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LATERALIZATION OF NON-WORD PROCESSING IN MONOLINGUALS

*Латералізація обробки невизначено вимовлених
слів монолінгвами*

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Abstract

A great bulk of research in the psycholinguistic literature has been dedicated to hemispheric organization of words. An overwhelming evidence suggests that the left hemisphere is primarily responsible for lexical processing. However, non-words, which look similar to real words but lack meaningful associations, is underrepresented in the laterality literature. This study investigated the lateralization of Turkish non-words. Fifty-three Turkish monolinguals performed a lexical decision task in a visual hemifield paradigm. An analysis of their response times revealed left-hemispheric dominance for non-words, adding further support to the literature. The accuracy of their answers, however, were comparable regardless of the field of presentation. The results were discussed in light of the psycholinguistic word processing views.

Key words: *monolinguals, non-word processing, lateralization, psycholinguistics.*

Introduction

The field of psycholinguistics investigated lexical processing and its brain correlates extensively. It has been confirmed that the left hemisphere is primarily responsible for lexical processing. For example, the bigger size of the left Planum Temporale, known as

the Wernicke's area, relative to its counterpart in the right hemisphere has been taken as evidence for left hemispheric dominance (Lieberman, 2002; Toga & Thompson, 2003; Frost et al., 1999; Hellige, 2001: 35-40; Hugdahl, 2005). More evidence was obtained from dichotic listening tasks, in which words were presented from both ears simultaneously (Hugdahl, 2005). Visual hemifield studies also confirmed this view (Jordan, Patching & Milner, 2000). The left hemisphere is known to be the mental lexicon where abstract word representations are located (Deason & Marsolek, 2005). The neuroarchitecture of the left hemisphere lends itself to parallel processing of words (Babkoff, Faust & Lavidor, 1997). In the literature, among a variety of experimental paradigms, lexical decision tasks have been used to reveal hemispheric representation of lexical processing. The rationale behind this task is to ask the participants to decide whether the letter strings are real words or non-words. While designing word lists, utmost care has been given to forming non-words, which phonologically and orthographically comply with real words, but differ in that they don't have meaningful mental representations. While their similarity to real words make them potential candidates for lexical process, the dissimilarity in meaning makes their recognition difficult for the participants. This view has been elaborated in Nemrodov et al. (2011), who attributed longer latencies and less accuracy for non-words as compared to real words. In the same vein, it has been suggested that non-word processing is more effortful when cognitive workload is taken into consideration (Kuchinke et al., 2005). This view, known as *Word Superiority Effect*, has found considerable support in the literature (Mohr et al., 1994; Lavidor et al., 2004; Kuchinke et al., 2005; Hauk et al., 2006; Nemrodov et al., 2011).

It has been well-established in the laterality literature that the left hemisphere is primarily responsible for lexical processing in monolinguals (Frost et al., 1999; Hellige, 2001; Lieberman, 2002; Sommer et al., 2004; Hugdahl, 2005; Deason & Marsolek, 2005; Jung-Beeman, 2005; Piai et al., 2014; Ardila, Bernal & Rosselli, 2016; Ries, Dronkers & Knight, 2016). Similarly, a good deal of evidence has been gathered as to how non-words are represented in the brain (Jordan, Patching & Milner, 2000; Jordan & Patching, 2003; Jordan, Paterson & Kurtev, 2009; Ripamonti et al., 2014). This study aims to throw light to lateralization of non-word processing by providing evidence from Turkish, an Uralic-Altaic language.

Method

Fifty-three participants (17 Males, 36 Females, Mean Age= 28.25, *SD*= 7.32) took part in the experiment. They were all right-handed as assessed by the Edinburgh Handedness Inventory (Oldfield, 1971). They had normal or corrected-to-normal vision, and they gave a written consent for their participation in the study.

Stimuli

We used 30 real words and 30 non-words as the stimuli. Real words chosen from a pool of 300 words in *Yazılı Türkçe'nin Kelime Sıklığı Sözlüğü* (Göz, 2003). They had five or six syllables, and there was no significant difference in their frequency of use ($F_{2,27} = 0.83$, $p > .05$, $\eta^2 = .058$). To form non-words, we changed one or two letters of real words and created phonologically and orthographically legitimate letter strings with five or six syllables.

Procedure

We used a lexical decision task in which the participants were instructed to decide whether the visually presented letter strings were real words or non-words. They were seated 40 cm away from the laptop computer and placed their chin on a chin rest. They were told to press the designated keys on the keyboard (1 for real words, 2 for non-words) as quickly and accurately as possible. To explore the lateralization of real words and non-words, we presented the stimuli vertically either in the right or the left of the screen in a random order. Before the experiment, the participants took part in a trial session, and the results of this session were excluded from the statistical analysis. The data was collected via Superlab 4.0 software program and statistically analyzed.

Results

Response Times for the Lateralization of Non-words

We found a significant difference in the response times for non-words depending on the field of presentation, $t(52) = -4.204$, $p = .000$. It was seen that the participants had shorter latencies when non-words were presented in the right visual field (641.03 ms, $SD = 96.99$) than when they were presented in the left visual field (671.48 ms, $SD = 94.94$).

Accuracy Rates for the Lateralization of Non-words

Contrary to response time data, we found no significant difference in the accuracy rates for non-words when they were presented in either field, $t(52) = -.080$, $p = .936$. The accuracy rates were comparable when the non-words were presented both in the right (61.25 %, $SD = .21$), and the left visual field (61.49 %, $SD = .21$).

Discussion

Enormous literature is devoted to investigating word processing in monolinguals. Also, real word and non-word processing has frequently been compared, and the findings

has shown that non-word processing is more effortful than processing real words for several reasons, i.e. non-words lack meaningful mental associations (Nemrodov et al., 2011). Lexical decision tasks in the psycholinguistic literature has been a testing ground to compare and contrast real words and non-words, and the findings favor the superiority of real words as compared to non-words in speed and accuracy (Mohr et al., 1994; Lavidor et al., 2004; Kuchinke et al., 2005; Hauk et al., 2006; Nemrodov et al., 2011). This study explored how non-words, formed according to phonological and orthographic rules in Turkish, an Uralic-Altaic language, are represented in the brain hemispheres.

The analysis of response times showed that the participants were faster in their responses to non-words when they were presented in the right visual field than when they were presented in the left visual field. However, the analysis of accuracy data showed no significant difference across visual fields. Our results partially support the evidence in the literature. For example, Jordan, Patching and Milner (2000) reported comparable success when non-words are presented in either visual field. Similarly, Jordan, Paterson and Kurtev (2009) found no evidence of hemispheric asymmetry in non-word processing as compared to real word processing. The discrepancy in our results can be explained by the *Speed-Accuracy Tradeoff* phenomenon (Bogacz et al., 2010; Heitz, 2014) which predicts that participants in experimental task make a choice between speed and accuracy, generally favoring one over the other. Similarly, our results show that the participants gave faster responses while they were accurate in their responses regardless of the field of presentation of the stimuli. This can be interpreted as comparable success in non-word processing when non-words are presented in either visual field. Also, it is known that, despite having no meaning, non-words look like real words. The stimuli in our study were formed by changing one or two letters of real words, which resulted in close similarity between real words and non-words. Due to shallow orthography of Turkish, this similarity might have led to a facilitatory effect on non-word recognition such that they were perceived as real words and processed faster when presented in the right visual field. Similar results were obtained in Ripamonti et al. study (2014), in which non-words formed in accordance with Italian, which has shallow orthography. The lack of visual hemifield effect was attributed to the similarity of words and non-words in Italian.

Conclusion

This study investigated hemispheric representation of non-word processing in monolingual Turkish speakers. We used a visual hemifield paradigm in which the participants (N=53) performed a lexical decision task. They were instructed to decide if the letter strings presented visually in the right or the left of the screen were words or non-

words. The analysis of response time data revealed a left-hemispheric dominance in non-word processing while accuracy rates were comparable regardless of the field of presentation of the stimuli. Our results partially support the left hemispheric dominance in lexical processing, but it is one of the few studies that investigate the Turkish language, which is underrepresented in the psycholinguistic literature. We investigated how non-words in Turkish is lateralized in a lexical decision task, future studies will explore how non-word processing is carried out by employing different experimental tasks.

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