

## Determinants of scanpath regularity in reading

Titus von der Malsburg, Reinhold Kliegl, & Shravan Vasishth (University of Potsdam)  
malsburg@gmail.com

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When people read sentences, the majority of eye movements proceed in one direction. Deviations from this default trajectory have been identified to index low-level oculo-motor constraints, high-level language processing, and age-related changes in perception and cognition. To our knowledge, there exists no study investigating how all these factors interact. We present an analysis of a comprehensive eye-tracking corpus (Kliegl, Grabner, Rolfs, & Engbert, 2004) that investigates how oculo-motor constraints, sentence processing, and aging together determine the regularity of scanpath trajectories in reading. The corpus (the Potsdam Sentence Corpus) consists of 144 simple German sentences that were read by 230 readers which differed in socioeconomic background, education, and age (ranging from 18 to 84). For the analysis, we used a measure that was recently proposed for the analysis of scanpath trajectories in reading (von der Malsburg & Vasishth, 2011). The scanpath analysis recovered effects that have previously been reported in the literature: short words, and syntactically more difficult sentences (as measured by surprisal, and retrieval difficulty) elicit more irregular scanpaths; also, older readers produce more irregular scanpath patterns than young readers. These results validate the scanpath method by von der Malsburg and Vasishth because they demonstrate that the method can recover effects that have previously been found in analyses of traditional eye-tracking measures.

Beyond these expected effects, we also found an interaction of age and the syntactic measures that has not been reported earlier: in older readers the effects of the syntactic processing difficulty are smaller than in younger readers, suggesting a shift in sentence processing strategies as readers age. This is a surprising result given earlier studies of the relation of aging and sentence processing that suggested only minor quantitative differences between old and young comprehenders (Davidson, Zacks, & Ferreira, 2003; Waters & Caplan, 2005). However, our result is consistent with the finding by Christianson, Williams, Zacks, and Ferreira (2006) that older readers may rely to a lesser degree on syntactic bottom-up information than young readers. We interpret the results in terms of shifts towards more risky and expectation-driven processing strategies on the oculo-motor level (c.f. Rayner, Reichle, Stroud, Williams, & Pollatsek, 2006) and the sentence processing level. We also consider the alternative explanation that more frequent lapses of attention in older readers followed by recognition of such lapses and subsequent corrections could cause the age differences observed in scanpath regularity (Wotschack & Kliegl, in press).

## References

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