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Eye movement correlates of foreign language proficiency in Russian learners of English. *Valeria Demareva*^{*1}, *Sofia Polevaia*^{1,2}, *Julia Edeleva*³.

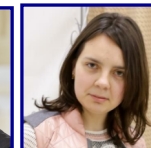
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SUMMARY

- The study tests the assumption that eye movement features of people with a high level of foreign language skills are similar during text reading in native and foreign languages.
- We offer new Eye Tracking based evaluation metrics for the level of language proficiency.

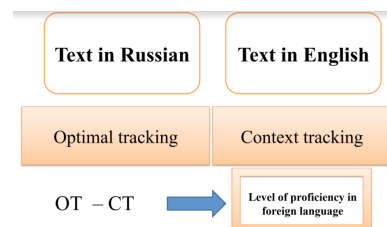
INTRODUCTION

Measuring language proficiency is required for many purposes. One possible application is in the field of recruitment. Another significant area is foreign language teaching and learning. In either case, the most widely used assessment procedure is testing. Such tests can take 2-5 hours and imply subjective evaluation of soft facts by specialists. However, today new instrumental methods of measuring language competence are available, where Eye Tracking (ET) is implemented for interactive monitoring of eye movements during reading. The interpretation of ET data is based on the assumption that the complexity level (objective and subjective) of working with a text is reflected in eye movements and can be recorded by ET.

References
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APPROACH

We hypothesized that the difference in eye movements when reading two texts with the same objective complexity reflects subjective factors, namely, the reader's individual level of language proficiency.



METHODS

22 students of Lobachevsky State University of Nizhny Novgorod aged 21-25 took part in the present study.

In the first stage the level of English was determined with the help of a Placement test.

For the second stage of the experiment recording of eye movements was carried out with the help of eye tracking SMI HiSpeed, with frequency binocular survey of 1250 Hz, a PC-based software SMI Experiment Suite 360[®] and iView v. 2.0.1. The calibration area was 1280*960. The recording was done for two eyes (binocular).

The texts of comparable objective complexity and meaning in Russian (L1) and English (L2) used as visual stimuli were displayed on a calibrated (gamma corrected) computer monitor

The Russian text consisted of 43 words, 6 sentences, 9 lines, the average number of characters per line was 24. The English text consisted of 53 words, 6 sentences, 8 lines, the average number of characters per line was 26. All the instructions, explanations, as well as reading comprehension questions to L1 and L2 were given in Russian.

RESULTS

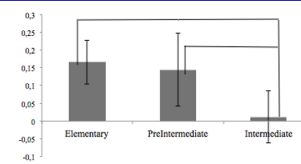


Fig. 1. Average difference coefficients (K_{SA}) for amplitude of saccades (SA) in students with different English language proficiency performing L1 (SA L1) and L2 (SA L2) reading.

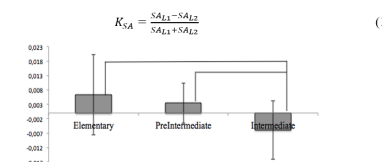


Fig. 2. Average difference coefficients (K_{PD}) for pupil diameter (PD) between students with different English language proficiency performing L1 (PD L1) and L2 (PD L2) comprehension tasks.

ANALYSIS

The amplitude of saccades was significantly greater in the "Intermediate" group than in the "Elementary" ($U=13$, $p=0.036$) and the "Pre Intermediate" ones ($U=4$, $p=0.035$). The fixation duration of students performing L2 comprehension task is significantly shorter in the "Intermediate" group than in the "Elementary" one ($U=14$, $p=0.045$).

The difference in saccade amplitude between L1 and L2 reading is much larger for students with Elementary level of English as compared to the other groups. Their saccade amplitude observably decreases for L2 reading. The difference coefficient (1) for the "Intermediate" group is smaller than in the "Pre-Intermediate" ($U=3$, $p=0.002$) and the "Elementary" ones ($U=5$, $p=0.042$) – see Figure 1.

As subjects with Elementary level were searching for answers to questions in texts their pupil diameter was bigger when they performed L1 Comprehension, while "Pre Intermediate" and "Intermediate" groups were characterized by an inverse pattern: the difference coefficient (2) in the "Intermediate" is smaller than in the "Pre Intermediate" ($U=14$, $p=0.045$) and the "Elementary" ($U=6$, $p=0.05$) ones - see Figure 2.

DISCUSSION

The following ET features correspond to the Intermediate level of English:

- 1) High saccade amplitude values when text reading in English;
- 2) Low fixation duration values when looking for answers in an English text;
- 3) The same or insignificantly decreased amplitude of saccades during text reading in English in comparison to text reading in Russian;
- 4) The same or bigger pupil diameter when performing comprehension tasks for English as compared to pupil diameter during comprehension in Russian;
- 5) The same fixation duration when performing comprehension tasks for English as compared to duration of fixations during comprehension in Russian.

CONCLUSIONS

1. The ET features of subjects with relatively high level of foreign language skills are similar when working with texts in their native and foreign languages.
2. This enables the implementation of new metrics where a text in a native language defines the "base line" in terms of ET values and the evaluation of foreign language competence is based on the difference in the amplitude of saccades, fixation duration, and pupil diameter when working with native and foreign language texts.

ACKNOWLEDGMENTS

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