STUDIES IN LANGUAGE AND MIND

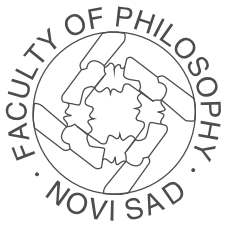
Edited by Sabina Halupka-Rešetar and Silvia Martínez-Ferreiro

Novi Sad, 2016

STUDIES IN LANGUAGE AND MIND

SELECTED PAPERS FROM THE 3RD WORKSHOP IN
PSYCHOLINGUISTIC, NEUROLINGUISTIC
AND CLINICAL LINGUISTIC RESEARCH

Edited by Sabina Halupka-Rešetar and Silvia Martínez-Ferreiro



Novi Sad, 2016

UNIVERSITY OF NOVI SAD
FACULTY OF PHILOSOPHY
Department of English

Editor-in-Chief:
Dr Ivana Živančević Sekeruš, Dean

Editors:
Dr Sabina Halupka-Rešetar
Dr Silvia Martínez-Ferreiro

Reviewers of the volume:
Dr Aleksandar Kostić, University of Belgrade, Serbia
Dr Petar Milin, Eberhard Karls Universität Tübingen, Germany
Dr Maja Miličević, University of Belgrade, Serbia

ISBN
978-86-6065-359-0

Filozofski fakultet u Novom Sadu
Odsek za anglistiku
Dr Zorana Đinđića 2,
21000 Novi Sad
Tel: +381 21 485 3900
+381 21 485 3852
www.ff.uns.ac.rs

CONTENTS

Dušica Filipović Đurđević[a,b,c], **Jelena Karapandžić**[d]
and **Jasmina Arsenijević Mijalković**[4]
[a]Department of Psychology, Faculty of Philosophy,
University of Novi Sad, Novi Sad, Serbia
[b]Laboratory for Experimental Psychology, Department of Psychology,
Faculty of Philosophy, University of Novi Sad, Novi Sad, Serbia
[c]Laboratory for Experimental Psychology, Department of Psychology,
Faculty of Philosophy, University of Belgrade, Belgrade, Serbia
[d]Faculty of Chemistry, University of Belgrade, Belgrade, Serbia
dfdurdevic@ff.uns.ac.rs, jela.karapandzic@gmail.com,
jasmina.arsenijevic@gmail.com

UDK 81'23

PRESENTATION MODALITY INTERACTS WITH THE EFFECT OF VISUAL PERCEPTUAL STRENGTH ON WORD PROCESSING[1]

Abstract:The aim of this research was to investigate the effect of visual perceptual strength across abstract and concrete words, as well as its relation to the modality in which the word is presented. Based on Perceptual Symbol Theory and previous findings, we hypothesized that visual perceptual strength will be negatively correlated with processing cost and will have a stronger effect when there is congruency between the presentation modality and the modality by which the concept denoted by the word can be experienced. These predictions were tested on abstract and concrete nouns which can be experienced only by visual perceptual modality. In both word groups the level of visual perceptual strength varied on a continuous scale. All groups wof nouns ere presented both in a visual and an auditory lexical decision task. The results revealed no main effect of visual perceptual strength and an interaction between visual perceptual strength and presentation modality. This interaction revealed that the effect of visual perceptual strength was present only in the visual lexical decision task, as expected. However, the direction of the effect was opposite to the one predicted. Additional analyses located this effect only to the case of concrete words. While the observed results can only partly be interpreted by Perceptual Symbol Theory, they contradict predictions of amodal theories.

[1]This research is funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia (grant numbers: 179033 and 179006).

Key words: visual perceptual strength, congruency effect, visual lexical decision, auditory lexical decision, perceptual symbol theory, grounded cognition, concreteness effects, abstract concepts, concrete concepts.

1. Introduction

For a long period of time scientists have been discussing in what way our conceptual knowledge is represented and organized. The theories according to which conceptual representations are amodal have long been dominant in cognitive psychology (Tulving, 1972; Smith & Medin, 1981; Fodor, 1975; Pylyshyn, 1984). According to these theories, sensorimotor experiences are translated into amodal conceptual representations, such as feature lists or a semantic network. These amodal conceptual representations bear no systematic resemblance to perceptual experiences based on which they were formed and they are connected with them arbitrarily (the same way words are connected with the concepts they denote). So, for example, the word *flower* bears no resemblance to the concept of flower which it denotes (thus, for example, flower could be called *grel*, which would not change its characteristics). In the same way, according to the theories of amodal conceptual representation, the amodal representation of the concept of flower bears no systematic resemblance to the perception of that object. Amodal symbols which represent concepts in the absence of perception are stored in a system which is separated from the perceptual system, while these two systems function by different principles (Barsalou, 1999). On the other hand, nowadays there is an increasing amount of evidence in favour of the existence of a modality-specific system where our conceptual knowledge is stored. This idea was proposed for the first time by the Dual-Coding Theory (Paivio, 1991), in which Paivio presumed the existence of verbal and nonverbal symbol systems in which our conceptual knowledge is stored. According to this theory, abstract concepts have only their verbal representation, while concrete concepts are dually coded and they have both their verbal representation and visual, auditory or some other kind of representation within some other modality, depending on the modality by which the concept can be experienced. Nowadays, one of the leading theories, according to which conceptual representations are modality-specific, is the

Perceptual Symbol Theory (Barsalou, 1999). According to this theory, conceptual representations (so-called perceptual symbols) are based on physical (perceptual) experience with what the concept represents, so the concept activation actually implies simulating the concrete experience. Simulating of the concrete experience refers to the reactivation of the patterns of activation which were present during the physical experience with the given concept. According to this theory, perceptual symbols are represented in the same system as the perceptual states which created them.

According to the perceptual symbol theory, perceptual symbols actually represent records of neural activations which underlie perception (Barsalou, 1999). Each type of symbol is stored in the corresponding brain area – visual symbols in the visual area, auditory symbols in the auditory area, proprioceptive symbols in the somatosensory and motor area, etc. Findings in the field of cognitive neurosciences supported this view. Thus, for example, a damage in the visual brain area causes difficulties in processing categories which are specified by visual characteristics such as, for example, the category of birds (Barsalou, 1999). Furthermore, experiments conducted with healthy participants (PET studies) have shown that in the naming task, the visual area is highly active while naming animals, whereas the motor area is highly active while naming concepts from the category of tools (Pulvermüller, 1999). Gonzalez and colleagues (2006) discovered in one of their studies that passively reading words which denoted smells or were smell-related (for example *dill*) led to increased activation in the primary olfactory areas. Similar finding have been demonstrated for the visual domain by Simmons et al. (2007) in a property verification task. Here, deciding about the colour of an object (e.g. *A banana is yellow*) activated the areas in the visual cortex that were activated in the colour perception task (left fusiform gyrus). Finally, studies conducted by Goldberg, Perfetti and Schneider (2006) have shown that the verification of various stimulus characteristics, such as colour, sound, touch and taste, activated the corresponding cortical areas which are related to coding visual, auditory, tactile and gustatory experiences.

Different objects (concepts) in the world around us can be experienced by one or more different senses. The fact that a certain concept (object) can be experienced by a certain sensory modality can be considered to be a characteristic of the given concept, just like its shape, colour or texture.

This characteristic can be called "modality presence" and it is one of the characteristics of concepts which will be studied in this paper. Thus, for example, the concept of rainbow has only one sensory modality – visual, since this concept can be experienced only by sight. The concept of noise can be experienced only by hearing, so it has only auditory sensory modality. On the other hand, some other concepts have a larger number of sensory modalities as they can be experienced by several senses – simultaneously or separately. The concept of rooster, for example, can be experienced by almost all senses – we can see it, hear it, touch it, smell it and even taste it.

In a previous study (Živanović & Filipović Đurđević, 2011), which focused on modality presence (modality specific perceptual strength) as a characteristic of concepts, we examined processing effects of the congruence between the sensory modality through which the concept can be experienced and the sensory modality of word presentation (visual vs. auditory). It was shown that such congruence led to the facilitation of word recognition in the lexical decision task. Words which denoted concepts that could be experienced only by sight were processed faster and more accurately in the visual lexical decision task (in which stimuli were shown visually, on a computer screen), than the words which denoted concepts that could be experienced only by hearing. On the other hand, in the auditory lexical decision task (where stimuli were presented auditorily), words which denoted concepts that could be experienced only by hearing were processed faster than the words which denoted concepts that could be experienced only by sight. This finding was interpretedin the light of the perceptual symbol theory (Barsalou, 1999): a word which represents the given concept activated perceptual simulation of the concept; perceptual simulation of the concept is based on physical experience with the concept, which involved reactivation of the neural pathways which were activated during the experience with the concept. For this reason, words were recognized faster (in the lexical decision task) when they were presented in the modality by which the given concept can be experienced than when they are presented in some other modality. Therefore, this finding presented further evidence in favour of the thesis that conceptual knowledge is stored in a system which is modality-specific, and that conceptual image activation is connected with reactivating the patterns of activation which were present during the experience with the concept. This interpretation is in accordance with a view presented

by Connel and Lynott (2012b) who stated that the process of modality specific perceptual stimulation would incur processing cost within that modality if it occupied attention to the extent that there would be no resourses left for modality specific simulation. Unlike that, if modality specific perceptual stimulation only directed attention without occupying resources (as was the case in Živanović & Filipović Đurđević, 2011), then a facilitation effect would be observed.

The largest number of studies which have provided evidence in favour of modality-specific organization of conceptual knowledge dealt with concrete concepts. Explaining representations of abstract concepts has been a challenge to modality-specific theories for a long time. Abstract concepts are defined as concepts which are not entirely physically or spatially defined (Barsalou & Wiemer-Hastings, 2005) and which, therefore, cannot be experienced by senses, so we could say that they do not have any sensory modalities. The question is how abstract concepts are represented, or to put it more precisely, how their representation is explained by the theories which presume the reactivation of neural pathways which were activated during the perception of concepts. The perceptual symbol theory (Barsalou, 1999) provided an explanation which is based on the representation of abstract concepts via perceptual symbols (just like the representation of concrete concepts). According to this theory, perceptual symbols can represent any aspect of experience, including all five sensory modalities, proprioception and introspection, and not only the experiences which come via senses. Representations for introspective experiences, i.e. perceptual symbols for introspective experiences, are developed in the same way as the representations of physical experiences (Barsalou, 2009), and such perceptual symbols are crucial for the representation of abstract concepts. Namely, abstract concepts are represented by complex simulations which include physical, social and introspective elements. When participants are given a word which denotes an abstract concept, a perceptual simulation of the specific situation in which that concept appears takes place. Both concrete and abstract concepts are always represented within a context, a situation, and not isolated. When abstract concepts are represented, according to modality-specific theories, the aspects which are crucial for a certain abstract concept are selected against the background, i.e. the context of the entire

event, and are mostly represented by perceptual symbols for introspective experiences.

As already mentioned, abstract concepts are defined as concepts which cannot be experienced by senses, which are not physically defined. However, while preparing an experiment for one of the previous researches (Živanović & Filipović Đurđević, 2010), a contradiction in the participants' responses (ratings) was observed. On that occasion, various types of participants' ratings for the words used as stimuli in the experiment were collected. Among other things, the participants were asked to rate the general concreteness of the concepts denoted by the given words, and to rate in what degree the concepts could be experienced by each sense. All ratings were performed on a seven-point scale. Unexpectedly, some words which were rated as abstract during general concreteness rating (score below 4 on the concreteness rating scale), were rated as having a modality on other scales (when the scales were separated by modalities and when participants rated in what degree a concept could be experienced by each sense). In other words, what would traditionally be considered as an abstract word was rated as if it could be experienced by a certain sensory modality, for example, as if it could be seen to a certain degree (so we would say that it has visual modality). Therefore, there was a discrepancy between general concreteness rating and sensory-modality specific rating. A similar finding has been reported by Connell and Lynott (2012). These findings led us to the following question: Is the presence of modalities a categorical variable (it can/cannot be seen, it can/cannot be heard, etc), as we have considered it so far, or is it actually a matter of degree? Our hypothesis was that the presence of modality can be considered to be a continuous variable – something can be seen more or less, more or less clearly, more or less obviously, with more or less difficulty, and that as such it influenced word processing. Something that has been rated as "more visible" (or it is observed by sight more easily) on the rating scale from 1 to 7 will be more quickly and more accurately recognized in the lexical decision task than something that has been rated as less visible or something that cannot be seen. Therefore, we would predict facilitatory effects of visual perceptual strength.

In this paper, we will focus only on the words which can be experienced only by sight in various degrees (starting from 1–it cannot be seen at all to 7 –it can easily be seen), but we will presume that the findings could be

generalized to other senses as well. Thus, the group of words used as stimuli in this research covered the entire range of the concreteness scale (from abstract to concrete words) and the entire range of the visibility scale (from words denoting concepts which could notbe experienced by sight at all and could not be experienced by any other sense, to those denoting concepts which could easily be experienced by sight, but could not be experienced by other senses). Therefore, the presented group of words included abstract and concrete words which could be experienced by sight in various degrees. All words were presented to the participants both in visual modality (in the visual lexical decision task) and in auditory modality (in the auditory lexical decision task). Based on the previous findings (Živanović & Filipović Đurđević, 2009; 2011), it is expected that the contribution of the presence of visual modality (i.e. visual perceptual strength) would be greater in the case of visual stimulus presentation than in the case of auditory presentation. As mentioned, it has been shown that congruence between the modality which the concept has and the modality inwhich the word denoting the given concept is presented facilitated word processing. Visual presentation of words would highly activate the visual area, which would enable the fastest recognition of words denoting concepts with visual sensory modality, the perceptual symbols of which are stored in this area. Therefore, according to the Perceptual Symbol Theory, a word which refers to a certain concept would activate the perceptual symbol of that concept which is stored in a specific brain area. If there is an overlap of neural pathways by which the information about the concept is received and of the pathways which would be activated by activating the perceptual symbol, the word recognition would be faster. This would be possible due to the fact that there would be no specific engaging of modality-specific attention (that would leave no resources for perceptual simulation), but only modality-specific attention directing (Connel & Lynott, 2012b). Thus, it could be expected that a higher degree of presence of a congruent modality would have greater influence, i.e. that a higher degree of presence of a congruent sensory modality would enable easier and faster activation of the perceptual symbol of that concept. Therefore, we predicted that facilitatory effect of visual strength would be stronger for visually presented words than for words presented auditorilly (i.e. we predicted interaction between presentation modality and visual perceptual strength).

To summarize, based on theories of grounded cognition (e.g. Barsalou, 1999), we predicted facilitatory processing effects of visual perceptual strength. Crucially, we predicted interaction between visual perceptual strength and presentation modality, with the effect of visual perceptual strength being strenger for visually presented words. This interaction could not be accounted for by amodal theories (e.g. Fodor, 1975), which presume that concepts are translated into amodal symbols which bear no resemblance to perceptual experiences based on which they have been formed and which are stored in a system which is separated from the perceptual system. Hence, according to these theories, the characteristics of the concepts should in no way influence processing of words that denote them, or the modality in which those words are presented.

2. Experiment

Our research consisted of two phases. In the first phase, a norming study was conducted in order to collect subjective ratings of several characteristics of the stimuli. In the second phase, we conducted visual and auditory lexical decision task experiments.

2.1. Method

2.1.1. Participants

One hundred and thirty-two participants took part in the first phase of the experiment (21 rated general concreteness, 24 rated familiarity, 86 rated per-modality perceptual strength). They were all native speakers of Serbian, either students at the Department of Psychology at the Faculty of Philosophy in Belgrade or final year students at the Secondary Medical School in Požarevac. Additional 56 participants took part in the experiments (29 in the visual lexical decision task and 27 in the auditory lexical decision task). They were all students at the Department of Psychology at the Faculty of Philosophy in Novi Sad and Serbian native speakers with normal hearing and normal, or corrected to normal, vision.

2.1.2. Stimuli

We selected 189 Serbian nouns (Appendix A) in the nominative singular and 189 pseudowords to be presented in the experiments. In the first phase of the research we collected concreteness, familiarity, and per-modality perceptual strength ratings for the full set of selected nouns.

General concreteness ratings were collected by instructing the participants to say to what degree it was possible to experience what the word denotes by the senses (to what degree something could be seen, heard, smelt or touched), i.e. they were asked to rate to what degree the given concept was concrete or abstract (number one meant that the word denotes something that cannot be experienced by the senses, e.g. *patriotism*, and number 7 meant that the word denotes something which can easily be experienced by senses, e.g. *rooster*). The words in the questionnaire were in alphabetical order. General concreteness ratings were collected from 21 participants.

Familiarity ratings were provided by 24 participants. When rating the familiarity of a word, the participants were asked to estimate how familiar they were with the word, i.e. how often they had come across the given word (number 1 meant that they were not familiar with the word, i.e. that they had never come across it before, while number 7 meant that participants had often come across the given word). The words were arranged in alphabetical order in the questionnaire.

Concreteness by modalities was assessed by asking the participants to estimate to what degree the concept denoted by the word can be experienced by one particular sense (for example, to what degree it was possible to see something); number 1 meant that the word denotes something which cannot be experienced by the given sense (e.g. *chirp* if the possibility of experiencing by sight is rated), and number 7 meant that the word denotes something that can be experienced by the given sense very easily (e.g. *peach*). This procedure resembled the one previously used (Connel & Lynott, 2012a; Lynott & Connell, 2013; Živanović & Filipović Đurđević, 2010; 2011). Ratings were performed for sight, hearing, smell, taste and skin senses (skin senses included touch, pain, warmth, but also various somatosensory information). The questionnaires were designed based on the Latin square design, so that one participant rated the presence of only one modality for one word (but all participants saw all words and rated all modalities). Therefore, there were five different groups of questionnaires (dif-

ferent groups of words for different modalities) with three different random sequences within each group of questionnaires.

The nouns presented in the experiment were selected so that they covered the entire range of the general concreteness scale (from abstract nouns, for which it was established based on the participants' ratings that they cannot be experienced by the senses, to concrete nouns) and the entire range of the scale of visual modality presence (from concepts which cannot be experienced by sight, e.g. *idea*, *thought*, to concepts which can easily be experienced by sight, e.g. *cloud*, *colour*). The nouns which were analyzed in this research were those that were rated as unexperienceable by other senses (i.e. as concepts which cannot be heard, smelt, touched, or tasted since they had lower [M<4] values on the scales on which their potential to be experienced by other senses was rated). Therefore, the stimuli used were abstract nouns and nouns denoting concepts which can only be experienced by sight to various degrees.

For the needs of the auditory lexical decision task, stimuli were recorded using a computer and specialized software – *Praat* (Boersma & Weenink, 2009). During the recording, the stimuli were pronounced by a male adult in the sentence "*Say the stimulus, please*." The stimuli were recorded in sentence context in accordance with previous research, in which the auditory lexical decision task was used (Slowiaczek & Pisoni, 1986), and in order to avoid too large word length when it is pronounced in isolation and to control the variation in the length of word pronunciation. After that, using *Praat* computer program, the words were extracted from their carrier sentence and presented to participants in the auditory lexical decision task.

Pseudowords were designed by replacing one (usually final) phoneme/grapheme in a noun so that the word would lose its meaning. Nouns other than the nouns used as stimuli in the experiment were used for the purpose of designing the pseudowords. The pseudowords were similar to words in their length (the number of letters) and the length of pseudoword pronunciation (in milliseconds).

2.1.3. Design

The criterion variables were the reaction time expressed in milliseconds and the percent of errors. The predictor variables were the type of task

(the task of visual/auditory lexical decision; this predictor was manipulated between participants, but within stimuli) and the degree of presence of visual modality, or visual perceptual strength (expressed by the participants' rating on a seven-point scale). The control variables were word length (expressed in the number of graphemes), the logarithm of lemma frequency (Kostić, 1999), familiarity (subjective frequency), general concreteness and the number of orthographic neighbours (Coltheart, Davelaar, Jonasson & Besner, 1977). Additionally, the length of word pronunciation was measured (in milliseconds) in the auditory lexical decision task; the correlation between this variable and word length measured in the number of letters was high ($r=0.86$, $p<0.01$), so for this reason, the length of word pronunciation was excluded from the analyses and the word length measured in the number of letters was used to represent this group of variables.

2.1.4. Procedure

Two tasks were used in the experiment – the visual lexical decision task and the auditory lexical decision task. In the visual lexical decision task, stimuli were presented visually, on a computer screen. The presentation of each stimulus was preceded by a fixation point in the duration of 1500 ms. The stimulus presentation time was limited to 1500 ms. The responses were given by pressing a button on the response box, and the participants gave their responses using both hands (the right button if the presented stimulus was a word, and the left one for the pseudowords if the participant was right-handed and vice versa for left-handed participants). If the participant did not respond to the presented stimulus in the time period of 1500 ms, he would receive the following feedback: "Try to answer a little faster!", and if a participant made a mistake, he would receive the following feedback: "You have made a mistake, try again!" In both cases, the same stimulus was presented again. Before the beginning of the experiment, the participants were given 8 practice trials. The examples presented during the practice were not included in the analyses.

In the auditory lexical decision task, the stimuli were presented auditorily, binaurally, via headphones. The responses were given by pressing a button on the response box using both hands, in the same way as in the visual lexical decision task. The participants received a visual feedback in case they made a mistake ("You have made a mistake, try again!") and in

case they failed to respond within the set time interval ("Try to answer a little faster!"). In both situations the stimuli were presented again. The presentation of each stimulus was preceded by an empty screen in the duration of 1000 ms (the empty screen was introduced in order to avoid a situation in which the feedback from the previous trial stays on the screen the entire time, and to make a pause between the trials, i.e. to avoid stimuli going one after another too fast), and after it a sound signal in the duration of 500 ms announced the stimulus. The maximum duration of stimulus presentation with the time for response was limited to 3000 ms. The reaction time was measured from the onset of the stimulus pronunciation to the moment of pressing a response button. In this task, the participants were also given 8 examples to practice before the beginning of the experiment. The examples presented during the practice were not included in the analyses.

Specialized software (SuperLab Pro 2.0; Cedrus, 2001) was used for the manipulation of independent variables and the measurement of dependent variables.

3. Results and discussion

Prior to the analyses, we excluded all of the pseudowords, as well as the items with above 25% error rate, and items that received <4 average rating for the possibility of being heard, smelled, tasted, or touched (based on collected norms). After this, there were 130 words that were included in the analysis. None of the participants were excluded, as the overall accuracy was high (<10% error rate per participant). Next, we considered the possibility of collinearity among our predictors by calculating Kappa coefficient (Belsley, Kuh & Welsch, 1980) and pairwise correlations between predictors. Although the Kappa coefficient was formally within the medium range (≈24, i.e. <30), we found that the correlation between general concreteness and visual perceptual strength was very high ($r=0.91$, $p<0.05$). This was not surprising, as we selected our stimuli trying to make visual perception strength as diverse as possible, while keeping other modality-specific strengths as low as possible. This led to variance in concreteness being dominantly attributable to visual perceptual strength. One possibility to deal with such collinearity would be to apply principal components analysis, as suggested by Wurm and

Fisicaro (2014). However, this would prevent us from being able to attribute the effects to visual perceptual strength *per se*. With this in mind, we decided to apply another strategy (as suggested by Baayen, 2008) not to include concreteness in the set of predictors, that is to include only one of the two highly correlated predictors, in this case – visual perceptual strength. We analyzed our data using R statistical software (http://www.r-project.org/) and mgcv package (Wood, 2006; 2011). Additionally, prior to the analyses, we transformed the predictors by centering them and deviding them by standard deviation, as suggested by Gelman and Hill (2007). We fitted mixed-effect generalized additive models to individual reaction times (using Gaussian as the underlying response distribution). In order to control for the possible effects of the outliers, we refitted each model after excluding the points with residuals that exceeded the range of -2.5/+2.5 standard units. As the structure of results after refitting resembled that of the original ones, we reported only the results of refitted model (Table 1).

Table 1. Coefficients from the generalized additive model fitted to reaction time.

Parametric coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	6.751	0.019	361.183	<0.001
Presentation modality: VLD	-0.237	0.025	-9.365	<0.001
Trial (order of presentation)	-0.005	0.004	-1.197	0.231
Word length in graphemes	0.014	0.005	2.670	<0.01
(log) Lemma frequency	-0.019	0.005	-3.675	<0.001
Word familiarity	-0.031	0.005	-6.295	<0.001

Smooth terms:

	edf	Ref.df	F	p-value
Factor smooth for Visual perceptual strength at the level of ALD	1	1.001	3.815	0.051
Factor smooth for Visual perceptual strength at the level of VLD	7.473	8.3	5.487	<0.001
by-Participant factor smooths for Trial	162.922	502	5.847	<0.001
by-Item random intercept	102.377	125	4.805	<0.001

N=6851; ML=-2943

In addition to random effects of items, and smoothing of order of trial presentation for each participant separately, our results revealed significant effects of several control variables. As expected, word length in graphemes had inhibitory effect, whereas (log) lemma frequency and word familiarity facilitated processing. Importantly, we observed a significant effect of visual perceptual strength, but only for visually presented words, that is, only in visual lexical decision task (VLD).

The observed visual perceptual strength by presentation modality interaction is in accordance with our predictions. However, the predicted effect of visual perceptual strength for auditorilly presented words was not observed. As can be seen in Table 1 and Figure 1 (left panel), there was a linear facilitatory trend, but this effect did not reach significance. At the same time, we predicted even stronger facilitation for visually presented words. However, as illustrated in Figure 1 (right panel), this effect was highly non-linear preventing us from clearly concluding about its trend.

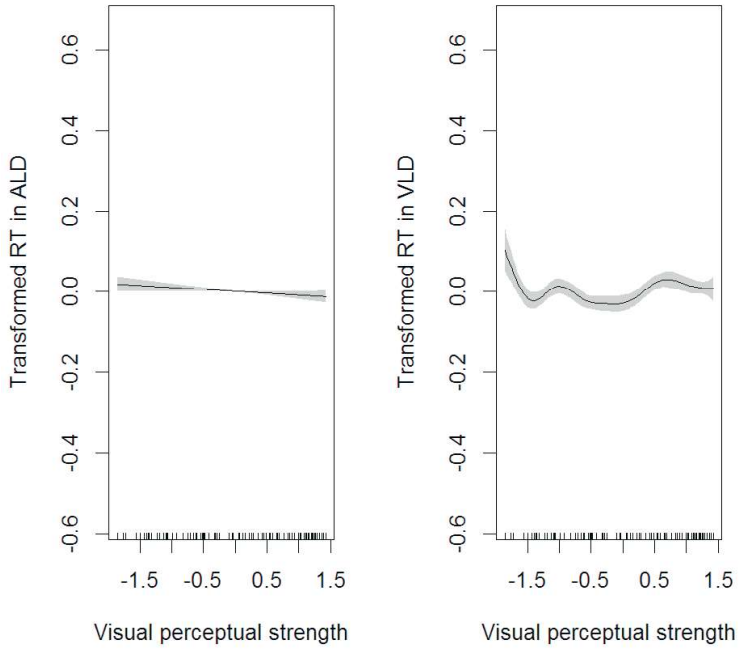


Figure 1. Partial effects of visual perceptual strength on reaction time observed in auditorylexical decision task (left panel) and visual lexical decision task (right panel).

4. General discussion

The registered result pattern does not fully agree with the findings of our previous research (Živanović & Filipović Đurđević, 2010; 2011) and it does not fully match our initial hypotheses. We did not observe a facilitatory effect of visual perceptual strength regardless of the presentation modality – although facilitatory in trend, this effect was not significant for auditorily presented words. Even more so, for visually presented words, although significant, the effect was highly non-linear, and not clearly facilitatory as we predicted. However, we did observe the predicted visual perceptual strength by presentation interaction, as the effect of visual perceptual strength was significant only for visually presented words.

Previous research which focused on studying the presence of sensory modalities (Popović, Živanović & Filipović Đurđević, 2009; Živanović & Filipović Đurđević, 2010; 2011; Popović Stijačić & Filipović Đurđević, 2015) has confirmed the hypothesis that the presence of a certain sensory modality can be considered to be one of the characteristics of a concept, just like its colour, shape or texture. According to amodal theories of the organization of our conceptual knowledge (Tulving, 1972; Smith & Medin, 1981; Fodor, 1975; Pylyshyn, 1984), our sensorimotor experiences are translated into amodal conceptual representations, which bear no systematic resemblance to perceptual experiences based on which they were formed and which are stored in a system which is separated from the perceptual system. Therefore, perceptual characteristics of concepts and the way in which the words which denote the concepts are presented should in no way influence the processing of the words which represent those concepts. The interaction which was registered in this research poses a challenge to amodal theories.

On the other hand, modality-specific theories (Barsalou, 1999) presume that perceptual characteristics of concepts have a significant influence on the formation of conceptual representations. According to these theories, conceptual representations (perceptual symbols) are stored in the same system as the perceptual experiences based on which they were formed. Consequently, the presence or absence of such characteristics and the presentation mode of the words which represent the concepts should influence word processing. The interaction between the visual perceptual strength and the stimulus presentation mode is expected according to modality-specific

theories, since they presume that the overlap (or the absence of it) of the neural pathways which were activated during the perception of words and the ones which should be activated by activating the perceptual symbols of those concepts will influence the processing of the words which represent the concepts. The problem which arises due to the findings of this research (even if we try to explain them by modality-specific theories) is the trend-masking nonlinearity of the observed effect. Namely, according to modality-specific theories, a higher degree of visual perceptual strength should facilitate word processing in the case of modality congruence (i.e. in the visual lexical decision task), since the perceptual symbols of the concepts which have visual modality are stored in the visual zone, which is highly active during the visual lexical decision task. The overlap of neural pathways which were activated in the task in which the stimuli were presented to the participants visually and the neural pathways which were activated by activating the perceptual symbols of the concepts which the words represent should facilitate word processing. However, we were not able to derive a clear conclusion regarding the trend of the effect of visual perceptual strength fof visually presented words, as the effect was highly nonlinear. One possible explanation could be that the effect that was observed for concrete words (Živanović & Filipović Đurđević, 2011) does not apply to the full range of concreteness scale, namely that it does not apply to abstract words. As previously suggested, the representation of abstract words poses a challenge for theories of embodied cognition (e.g. Dove, 2009; 2015). Our results did not corroborate our expectation of continuity, and suggested that processes that were observed for concrete words might not be transferable to the full range of the abstract-concrete continuum. Some previous studies also suggested a discontinuity of this scale (Connel & Lynnott, 2012).

While our results pose a challenge for theories of amodal representation, they leave open the question of continuity between abstract and concrete words, and call for further investigation.

References

Baayen, R. H. (2008) *Analyzing Linguistic Data. A Practical Introduction to Statistics Using R.* Cambridge: Cambridge University Press.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences* 22: 577-660.

Barsalou, L. W., Simmons, W. K., Barbey, A. K., & Wilson, C. D. (2003). Grounding conceptual knowledge in modality-specific systems. *TRENDS in Cognitive Sciences* 7/2: 84-91.

Barsalou, L. W., & Wiemer-Hastings, K. (2005). Situating abstract concepts. In D. Pecher and R. Zwaan (eds.), *Grounding cognition: The role of perception and action in memory, language and thought*. New York: Cambridge University Press, 129-163.

Barsalou, L. W. (2009). Simulation, situated conceptualization and prediction. *Philosophical Transactions of the Royal Society B* 364: 1281-1289.

Bleasdale, F. A. (1987). Concreteness-dependent associative priming: separate lexical organization for concrete and abstract words. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 13: 582-584.

Boersma, P. & Weenink, D. (2009). Praat: doing phonetics by computer (Version 5.1.05) [Computer program]. Retrieved May 1, 2009, from http://www.praat.org/

Coltheart, M., Davelaar, E., Jonasson, J. F., & Besner, D. (1977). Access to the internal lexicon. In S. Dornic (ed.), *Attention & Performance VI* Hillsdale, NJ: Erlbaum, 535-555.

Connell, L., & Lynott, D. (2012a). Strength of perceptual experience predicts word processing performance better than concreteness or imageability. *Cognition* 125: 452-465.

Connell, L., & Lynott, D. (2012b). When does perception facilitate or interfere with conceptual processing? The effect of attentioinal modulation. *Frontier in Psychology* 3: 474.

Dove, G. O. (2009). Beyond perceptual symbols: A call for representational pluralism. *Cognition* 110: 412-431.

Dove, G. O. (2015). How to go beyond the body: an introduction. *Frontiers in Psychology* 6: 660.

Gelman, A., & Hill, J. (2007). *Data Analysis Using Regression and Multilevel/ Hierarchical Models*. Cambridge: Cambridge University Press.

Goldberg, R. F., Perfetti, C. A., & Schneider, W. (2006). Perceptual knowledge retrieval activates sensory brain regions. *Journal of Neuroscience* 26: 4917 – 4921.

González, J., Barros-Loscertales, A., Pulvermüller, F., Meseguer, V., Sanjuán, A., Belloch, V. et al. (2006). Reading cinnamon activates olfactory brain regions. *Neuroimage* 32: 906 – 912.

Kostić, Đ. (1999). *Frekvencijski rečnik savremenog srpskog jezika. Tom I – VII*. Institut za eksperimentalnu fonetiku i patologiju govora, Beograd i Laboratorija za eksperimentalnu psihologiju Filozofskog fakulteta u Beogradu.

Lynott, D., & Connell, L. (2013). Modality exclusivity norms for 400 nouns: The relationship between perceptual experience and surface word form. *Behavior Research Methods* 45: 516-526.

Marschark, M., & Hunt, R. R. (1989). A reexamination of the role of imagery in learning and memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 15: 710-720.

Paivio, A. (1969). Mental imagery in associative learning and memory. *Psychological Review* 76: 241-263.

Paivio, A. (1991). Dual Coding Theory: Retrospect and Current Status. *Canadian Journal of Psychology* 45/3: 255-287.

Popović, M., Živanović, J., & Filipović Đurđević, D. (2009). Uticaj broja i vrste čulnih modaliteta na procenu konkretnosti reči i brzinu obrade reči. *XV naučni skup Empirijska istraživanja u psihologiji.* Beograd: Filozofski fakultet u Beogradu, Institut za psihologiju i Laboratorija za eksperimentalnu psihologiju, 6-7 februar, 2009. 24-25.

Popović Stijačić, M., & Filipović Đurđević, D. (2015). Uspešnost reprodukcije u zavisnosti od broja čula kojima je moguće iskusiti pojam. *Primenjena psihologija* 8/3: 335-352.

Pulvermüller, F. (1999). Words in the brain's language. *Behavioral and Brain Sciences* 22: 253-336.

Simmons, W. K., Ramjee, V., Beauchamp, M. S., McRae, K., Martin, A., & Barsalou, L. W. (2007). A common neural substrate for perceiving and knowing about color. *Neuropsychologia* 45: 2802 – 2810.

Slowiaczek, L. M., & Pisoni, D. B. (1986). Effects of phonological similarity on priming in auditory lexical decision. *Memory & Cognition* 14/3: 230-237.

Wood, S. N. (2006). *Generalized Additive Models: An Introduction with R.* Chapman and Hall/CRC.

Wood, S. N. (2011). Fast stable restricted maximum likelihood and marginal likelihood estimation of semiparametric generalized linear models. *Journal of the Royal Statistical Society B* 73/1: 3-36.

Wurm, L. H., & Fisicaro, S. A. (2014). What residualizing predictors in regression analyses does (and what it does not do). *Journal of Memory and Language* 72: 37-48.

Yarkoni, T., Balota, D., & Yap, M. (2008). Moving beyond Coltheart's N: A new measure of ortgrafic similarity. *Psychonomic Bulletin & Review* 15/5: 971-979.

Živanović, J., & Filipović Đurđević, D. (2011). On advantage of seeing TEXT and hearing SPEECH. *Psihologija* 44/1: 61-70.

Živanović, J., & Filipović Đurđević, D. (2010). Efekat kongruentnosti čulnih modaliteta – istraživanje na pridevima i glagolima. *XVI naučni skup Empirijska istraživanja u psihologiji*. Beograd: Filozofski fakultet u Beogradu, Institut za psihologiju i Laboratorija za psihologiju, 5-6 februar, 2010. 21-22.

Appendix A. Stimuli and collected ratings

Word	Visual perceptual strength	Auditory perceptual strength	Olfactory perceptual strength	Gustatory perceptual strength	Tactile perceptual strength	Concreteness	Familiarity	Word length in graphemes	Lemma frequency	Coltheart N
ZENIT	3.67	1.47	1.17	1.19	1.24	2.86	3.42	5	14	0
NEBO	6.63	1.00	1.65	1.47	1.33	4.19	6.00	4	2818	4
KOMETA	5.53	2.12	1.35	1.22	1.69	4.05	2.96	6	11	2
BOJA	6.71	1.00	2.12	1.94	1.75	5.48	6.21	4	830	18
OSEKA	5.67	2.94	2.24	1.12	2.47	4.62	3.42	5	24	4
TEKST	7.00	4.53	1.28	1.13	1.94	4.57	5.71	5	87	1
TUFNA	6.71	1.00	1.28	1.56	2.18	4.81	3.25	5	0	1
FLEKA	6.75	1.12	2.65	2.11	3.19	5.29	4.54	5	2	3
SUMRAK	6.59	1.44	1.44	1.41	1.47	4.14	4.42	6	187	0
INTERNET	5.24	2.00	1.06	1.00	1.31	2.62	6.79	8	0	2
ODSJAJ	6.06	1.19	1.00	1.06	2.53	4.48	3.88	6	67	1
MEHANIZAM	5.13	3.47	2.41	1.12	2.28	3.14	4.04	9	19	0
BRIGA	3.35	3.00	1.41	1.39	2.38	2.57	6.13	5	264	2
POLET	4.94	2.73	1.82	1.59	2.59	2.76	3.88	5	83	6
SREĆA	5.24	4.67	1.44	1.82	2.41	3.24	6.46	5	1011	5
UMOR	3.88	3.12	1.78	1.25	4.76	2.81	5.88	4	232	6
ANALIZA	3.76	2.38	1.24	1.11	3.06	1.76	5.92	7	54	0
OČAJ	4.61	2.69	1.06	1.59	2.47	2.33	4.33	4	73	4
PRAVAC	5.00	1.13	1.12	1.18	2.24	2.95	5.58	6	208	6
IDEAL	2.12	2.12	1.24	1.22	1.25	1.62	4.67	5	46	0
MISAO	1.25	3.24	1.06	1.71	1.94	1.67	5.52	5	1163	0
TEORIJA	2.25	5.88	1.00	1.06	1.24	1.67	5.96	7	34	0
POŠTOVANJE	3.61	2.94	1.18	1.24	2.00	2.05	5.79	9	53	0

PAMET	2.61	2.69	1.00	1.12	1.35	1.81	6.13	5	40	2
ŠANSA	1.88	2.06	1.50	1.06	1.35	1.86	6.00	5	43	0
UGLED	2.65	2.00	1.39	1.19	1.88	2.19	5.25	5	42	2
KVADRAT	6.69	1.00	1.12	1.18	3.17	4.24	4.54	7	20	0
KRETANJE	6.63	4.76	2.18	1.41	5.67	3.29	5.29	7	86	0
POGLED	6.00	1.25	1.12	1.35	2.29	3.19	5.75	6	1039	1
GEN	1.76	1.24	1.00	1.11	2.00	2.00	4.75	3	0	8
PLAVETNILO	6.29	1.25	1.12	1.71	1.18	3.90	3.25	10	44	0
HRABROST	3.59	2.59	1.53	1.11	1.47	2.00	5.83	8	75	0
PREZIR	4.06	3.89	1.25	1.47	2.12	2.67	4.42	6	22	0
ČEŽNJA	2.41	2.12	1.76	1.56	2.13	2.24	4.46	5	414	0
NARAV	3.06	3.29	1.24	1.35	1.78	2.33	4.92	5	14	2
ŽIVOT	4.06	3.53	2.94	2.19	3.82	3.14	6.58	5	3423	2
SAVET	1.76	6.00	1.25	1.35	1.59	2.43	5.91	5	1	6
OBEĆANJE	1.56	5.12	1.06	1.35	1.61	1.62	5.71	7	70	0
SVITANJE	6.88	1.94	1.88	1.35	1.71	4.19	4.83	7	233	0
DUGA	6.71	1.00	1.06	1.17	1.00	4.10	3.79	4	180	13
SATELIT	5.71	1.56	1.06	1.24	1.71	3.76	4.00	7	10	0
HORIZONT	5.47	1.18	1.24	1.06	1.06	3.33	3.71	8	99	0
DAN	6.47	2.59	3.06	1.17	1.19	4.19	6.75	3	5758	15
NASLOV	6.44	1.47	1.18	1.00	1.22	4.24	5.50	6	61	1
SVEMIR	4.94	1.22	1.31	1.18	1.41	2.90	4.26	6	96	0
MRLJA	6.81	1.00	2.41	2.24	3.28	4.81	4.25	4	81	2
NATPIS	6.94	1.35	1.00	1.00	1.44	4.48	5.21	6	53	0
MIMIKA	6.31	1.41	1.06	1.18	3.39	3.67	3.17	6	5	0
LET	6.19	3.65	1.82	1.18	3.78	3.67	4.17	3	344	19
BRZINA	4.59	3.94	1.53	1.33	2.63	3.90	6.17	6	92	3
CIKLUS	2.35	2.00	1.88	1.28	2.56	2.00	5.04	6	35	0
ELAN	2.76	2.41	1.47	1.22	1.63	2.24	3.67	4	25	10
LJUBOMORA	4.88	3.65	1.24	1.88	3.00	2.76	5.63	8	10	0
ZANOS	2.59	3.29	2.67	1.63	2.59	2.62	5.39	5	278	2
RAZVOJ	4.59	1.44	1.19	1.59	2.18	2.62	5.96	6	214	2
RADOST	5.41	5.56	1.50	1.71	2.65	3.05	6.13	6	1146	3
SEOBA	5.24	2.67	1.06	1.41	1.47	3.05	3.92	5	24	2

ZNANJE	3.35	4.88	1.50	1.44	2.47	2.62	6.33	5	153	0
MAŠTA	2.00	2.53	1.47	2.24	2.11	2.00	5.42	5	212	6
PONOS	3.94	2.31	1.35	1.12	1.71	2.14	5.63	5	129	3
PAMĆENJE	1.78	1.63	1.35	1.24	1.63	2.38	6.17	7	37	0
POJAM	3.67	3.19	1.12	1.29	1.41	1.81	5.25	5	66	3
SLUTNJA	1.88	2.67	1.31	1.29	2.24	1.86	4.71	6	264	0
USLOV	1.71	4.53	1.06	1.06	1.12	1.71	6.17	5	422	0
TROUGAO	6.88	1.12	1.00	1.06	2.06	4.43	4.58	7	11	0
TRIK	4.71	2.71	1.39	1.13	2.41	3.19	4.08	4	7	5
TRAG	6.53	1.82	3.22	1.63	2.82	4.48	4.63	4	623	9
DINOSAURUS	5.53	2.41	2.88	1.39	2.44	3.71	3.13	10	0	0
ŠARENILO	7.00	1.24	1.61	1.44	2.47	4.57	4.33	8	8	0
PRESTIŽ	2.88	1.89	1.38	1.53	2.12	2.24	4.17	7	9	0
SIGURNOST	3.41	2.83	1.38	1.71	2.65	2.14	5.50	9	58	0
ISHOD	3.35	2.53	1.35	1.22	1.33	2.71	4.75	5	19	1
OBUKA	3.25	2.47	1.53	1.00	1.61	2.43	4.67	5	26	5
ŽUDNJA	2.65	3.53	2.39	1.75	3.24	2.67	4.67	5	229	0
OPROŠTAJ	3.44	4.38	1.29	1.18	2.88	2.10	4.88	8	82	0
ZAHVALNOST	3.13	5.65	1.44	1.19	2.25	2.05	5.58	10	42	0
JUTRO	6.29	3.29	4.35	1.78	1.25	4.00	6.42	5	1289	0
MUNJA	6.13	3.82	1.47	1.24	2.33	4.24	4.67	4	216	8
SVETLOST	6.82	1.11	1.44	1.35	2.63	4.71	5.54	8	667	0
FATAMORGANA	4.18	1.29	2.18	1.44	1.56	2.52	2.50	11	5	0
NOĆ	6.81	1.82	2.53	1.53	2.44	4.29	6.33	3	4334	7
SENKA	6.71	1.00	1.13	1.06	1.31	3.90	4.75	5	1209	5
VASIONA	3.18	1.59	1.06	1.06	1.00	2.62	3.42	7	48	1
OTISAK	6.33	1.19	1.35	1.53	4.88	4.67	3.46	6	43	2
TAMA	6.65	1.35	1.50	1.25	1.41	4.00	4.83	4	823	18
ISKRA	5.35	2.12	1.75	1.44	3.19	3.71	3.04	5	136	0
LEPOTA	6.69	2.00	2.25	2.41	3.89	3.43	6.42	6	509	0
DALJINA	5.29	3.24	2.00	1.17	2.00	3.57	5.54	6	675	1
PATNJA	4.78	3.56	1.12	1.82	3.35	2.71	5.08	5	232	1
POROK	4.33	1.60	2.71	3.82	2.50	2.95	4.50	5	24	3
TUGA	3.94	4.71	1.67	1.50	3.47	2.38	4.83	4	1326	15

ZDRAVLJE	3.47	2.41	2.83	1.81	4.88	2.95	6.33	7	234	0
UŽITAK	3.24	4.06	3.78	2.75	4.06	3.10	5.13	6	6	0
LJUTNJA	5.00	4.47	1.12	1.94	3.39	2.90	5.50	5	13	0
SMER	5.53	1.78	1.13	1.24	2.06	2.62	5.13	4	52	9
PRAVDA	2.61	2.38	1.18	1.53	2.12	1.86	6.00	6	140	1
MORAL	2.19	1.71	1.18	1.41	1.11	1.67	5.13	5	24	5
PORAZ	3.44	2.69	1.29	1.53	1.94	2.00	5.17	5	126	1
IDEJA	1.88	3.59	1.35	1.11	1.13	1.90	6.33	5	110	0
POVOD	2.11	2.38	1.00	1.12	1.41	2.05	5.38	5	100	6
STANJE	4.00	3.06	2.25	1.53	3.35	2.62	5.46	5	399	0
ZAKON	2.41	5.24	1.11	1.19	1.59	2.00	5.25	5	431	3
KRUG	6.63	1.00	1.24	1.18	3.17	4.05	5.21	4	633	3
TREPTAJ	5.88	3.18	1.06	1.25	4.29	4.33	3.75	7	30	1
CIFRA	6.82	2.53	1.00	1.00	1.00	3.62	4.71	5	24	2
BLEDILO	6.65	1.00	1.06	1.11	2.94	4.19	4.13	7	27	1
MODRICA	6.94	1.06	1.29	1.12	6.50	5.24	4.67	7	12	4
PREVARA	3.76	3.39	1.56	1.71	2.06	2.24	5.50	7	38	2
ZABORAV	1.41	1.59	1.56	1.25	2.18	1.62	5.08	7	231	0
KRIZA	2.53	2.00	1.35	1.47	1.72	1.95	5.58	5	71	2
SLOGA	3.94	2.72	1.25	1.47	1.35	2.52	4.67	5	22	5
ISKAZ	2.82	5.38	1.06	1.11	1.44	3.62	4.04	5	24	2
ISTINA	3.71	4.59	1.76	1.33	2.19	2.52	6.00	6	375	2
POUKA	2.61	3.56	1.29	1.41	1.47	1.95	5.00	5	10	2
VEČE	6.24	2.29	3.72	1.13	1.24	4.05	5.54	4	569	4
OBLAK	6.81	1.12	2.00	1.47	1.56	4.48	5.33	5	1565	2
MAGLA	6.31	1.12	2.81	2.06	2.56	4.14	3.83	5	631	2
OSMEH	6.83	3.69	1.18	1.59	4.12	5.52	6.21	5	720	1
PEJZAŽ	6.89	1.31	2.41	1.53	1.82	4.57	4.21	6	107	1
PANORAMA	6.28	1.38	1.24	1.06	1.35	4.10	3.33	8	15	0
KOSMOS	2.65	1.18	2.00	1.06	1.25	2.48	3.04	6	2	1
ZRAK	5.12	1.18	1.56	1.31	3.12	3.86	4.33	4	3	10
LAVA	6.94	4.88	3.53	2.24	6.00	4.76	2.96	4	35	13
MESEČINA	6.50	1.18	1.35	1.18	1.56	4.05	4.33	8	424	0
STARENJE	5.00	1.44	1.63	1.59	3.71	3.14	5.42	7	3	0

BLIZINA	5.65	3.65	3.00	2.28	3.81	3.90	5.79	7	163	1
NEMIR	4.06	3.82	1.35	1.47	3.61	2.57	4.54	5	390	2
PAD	5.72	4.81	1.24	1.35	5.41	4.52	4.29	3	147	20
ZALJUBLJENOST	4.88	3.65	2.33	1.75	4.82	3.14	6.21	11	4	0
BOLEST	5.06	2.18	3.00	3.00	5.06	4.10	5.75	6	222	0
IZNENAĐENJE	4.47	4.06	1.76	1.28	1.93	3.14	6.00	10	84	0
POJAVA	5.83	3.75	2.06	1.35	2.06	2.86	5.29	6	142	2
ZAMOR	3.59	3.06	1.50	1.31	4.76	2.95	5.33	5	13	7
LJUBAV	2.81	3.29	1.94	2.76	5.06	2.95	6.38	5	2365	1
MOTIV	2.13	1.65	1.06	1.06	1.33	1.71	5.50	5	71	0
PRETPOSTAVKA	1.47	3.89	1.38	1.18	1.82	1.81	5.46	12	19	1
NAGON	3.19	2.41	1.59	1.65	3.89	2.14	5.04	5	24	4
PRKOS	4.41	3.67	1.19	1.59	2.24	2.81	4.96	5	60	0
STEPEN	2.41	1.78	1.06	1.29	2.53	2.10	4.88	6	106	1
LINIJA	6.50	1.00	1.06	1.24	3.33	4.14	5.13	6	6	5
VREME	3.65	1.76	2.33	1.19	2.35	2.14	6.00	5	2376	1
MANIRI	4.44	3.94	1.18	1.24	2.56	3.05	4.13	6	7	1
MLAZ	6.69	5.94	2.75	3.00	6.50	4.76	4.00	4	164	7
CRVENILO	6.88	1.00	1.29	1.56	4.69	4.71	4.58	8	9	1
PLAMEN	6.72	1.63	4.88	2.82	6.82	5.62	4.38	6	464	3
ODLUKA	2.83	4.06	1.18	1.24	1.35	1.67	5.54	6	446	1
DOKAZ	4.71	2.35	2.24	2.06	2.25	3.24	4.75	5	92	0
MRŽNJA	3.94	3.53	1.50	1.94	3.22	2.76	4.79	5	320	0
SLUH	1.13	4.67	1.06	1.29	1.47	2.33	5.42	4	98	3
LAŽ	2.13	5.06	1.47	1.59	1.89	2.48	5.26	3	192	9
INTERPRETACIJA	4.00	5.59	1.00	1.00	1.94	2.10	4.67	14	19	0
PRENOS	3.94	4.28	1.25	1.18	2.88	2.62	5.21	6	43	1
PRASKOZORJE	5.78	1.50	2.29	1.59	1.24	2.80	2.17	11	47	0
PLANETA	4.71	1.25	1.59	1.59	2.24	3.52	4.25	7	47	1
SUNCE	6.88	1.00	1.38	1.53	5.06	5.10	6.08	5	2984	2
PLIMA	6.06	2.56	2.71	1.41	2.47	4.57	3.33	5	140	3
BLJESAK	6.65	1.47	1.18	1.17	1.44	4.95	3.83	6	133	1
MRAK	6.81	1.41	1.76	1.59	1.72	4.19	5.83	4	1307	11
VARNICA	6.12	3.59	3.33	1.25	4.69	4.71	4.33	7	72	3

PANTOMIMA	6.39	1.31	1.00	1.06	2.41	3.95	3.25	9	6	0
RUPA	6.82	1.33	1.31	1.88	5.25	4.81	5.17	4	80	18
POMRAČINA	5.94	1.00	1.35	1.00	1.71	4.05	3.75	9	53	0
PROSTOR	6.81	2.17	2.06	1.47	4.35	4.05	5.50	7	398	0
UŽIVANJE	4.29	4.35	3.33	2.63	4.35	3.48	5.92	7	19	0
OPREZ	3.56	2.31	1.24	1.53	2.00	2.05	4.21	5	19	0
SILA	3.41	2.41	1.38	1.94	3.59	2.95	5.13	4	25	13
STRAH	5.00	4.44	1.50	1.53	3.41	3.00	5.46	5	3	1
POGODAK	5.44	3.56	1.12	1.41	3.29	3.52	5.29	7	6	1
RAST	5.35	1.22	1.13	1.71	3.12	3.19	5.38	4	46	6
POROD	4.94	2.94	1.71	1.59	3.88	3.57	3.83	5	16	4
GREH	2.00	2.47	1.65	2.17	1.94	1.52	5.00	4	194	1
DEMOKRATIJA	2.35	2.06	1.00	1.00	1.31	1.33	4.75	11	186	1
NAUKA	2.13	2.41	1.12	1.41	1.00	1.86	6.08	5	116	1
IZDAJA	3.35	3.24	1.59	1.17	2.25	2.19	4.79	6	67	0
OSUDA	3.44	5.07	1.41	1.47	2.94	2.43	3.75	5	21	4
RAZUM	2.53	3.61	1.31	1.53	1.31	2.33	5.92	5	64	0
SVRHA	2.00	1.94	1.13	1.18	1.00	1.86	5.33	5	114	1
TAČKA	6.71	1.00	1.11	1.13	2.18	3.95	6.04	5	2	4
SPOT	6.53	3.61	1.13	1.35	1.29	5.24	4.96	4	0	7
POKRET	6.39	4.19	1.76	1.53	5.59	3.81	5.63	6	365	1
TUNEL	6.82	2.06	3.50	1.13	2.76	4.95	4.21	5	98	0
PROVIDNOST	5.35	1.00	1.13	1.24	1.71	3.57	4.30	10	2	1
UZROK	3.06	3.18	1.44	1.63	1.71	2.00	5.67	5	63	0
ŽELJA	2.71	4.41	2.83	1.63	2.47	2.14	6.50	4	795	4
GUBITAK	2.88	2.47	1.41	1.17	3.00	2.24	5.17	7	85	0
METOD	2.06	2.12	1.06	1.06	1.22	2.05	5.17	5	40	1
UTEHA	2.47	4.94	1.44	1.19	3.18	2.43	5.08	5	170	1
TAJNA	2.24	5.47	1.67	1.25	1.88	2.00	6.00	5	511	8
UVREDA	3.06	6.18	1.33	1.31	2.31	2.52	5.04	6	43	0

CIP - Каталогизација у публикацији
Библиотека Матице српске, Нови Сад

81’23(082)

NOVI Sad Workshop on Psycholinguistic, Neurolinguistic and Clinical Linguistic Research (3 ; 2015 ; Novi Sad)
Studies in language and mind [Elektronski izvor] / 3rd Novi Sad Workshop on Psycholinguistic, Neurolinguistic and Clinical Linguistic Research, April 18th, 2015, Novi Sad ; [editors Sabina Halupka-Rešetar, Silvia Martínez-Ferreiro]. - Novi Sad : Faculty of Philosophy, 2016

Dostupno i na: http://digitalna.ff.uns.ac.rs/sadrzaj/2016/978-86-6065-359-0. - Nasl. sa naslovnog ekrana. - Opis zasnovan na stanju na dan: 12.05.2016. - Bibliografija uz svaki rad.

ISBN 978-86-6065-359-0

a) Психолингвистика - Зборници
COBISS.SR-ID 305491719