et al., 2010).

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## Discussion

Text-based reading treatment resulted in increased reading fluency in an individual with aphasia and alexia. Moreover, patterns of eye-movements changed as a result of treatment. A shift in first fixation position, together with shifts in single word reading effects suggest text-based treatment may have served to change JM from using a sub-lexical reading strategy to a lexical one. These results demonstrate the potential utility of using eye-movements as a parameter of interest when investigating response to reading treatment.

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