

## POSTER SESSION: Language processing and reading comprehension

### Using naturalistic eye tracking data to understand children's reading difficulties

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Eye tracking studies of reading primarily involve skilled adult readers in controlled laboratory settings. Before this research can contribute to practical reading teaching, it is necessary to verify that insights from this domain generalize to the settings and populations where reading teaching happens. Owing to the developments in eye tracker price and quality, gaze recordings from naturalistic reading teaching can be leveraged for this purpose and for developing models for automated reading performance analysis.

In the present research, we use eye-tracking data collected during real reading training sessions in Danish schools where 95 students, who had been referred to extra reading intervention, read texts of varying difficulty aloud, while their eye movements were recorded. The data was analysed in two ways.

The first analysis investigated students' total gaze time per word in a linear mixed model. The largest effects were of word length, with longer gaze times for longer words, and of word frequency, with particularly large facilitatory frequency effects for those words that occurred for the first time in the given text. These effects are similar to what we observed with adult, skilled readers, but with generally larger effect sizes in the present study. In addition, the analysis showed significant effects of the word's position in the line and text, and the readers' experience with the system, both within and across sessions.

Secondly, the data was analysed to predict misread words using machine-learning techniques. Automatic identification of misread words may be useful for semi-automating reading assessment and assistance. In addition to 16 basic features, we explored the contribution of three feature groups: 7 linguistic features, 15 word-level gaze features, and 8 context-level gaze features. Combining context- and word-level gaze features gave the best result with 41.19 F1 score.<sup>1</sup> Using only the basic features gave an F1 score of 18.78.

In sum, these analyses show that eye-tracking in a naturalistic reading teaching setup shows a range of gaze behaviours that are also observed in laboratory-based research on eye movements in reading, and that this data may be leveraged for developing automatic analysis of reading. This demonstrates the possibility for eye tracking to contribute directly to practical reading teaching by helping teachers identify and support students' development of reading strategies. Further avenues of research include closer investigation of students' individual profiles, the role of word context, and individual, automatic reading assessment and feedback.

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<sup>1</sup> F1 score balances precision and recall and is a useful evaluation metric when class distributions are skewed.