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EMPIRICAL STUDIES IN PSYCHOLOGY

MAY 13– 16th, 2021
FACULTY OF PHILOSOPHY, UNIVERSITY OF BELGRADE

INSTITUTE OF PSYCHOLOGY
LABORATORY FOR EXPERIMENTAL PSYCHOLOGY
FACULTY OF PHILOSOPHY, UNIVERSITY OF BELGRADE

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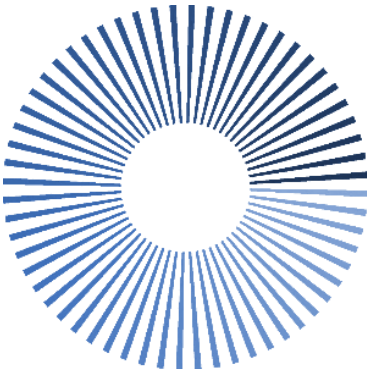
Institute of Psychology, Faculty of Philosophy, University of Belgrade



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Belgrade, 2021

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TUNING FORKS (E. Zimmermann, Leipzig – Berlin)
Instruments for generating tones of a given frequency. They are used in studies of auditory sensitivity for determining the differential, absolute and upper thresholds. Figure shows a set of three tuning forks generating the C-major chord, each fork generating the tones of 256 Hz (c^1), 320 Hz (e^1), and 384 Hz (g^1) respectively. The forks were tuned to the pitch of the originals from the German Physico-Technical Imperial Institute (Phys.-techn. Reichsanstalt).

Effect of Visual Degradation on the Processing of Latin and Cyrillic Words

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Abstract

The word processing begins with visual discrimination and accurate identification of individual letters. Letter processing is based on perceptual processing of their integral features. It was founded that not all features have the same importance in that process. The aim of this research is to examine importance of specific features in recognition Serbian words written in two different alphabets – Cyrillic and Latin. In different experimental situations 60 words and 60 pseudo-words were presented in isolation in the task of lexical decision. 37 subjects, who first learned Cyrillic alphabet and did not have preferred alphabet, took part in the experiment. Unexpectedly, results showed that the reaction time for processing Cyrillic and Latin words degraded at the junction level is shorter than for non-degraded words. The results can be partially explained by the interactive activation model.

Keywords: visual degradation, word processing, Latin, Cyrillic

Introduction

In Serbian language, the same word can be written using one of the two simultaneously utilized alphabets, Cyrillic and Latin. A review of previous research indicates that there are differences in their processing (Vejnović & Jovanović, 2012; Vejnović, Dimitrijević, & Zdravković, 2011; Pašić, 2004). Some studies have examined visual level of description in word recognition and it's relation to phonological level. It was determined that fluent readers do not give preference to the visual word-specific strategy. Subjects can not eliminate the phonological strategy, even when it was detrimental for performance (Feldman, 1981). The findings also suggest that word recognition in the terms of phonology is independent of lexical entries, and is sensitive to component orthographic structure (Feldman & Turvey, 1983). On the other hand, there is a series of research in other languages that is completely focused on the visual aspect of word recognition based on feature analysis (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; McClelland & Rumelheart, 1981). Their main assumption is that features are basic level in process of activation of word-level representations. The model that best explains this view is interactive activation model. According to this model, the processing of information during reading includes three levels (feature level, letter level and word level). Information can go in both directions, from lower to higher level and from higher to lower. There are excitatory and inhibitory two-way connections between each of the two levels (McClelland & Rumelheart, 1981; Rumelheart & McClelland, 1982). Since the processing begins with features, the question is whether different types of features are equally important in letters and words recognition. One way to test this is to degrade or hide them and record processing speeds. The main idea of such procedure is that removing the specific visual part of feature that are important for the identification, will reduce the processing efficiency. In studies conducted in other languages, it was determined that the ends (terminal parts) of lines represent important features for recognizing individual letters. Horizontal lines are also important components in recognition, although their influence was smaller. This can be explained by the fact that they are not present in every letter (Fiset, Blais, Arguin, Bub, & Gosselin, 2008). In experiments conducted by Lanthier and co-workers (Lanthier, Risko, Stolz, & Besner, 2009), it was found that removing the junctions in isolated presented letter has a more negative effect on processing speed than removing the middle parts. But, in an experiment in which there was no time limitation in stimulus exposure, the junctions and middle parts of the letter lines were of equal importance.

Our research seeks to examine the degradation effect on Latin and Cyrillic word processing. Specifically, the main goal of the study is to determine whether same feature is equally important for both Latin and Cyrillic letters and words recognition. The focus is on junctions because they indicate the relations between parts of letter. If junctions contain key information for recognition, their removal should make word processing significantly slower.

Method

Participants

Thirty-seven subjects, students of the University of Banja Luka, participated in the experiment. All participants reported that Cyrillic was the first alphabet they learned, as well as that they used both alphabets equally in reading and writing. All subjects had normal or corrected to normal vision.

Materials and Design

Two factors were varied in the experiment - *alphabet* (Cyrillic, Latin) and *visual degradation* (degradation at the line junctions, absence of degradation). The lexical decision task was used. The stimuli were 6-charcters long words and pseudo words; words were masculine nouns in the nominative singular. All stimuli were written in lowercase in Arial font 48. Examples of stimuli are shown on Figure 1.

Procedure

The subjects were shown stimuli on a computer screen. Their task was to answer whether a stimulus was a word or a pseudo-word. Participants were divided into four groups according to the type of shown stimuli: Latin non-degraded and degraded stimuli and Cyrillic non-degraded and degraded stimuli. The total number of trials for each participant was 120 (60 words and 60 pseudo-words) with 6 additional trials for the exercise. Both reaction time and the percentage of errors were measured. Experimental session lasted approximately 15-20 minutes per participant.

Figure 1. Examples of stimuli

Results

The effect of visual degradation on word processing speed was observed ($F(1,2216)=56.119$, $p<.001$, $\eta^2=.026$). Effect of alphabet was not statistically significant ($F(1,2216)=.897$, $p>.05$). With Scheffe post hoc analysis average reaction time were classified into two groups - (1) degraded Cyrillic words (830.2 *ms*), degraded Latin words (831.1 *ms*) and (2) non-degraded Cyrillic words (909.1 *ms*), non-degraded Latin words (933.6 *ms*).

Contrary to the initial assumption, the reaction time for processing degraded words was shorter than for non-degraded ones. The same effect is present in both Latin and Cyrillic words (Figure 2).

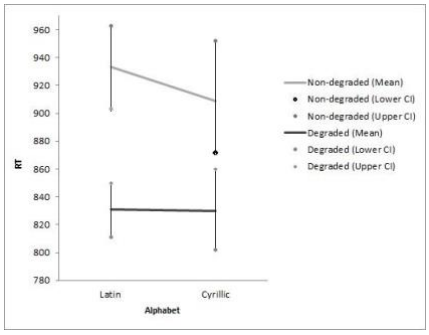

Figure 2. Reaction time depending on the *alphabet* and *visual degradation* of words

The same analysis was done for pseudowords. The effect of degradation on reaction time was not obtained in pseudowords ($F(1,2216)=2.048$, $p>.001$), but there was statistically significant effect of alphabet ($F(1,2216)=50.475$, $p<.001$, $\eta^2=.023$). A statistically significant interaction between the manipulated factors was also obtained ($F(1,2216)=27.759$, $p<.001$, $\eta^2=.013$). Degraded Latin pseudowords were processed faster than nondegraded. On the other hand, the reaction time is significantly longer for processing degraded Cyrillic pseudowords compared to non-degraded (Figure 3).

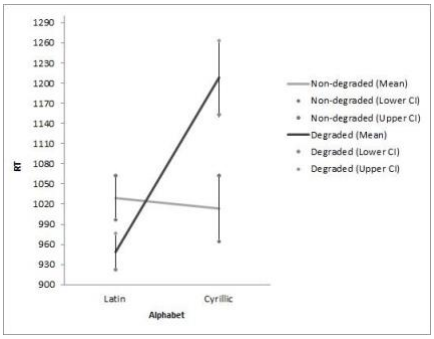

Figure 3. Reaction time depending on the *alphabet* and *visual degradation* of pseudo words

In terms of accuracy, the obtained results showed a similar pattern. In the word processing analysis, only effect of degradation on the accuracy of the answer was obtained ($F(1,2216)=28.056$, $p<.001$, $\eta^2=.013$). More errors were present in degraded words than in non-degraded ones. Contrary to that, there is no effect of degradation on accuracy in the processing of pseudo words, but the effect of alphabet was statistically significant ($F(1,2216)=64.046$, $p<.001$, $\eta^2=.029$). The obtained results also showed a significant interaction of degradation and alphabet (($F(1,2216)=8.7856$, $p<.01$, $\eta^2=.004$). More errors were observed in degraded Latin pseudo words.

Discussion and conclusion

The word processing begins with visual discrimination and accurate identification of individual letters. It was found that efficient letter processing is based on perceptual processing of their individual features, wherein all the features do not have the same significance. This study examined the effect of degradation at the junctions of letter lines on the processing speed, assuming that they could be important sources of information needed to identify letters. We also wanted to examine whether this feature is equally significant for recognition of Latin and Cyrillic letters and words. Although it was expected that the processing will slow down, the results showed just the opposite. Degraded words, both Latin and Cyrillic, are processed faster than whole words. The negative effect of degradation appeared only in Cyrillic pseudo-words. The results can be partially explained by the interactive activation model. According to this model, the processing of words includes three levels – feature, letter and word level. The flow of information starts at the feature level where the basic visual feature of each letter in the word is detected (McClelland & Rumelheart, 1981). Then excitatory or

inhibitory activation spreads to hierarchically higher levels. This model also explains the effect of word superiority, which refers to the fact that people recognize letters faster and easier if they are presented in words than when they are presented in isolation (Rumelhart & McClelland, 1982). At the lowest level of features, it is possible that this type of degradation activates the perceptual principle of closure that contributes to the spread of excitatory activation and speeds up processing of words. Similar results were obtained by Lantier et al. (2009). They found that removing junctions in individual letters significantly slowed down the recognition time. However, when such degraded letters were part of the whole word, such a detrimental effect was not observed. The results obtained on the pseudo words differ for two alphabets. The processing time pattern is repeated for Latin words, but in case of Cyrillic pseudo words degradation slowed reaction time.

Although the results of this study did not confirm the initial assumption, future studies should examine the degradation effect on words with different frequency as well as the degradation effect of different features on words processing.

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