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Working Memory Capacity and Eye Movement Patterns in Reading: A Correlational Analysis of Regressions in the Slovenian MultiplEYE Dataset

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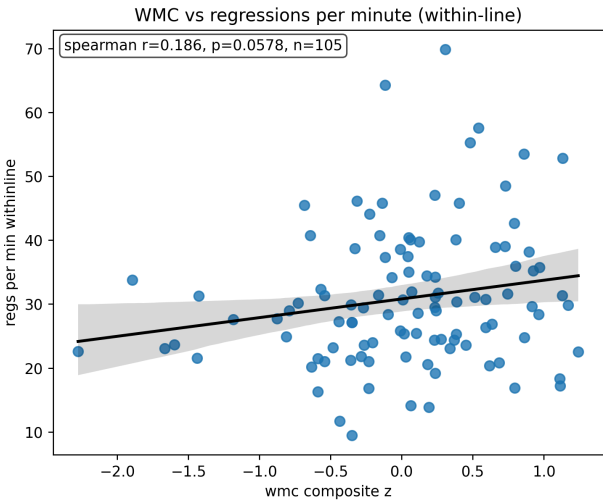
Working Memory Capacity (WMC) reflects an individual's ability to maintain and process information simultaneously and is considered a key factor in reading comprehension efficiency (Daneman & Carpenter, 1980; Just & Carpenter, 1992). Prior research suggests that limited WMC leads to processing difficulties, which may manifest in eye movement behavior such as increased regressions (backward eye movements) (Just & Carpenter, 1992; Rayner, 1998). The present preliminary analysis aims to investigate whether lower WMC scores are associated with a higher frequency of regressions in the Slovenian language in native speakers during reading tasks, focusing on trials where readers demonstrated at least basic text comprehension.

The preliminary analysis is based on eye-tracking data collected in Slovenia as part of the MultiplEYE project. Regressions were extracted from EyeLink saccade events and defined as leftward saccades exceeding 50 pixels within the same text line, with vertical deviation < 30 pixels, then normalized per minute to control for reading time. WMC was operationalized as a composite z-score derived from memory updating, operation span, sentence span, and spatial short-term memory tasks using partial-credit unit scoring. Text understanding was assessed with six comprehension questions after each text and used as a filtering criterion. The dataset included 105 participants and 10 texts from different categories (literary, instructional, popular science, and argumentative), yielding 1050 participant–text observations with comprehension above 60%.

Preliminary results showed a small positive but non-significant association between WMC and regression rate (Spearman's r = 0.186, p = 0.0578; Figure 1). Additionally, we tested whether comprehension was predicted by regressions per minute, WMC, and their interaction, while controlling for text category and accounting for repeated measurements within participants. The results showed no significant effects of regressions per minute, WMC, or their interaction, while text category emerged as the strongest predictor.



The observed trend between WMC and regression rate does not align with the initial assumption that regressions primarily reflect processing difficulty. Some eye movement research suggests that regressions are not exclusively indicators of failure of text understanding but can also reflect adaptive rereading strategies that support integration and comprehension (Staub & Benatar, 2013). In this context, the present trend may indicate that higher-capacity readers may use rereading strategies more frequently. To better understand how WMC relates to eye-movement behavior, the analysis should also test whether the effect is moderated by individual differences in reading skill, examine each WMC component separately, assess whether the effect varies with text difficulty and distinguish between different types of regressions, such as short corrective regressions and long-distance rereading.

References

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