

# Eye-movement Comparison in Reading in Deaf and Hearing Russian Sign Language Speakers

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## Why is it important to study reading in deaf population?

466 million deaf people worldwide

For several reasons most of the deaf people have poorer reading skills and lower literacy rate than hearing people of the same age

## Deaf individuals' features in perception and reading

### Advantages:

- Perceive most of the information with their eyes  
→ have improved visual perception
- May be bilinguals

### Possible disadvantage:

- Hearing impairment → later language acquisition  
→ poor language skills → difficulties in learning to read

## Two types of sign language speakers

### Deaf people:

- Have **no** access to sounds.
- Do **not** rely on phonological codes while reading.

### Hard-of-hearing people:

- Have access to sounds.
- May rely on phonological codes while reading.

## Goals of the current study

- To find out whether there are any differences between deaf and hearing Russian Sign Language speakers in eye movements while reading.
- To find out whether hearing Russian Sign Language speakers also have enhanced peripheral vision that assists them in reading.



## Reading experiment

### Equipment:

Desktop eye tracker “Eyelink 1000+”.

### Participants:

13 hard-of-hearing users of both speech and sign language (M age = 25)

13 deaf, using only sign language (M age = 29)

### Materials:

144 sentences from the Russian Sentence Corpus

In 58% of cases - questions about the content of the sentences

Average sentence length = 9 words

### Example of the sentence:

The road leads into the deep forest, winding along the slopes.

### Question and suggested answers:

Where does the road lead?

Into the forest

Into the garden

Into the village

## Visual attention experiment

### Equipment:

Desktop eye tracker “Eyelink 1000+”.

### Participants:

9 hard-of-hearing users of both speech and sign language (M age = 23)

13 deaf, using only sign language (M age = 29)

### Materials:

64 images

### Task for participants:

The participants had to remember a picture, and then identify it among the others.



## Results

### 1. Reading experiment

No significant differences between deaf and hearing groups were found in the following parameters:

- First fixation duration
- Single fixation duration
- Gaze duration
- Second pass reading time
- Total word reading time
- Skipping rate
- Probability of fixating word once
- Probability of fixating word more than once
- Saccade landing position
- Number of fixations on word

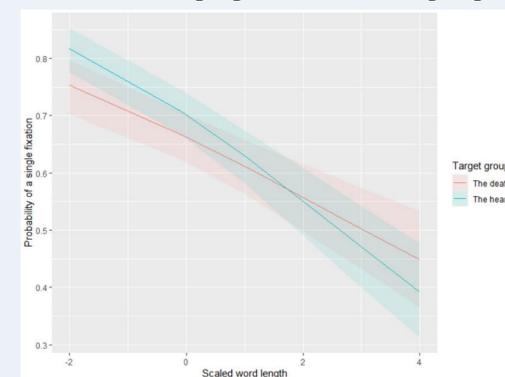
Significant differences between deaf and hearing groups that may indicate less-skilled reading level in deaf individuals:

- Lower comprehension questions response accuracy in deaf individuals (70% vs. 80% for hearing individuals).
- Short and semantically simple words such as conjunctions, particles, and prepositions facilitate reading for deaf individuals more than for the hearing.

Indication of improved peripheral visual perception in deaf individuals:

Deaf individuals are more likely than the hearing to have one fixation on a long word.

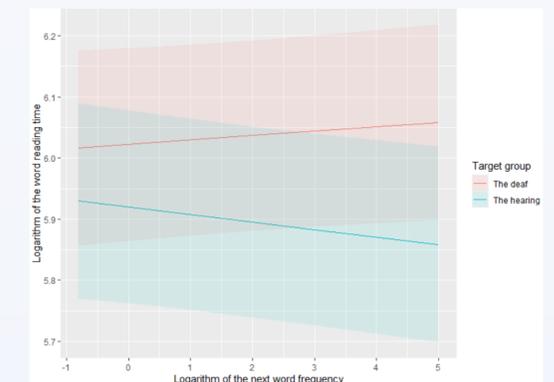
If the current word is a highly frequent one, then the next word is preprocessed in the periphery.



Indication of improved peripheral visual perception in the hearing:

If the next word is a highly frequent one, then the following parameters decrease:

- duration of the first fixation on the current word
- number of fixations on the current word
- second pass reading time
- total word reading time



### 2. Visual attention experiment:

No significant differences between groups in the reaction time in finding target images in any of the conditions (full-screen search and search in conditions with limited fields of perception).

## Conclusions

- Mostly deaf and hearing Russian Sign Language native speakers have comparable reading skills.
- Both deaf and hearing individuals are able to extract information in the periphery effectively while reading. But neither group benefited in visual search task.

Both groups have an enhanced peripheral vision

Or

Both groups can effectively extract information while reading, but do not have enhanced peripheral vision