PUPIL DILATION AS A WINDOW TO ESTONIAN LEXICAL PROCESSING

Background

Pupillometry (i.e. the measurement of pupil dilation) has been a popular method in psychological research, such that greater pupil dilation reflects a larger cognitive load . A few studies have also applied it in lexical processing and shown that less frequent words trigger stronger pupillary response (Kuchinke *et al.*, 2007; Papesh & Goldinger, 2012). However, the research is still relatively sparse and these studies have presupposed similar kind of effects for all participants. We challenged this assumption by studying how lexical properties of the stimuli, such as frequency and orthographic length, influence individual subjects' pupillary response.

Methods

33 native speakers of Estonian (22-69 years, mean age 38) completed a standard word naming study while their pupil dilation was tracked with an eye-tracker. We were interested in two questions: (i) whether pupil size reflects lexical processing costs during word naming, and (ii) whether the costs are the same for each participant.

Results

Using generalized additive mixed regression modeling (Wood, 2006), we identified three types of pupil response patterns during the word naming task. First, there were subjects whose pupil increased both in response to the stimulus onset and articulation offset. Second, there were subjects whose pupil increased only in response to the articulation offset. Third, some subjects showed only a minor increase in pupil response in general. We added group membership as a predictor to the model and observed that it significantly improved the model fit (X^2=83721.693, df=8.000; *p*<0.0001). What our results show is that although for all participants lexical processing is reflected in pupil responses, there are significant differences in the shape, magnitude, and timing of these effects.

Conclusion

In summary, pupil size can be successfully used to measure lexical processing. However, inter-participant variability should be taken into account (see Roehm et al. 2007 for similar conclusions in EEG research). Future research is needed to determine what triggers these differences (see Kuperman & Van Dyke, 2011 for individual differences in processing due to reading ability).

Reference

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