

Features of eye movements in
reading texts by Russian-speaking
students with different levels of
language proficiency

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Eye-tracking school, 2015

HYPOTHESIS

Text in Russian

Text in English

Optimal tracking

Context tracking

OT – CT

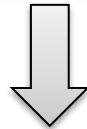


**Level of proficiency in
foreign language**

Language proficiency assessment by Eye Tracking



Through working with
texts

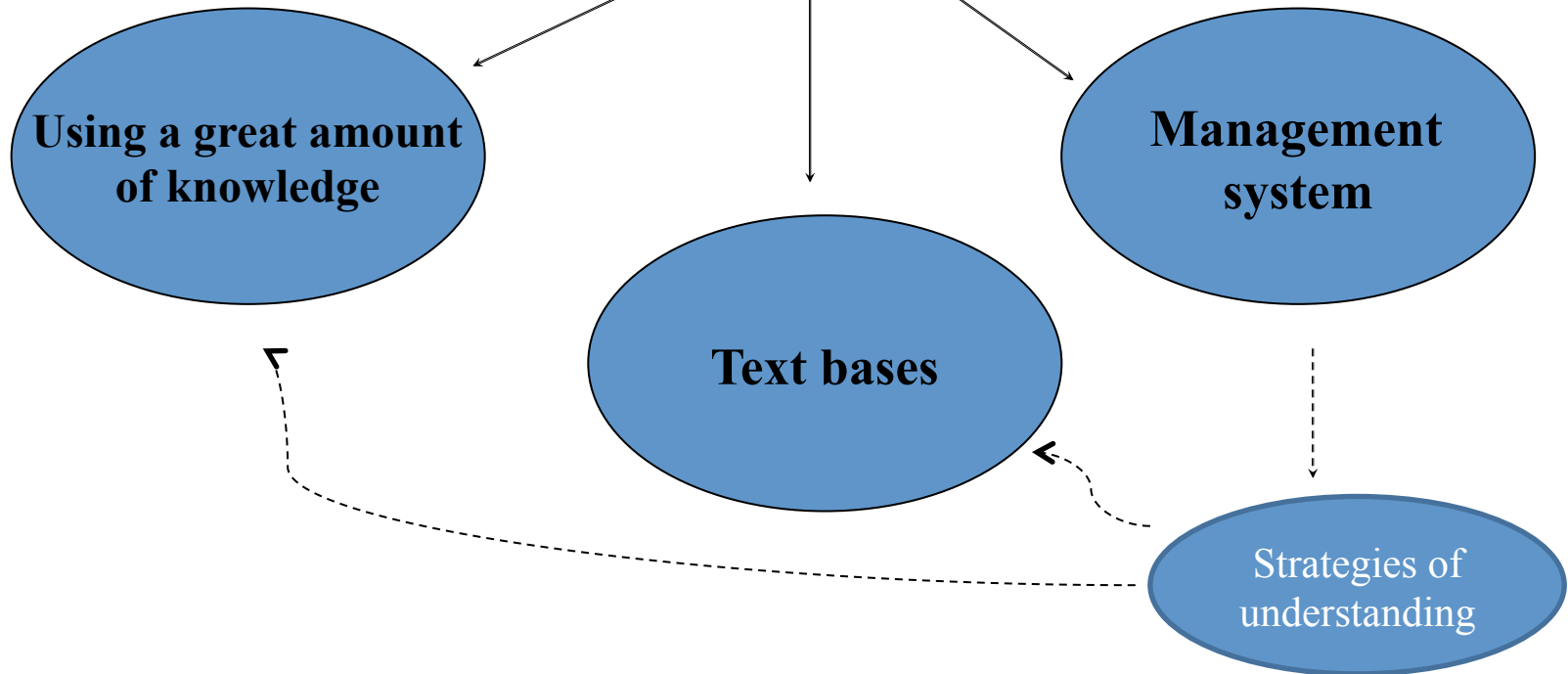


Working with a text ↔ Text
understanding

According to N.N. Leontyeva the result of text understanding is forming a semantic structure of a text:

- Linguistic structure of sentences of text (local understanding).
- Semantic networks of a text (global blurred understanding).
- Information structures of a text (global generalized understanding).
- Database structure and knowledge (selective special understanding) (Leontyeva, 2006).

Situational model of text understanding (T. A. Van Deik & V. Kintch)



The use of knowledge in understanding the text refers to the ability to relate to the lyrics of some existing structures of knowledge on which a model of the situation is based and created (Schank,1979)

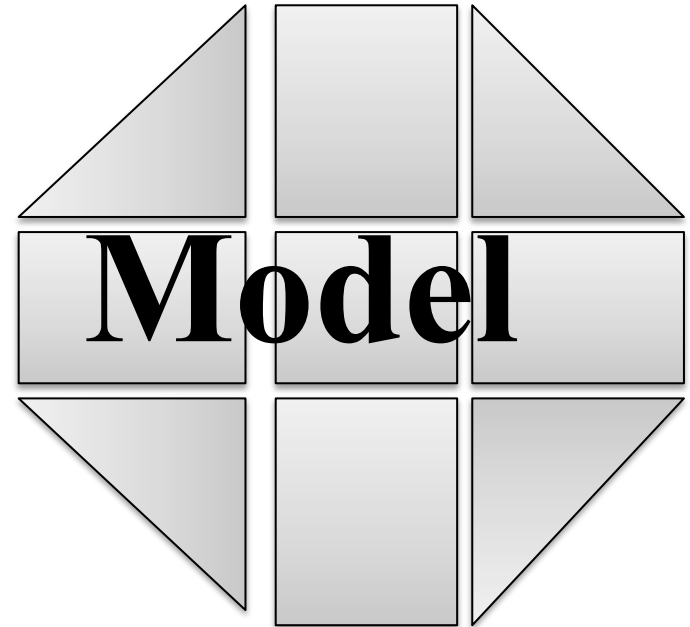
So, **text understanding** is impossible without using strategies & text bases.

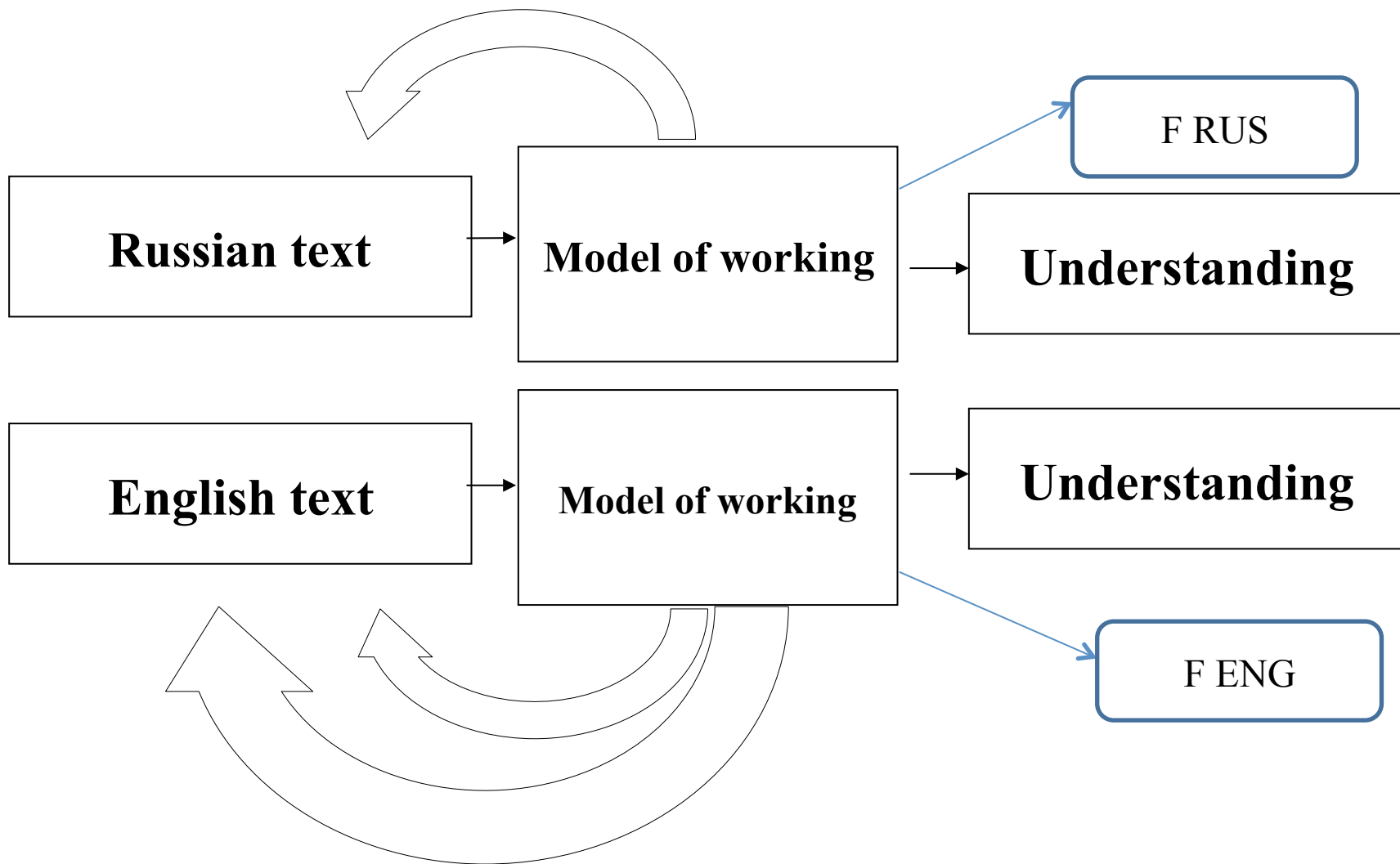
This comprises **a model of working** with a particular text.

Using Eye Tracking we can try “**to measure**” the work of this model...

and **compare** the models of working with texts in different languages.

**Learning a
language**





F – parameters of eye movements while working with a text

Difference of eye movements

$$\Delta F = F_{\text{rus}} - F_{\text{eng}}$$

It's the difference of eye movements while working with texts in different languages.

F – parameters of eye movements while working with a text

Comparing 2 groups:

1. High proficiency group:

$$\Delta F_{hp} = \Delta L + \Delta M1$$

2. Low proficiency group:

$$\Delta F_{lp} = \Delta L + \Delta M2$$

$$\Delta F_{hp} - \Delta F_{lp} = \Delta L + \Delta M1 - \Delta L - \Delta M2$$

$$\Delta F_{hp} - \Delta F_{lp} = \Delta M1 - \Delta M2$$

ΔL – difference of languages

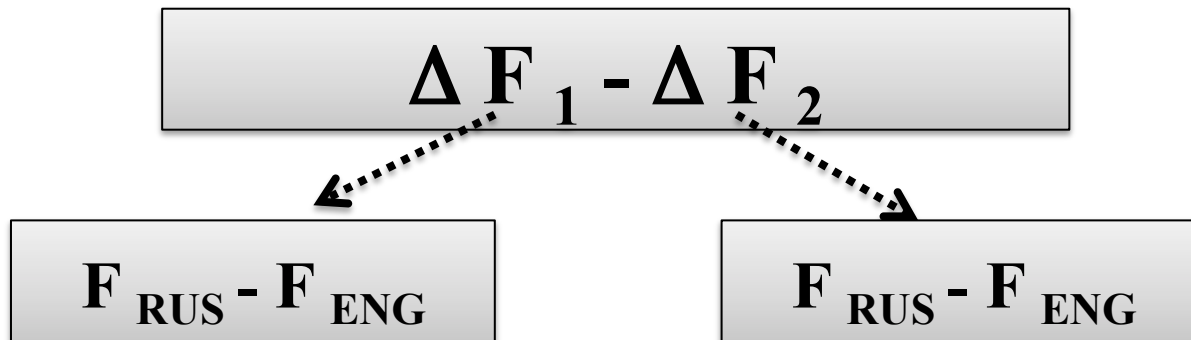
$\Delta M1$ – difference of models used by people with high level of English while reading in English and

$\Delta M = M_{rus} - M_{eng}$

Russian
 $\Delta M2$ – difference of model used by people with low level of English while reading in English and Russian

F – parameters of eye movements while working with a text

So, ΔF depend on difference of differences of models used while reading and doesn't depend on difference in languages



F – parameters of eye movements while working with a text

Experimental data

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Stages of experiment

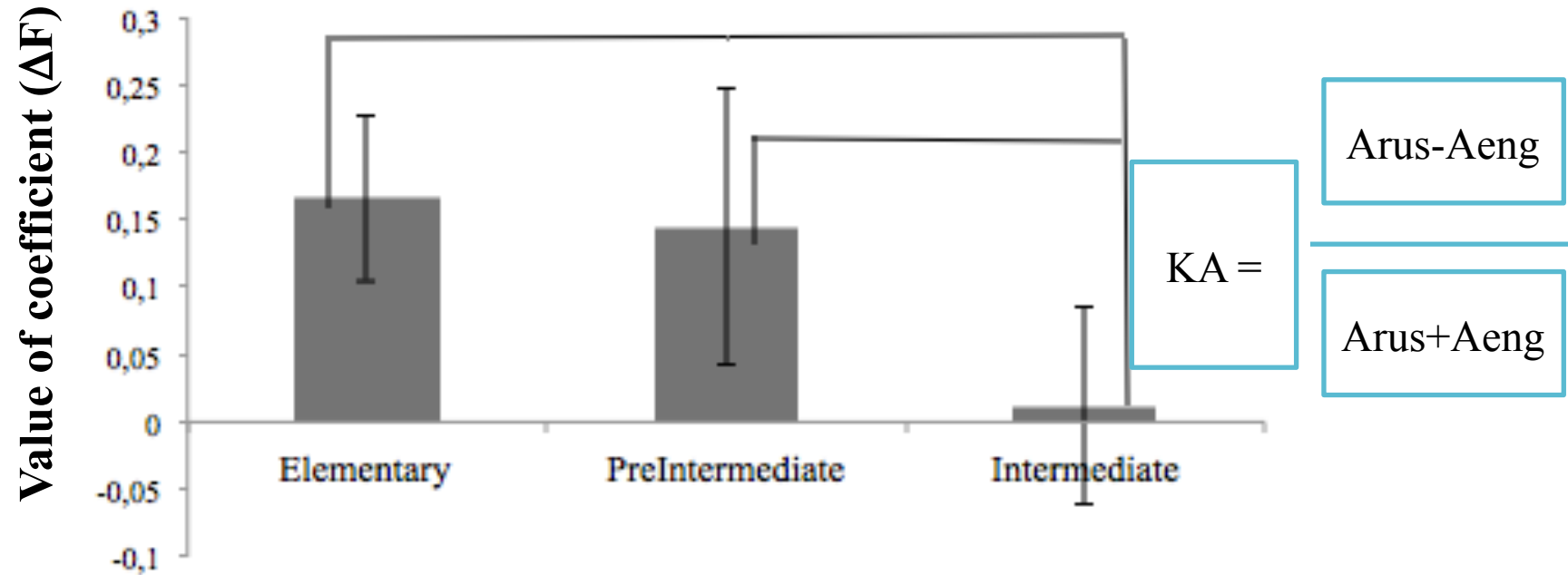
1. Evaluation of language proficiency
2. Eye Tracking while reading English & Russian texts
3. Eye Tracking while searching for an answer in the text

Stimuli

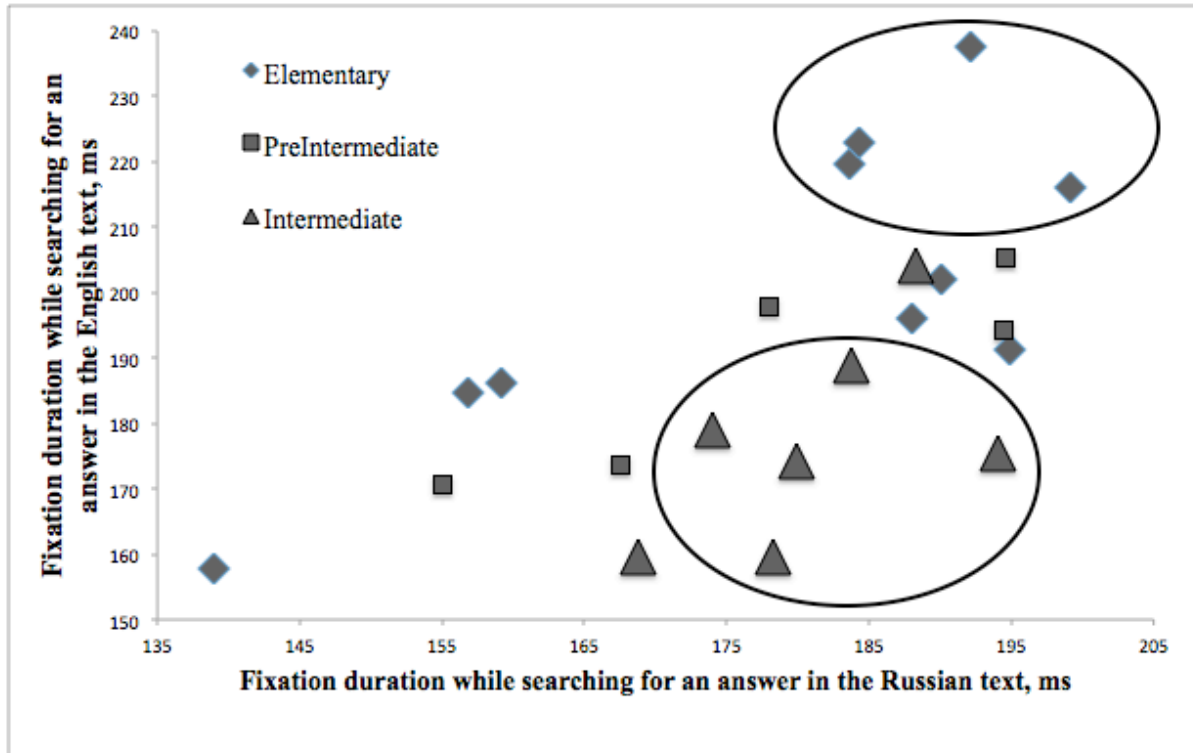
You have got 5 fruits in the basket: 2 oranges, 2 pears and 1 pineapple.
Take the big orange and put it on the plate. Put the pineapple there, too. Put the red pear into your left pocket. Put the little orange into your right pocket. Put the green pear on the table.

В корзине 5 предметов: 2 яблока, 2 ветки винограда и 1 лимон.
Выбери красное яблоко и положи в правый карман. Потом туда же положи ветку зеленого винограда. Зеленое яблоко положи в левый карман. Лимон положи на стол. Ветку красного винограда положи на тарелку.

Connection between score for English & amplitude coefficient (in reading)

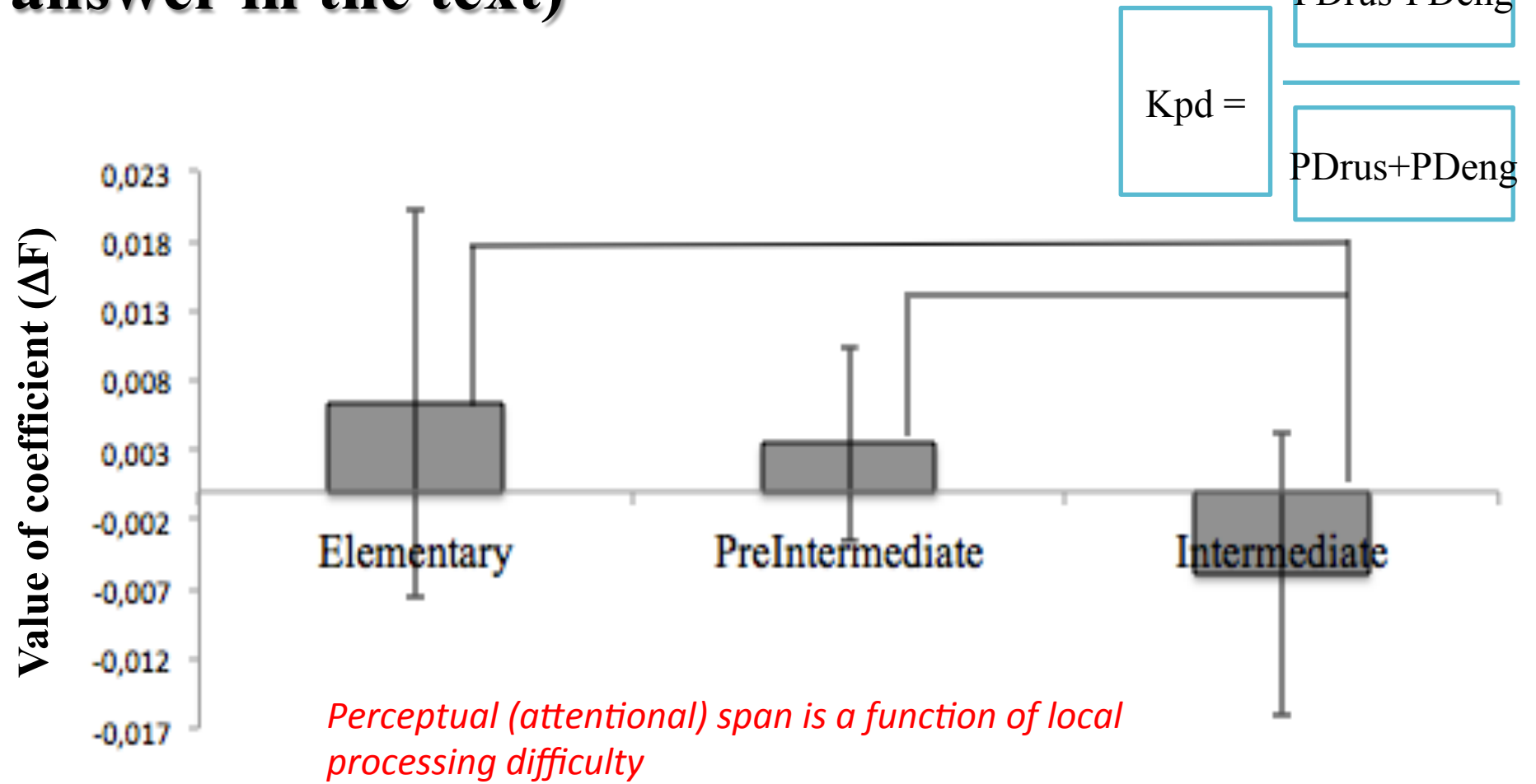


Fixation parameters while searching for answer in Russian and English texts

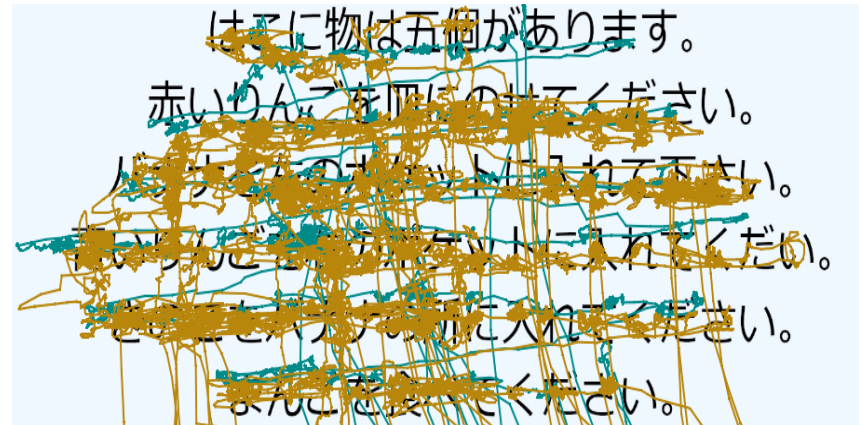
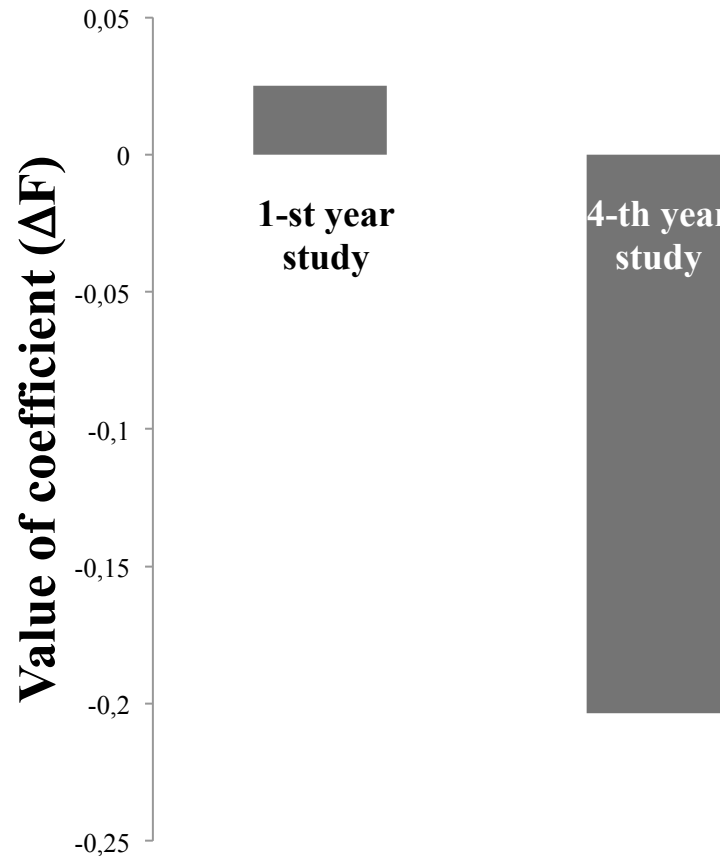


*We can mark the fixation parameters specific for Elementary level: bigger fixations while working with English text comparing with Russian.
The fixation parameters specific for Intermediate level are: the same value of fixation duration while working with both texts.*

Connection between score for English & pupil diameter (in searching for an answer in the text)



Results (Japan language)



Parameters of eye movements can be informative when we need to evaluate language proficiency.

Difference coefficients of parameters while working with native & foreign texts are the most important.

Text in Russian

Text in English

Optimal tracking

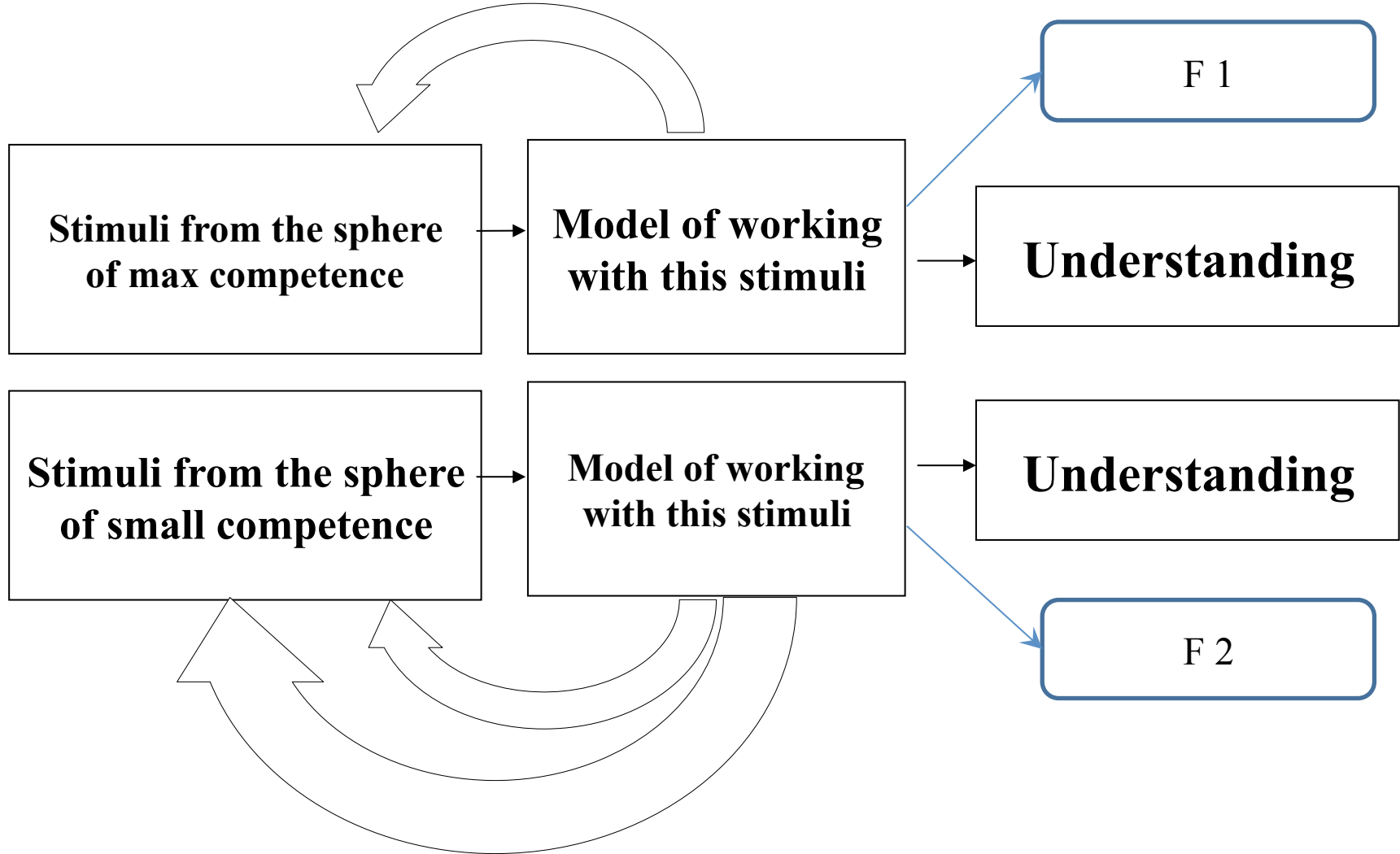
Context tracking

OT – CT



**Level of proficiency in
foreign language**

Activity with different levels of competence



**Stimuli from the
sphere
of max competence**

**Stimuli from target
context**

Optimal tracking

Context tracking

OT – CT



**Level of competence in
target context**

So, by using **such approach** we can value **not only language competence** but also professional.

Conclusions:

1. Parameters of eye movements can be informative when we need to evaluate language proficiency.
2. Different coefficients of parameters while working with native & foreign texts are the most important.
3. We found the following informative parameters:
 - a) Amplitude of saccades
 - b) Fixation duration
 - c) Pupil diameter while searching for an answer in the text

CORPUS ANALYSIS AND EYE MOVEMENTS IN READING

Eye-tracking school, 2015

*It is experimentally shown that one of the most important objective factors of heterogeneity in the distribution of fixations of the text is its frequency structure [Juhasz, Liversedge, White, Rayner, 2006], and **the distribution of fixations is a function of the frequency of words and lexical uniqueness [Rayner, Duffy, 1986].***

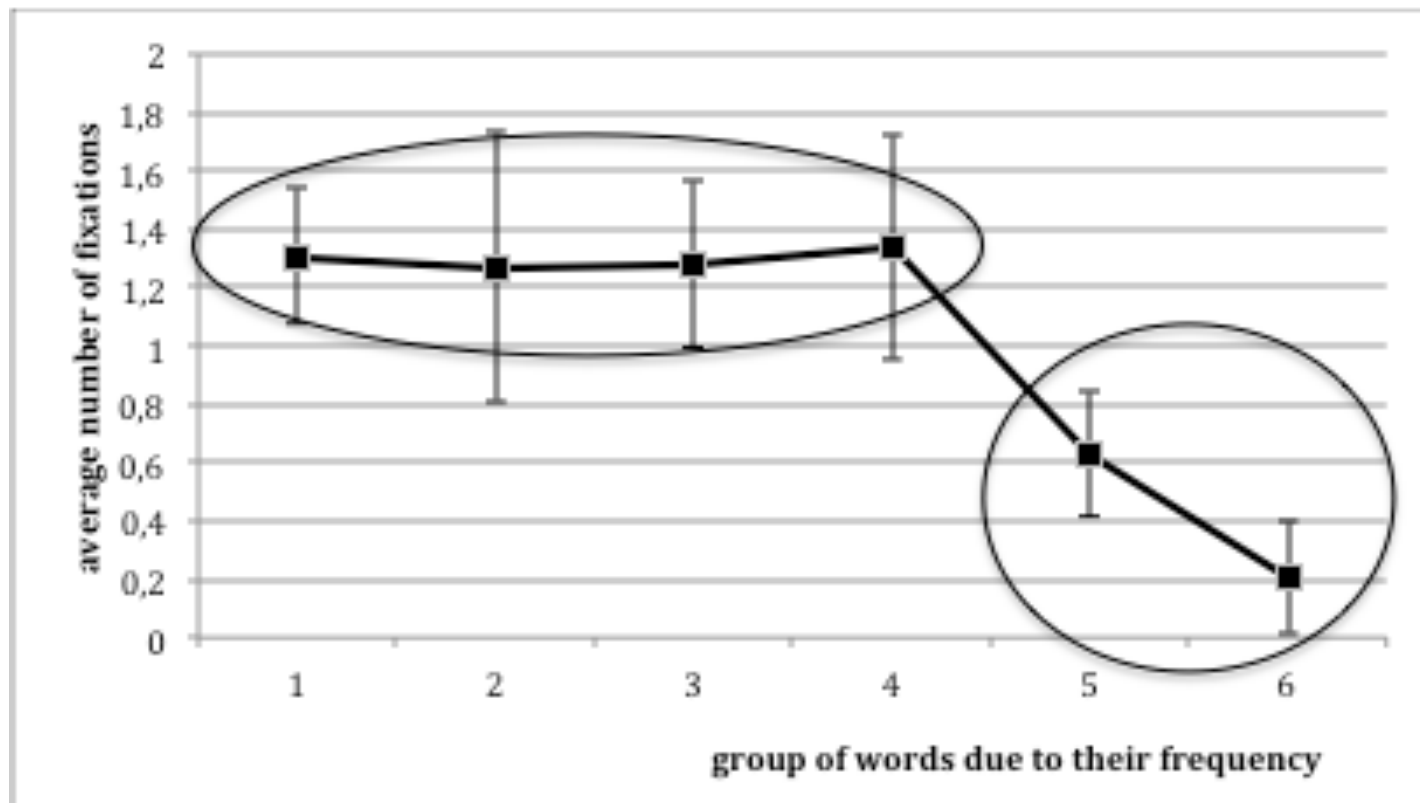
Materials

- 102 eye-tracking recordings of 17 volunteers aged 19 to 23 years (2 males and 15 females).
- 6 texts were used as stimulus material: one text in Russian (43 words), five texts in English (41, 53, 51, 50, 53 words, respectively).
- 9 people had Elementary, 8 people - Intermediate and Upper Intermediate level. Further, the results were treated in two groups of subjects: “Elementary” and “Intermediate and above”.

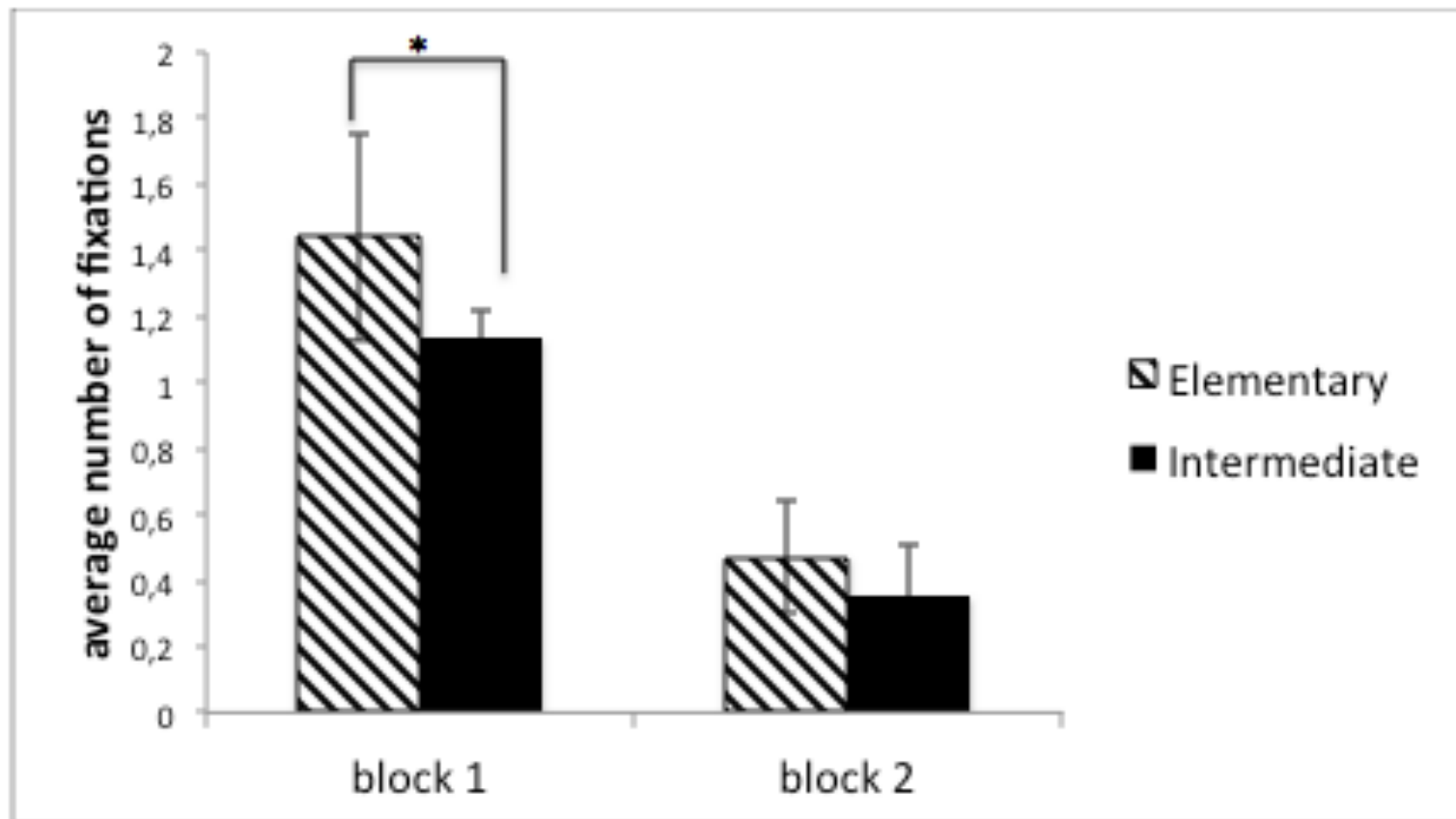
Range of frequency for groups of words 1-6 in the Russian text

Group №	Range of frequency
1	0,000000076-0,000000292
2	0,000000425-0,000000546
3	0,000000971-0,00000162
4	0,000002405-0,000003334
5	0,000012436-0,000088872
6	0,0003493-003874386

The dependence of the average number of fixations on groups of words by frequency in reading the Russian text (oval marked "high" and "low-frequency" words).



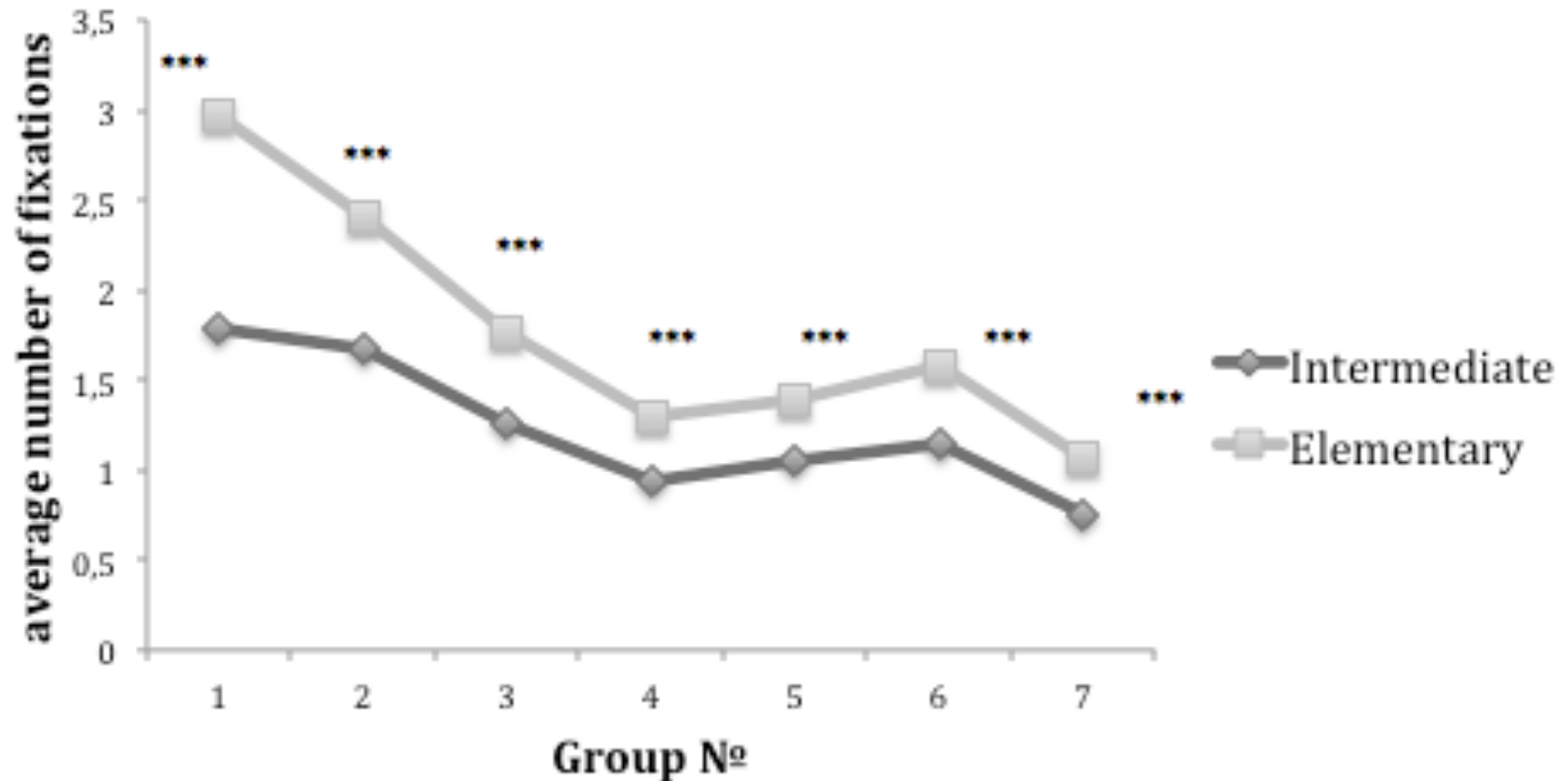
Average number of fixations on blocks 1 and 2 in reading the Russian text as a function of the level of English proficiency



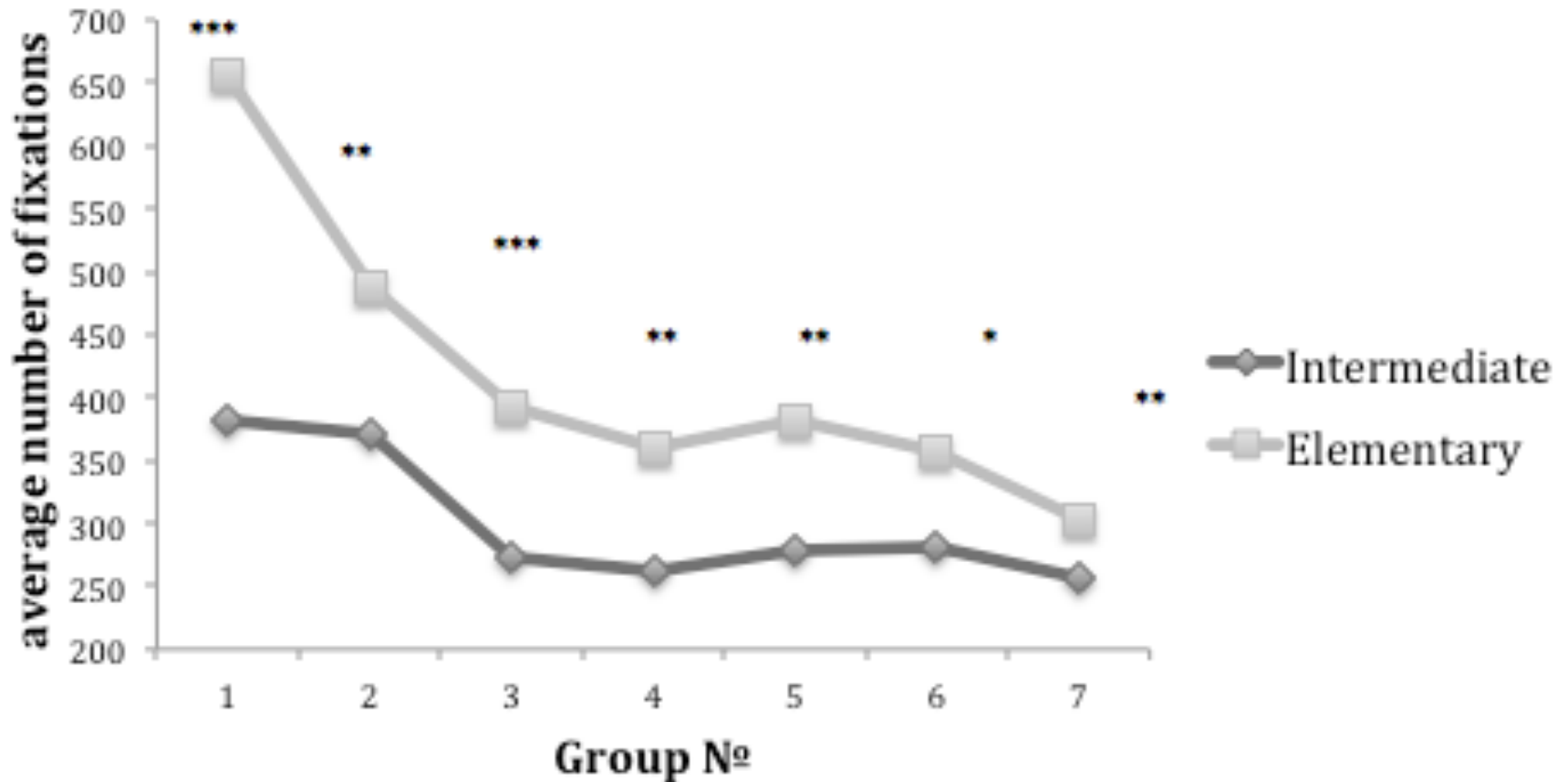
Range of frequency for groups of words 1-7 in the English text

Group №	Range of frequency
1	0,00000004-0,00001688
2	0,00002113-0,00005055
3	0,00007024-0,00020924
4	0,00022393-0,00044641
5	0,00056681-0,00089831
6	0,00111902-0,00516591
7	0,00661498-0,02136923

Average fixation duration as a function of a group of words in the English text in subjects with Elementary and Intermediate level



Average fixation duration as a function of a group of words with different frequency in reading English texts by the subjects with Elementary and Intermediate level



Conclusions

- The study clearly replicated the previously reported additive effects of the two variables in the eye movement record: low-frequency words increased fixation durations compared to high-frequency words.
- Namely, the study showed that the frequency structure of the Russian text affects the distribution of fixations in reading, like other scientists have demonstrated for the English language [Inhoff, Rayner, 1986] [Rayner, Duffy, 1986].
- In reading the Russian text by the Russian-speaking students there is the same relationship: the higher is the frequency of the word, the more and longer fixations are made.

Conclusions

- The study found that people with a level of Intermediate make fewer fixations on low-frequency words in the Russian text (which shows the distortions introduced by the study of a second language in the process of working with a text in their native language)
- People with the level of Elementary make a great number of fixations, and make it longer on **each** frequency-group in the English text.

*Thanks' for
attention!!!*

