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DO MORPHOLOGICAL FEATURES AFFECT THE COGNITIVE PROCESSING OF DEVERBAL NOMINALS IN SERBIAN?[2]

The aim of this study was to examine whether different morphological characteristics of Serbian deverbal nominals affect their lexical processing. According to morphological differences, there are three subtypes of the process and result deverbal nominals in Serbian: (i) result nominals end with the zero suffix, while process nominals end with the deverbal suffix –nje (e.g., žubor/žuborenje [eng. burble]); (ii) result nominals differ from process nominals in the presence of the –va infix (e.g., rešenje/rešavanje [eng. solution]); (iii) process nominals end with the deverbal suffix –nje, while result nominals end with other derivational suffixes (e.g., rotiranje/rotacija [eng. rotation]). The final results of three self–paced reading experiments suggest that different morphological features do not affect the processing of deverbal nominals, which strongly supports a–morphous approach to the morpho–lexical processing, as well as the distributed morphology perspective in the field of theoretical linguistics.

Key words: a–morphous morphology, derived nouns, deverbal nominalization, distributed morphology, morpho–lexical processing

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Introduction

Deverbal nominalization is a process in which derived nouns are formed out of verbs. In the last few decades, this phenomenon has been the subject of a number of debates in theoretical linguistics, mostly due to its very complex semantic and syntactic nature (Alexiadou, 2010; Grimshaw, 1990; Paul, 2014; Zlatić, 1997). Grimshaw (1990) has proposed a division of deverbal nominals into three categories: i) process or complex event nominals, which have an argument structure and take obligatory complements (e.g., deverbal nominal *examination* in the example *The instructor's examination of the student*); ii) result nominals, which do not take obligatory complements, therefore they do not have an argument structure (e.g., deverbal nominal *exam* in the example *The instructor's exam*); iii) simple event nominals, which also do not take obligatory complements and do not have an argument structure (e.g., deverbal nominal *examination* in the example *The instructor's examination*). Although the difference between these types of deverbal nouns is clear, this division is proven to be appropriate only in the English language. Previous studies conducted in Serbian suggest that the third category, simple event nominals, is not a relevant category in this language (Gatarić, Srdanović, Nenadić, & Šarić, 2019; Radman, 2015; Srdanović, Gatarić, & Šarić, 2018; Zlatić, 1997). The research conducted by Srdanović et al. (2018) propose both theoretical and experimental vidimus that simple event nominal category is considered to behave identically as process deverbal nominals in Serbian, therefore not satisfying any condition to be seen as a separate category or subcategory in Serbian. Furthermore, it seems that only two distinctive categories of deverbal nominals are relevant for the Serbian language: i) result deverbal nominals (e.g., deverbal nominal *drhtaj* in the example *Snežanin drhtaj je nagoveštavao dolazak zime* [eng. *Snežana's tremble signalled the arrival of winter*]), and ii) process or complex event nominals (e.g., deverbal nominal *drhtanje* in the example *Snežanino drhtanje ruku je nagoveštavalo dolazak zime* [eng. *Snežana's trembling of hands signalled the arrival of winter*]) (Gatarić et al., 2019; Radman, 2015; Srdanović et al., 2018). The key difference between these two types of deverbal nominals is that the process deverbal nominals take obligatory arguments, whereas the result deverbal nominals do not (Grimshaw, 1990). Moreover, the process deverbal nominals are created from imperfective verbs, while the result deverbal nominals are created from perfective verbs (Gatarić et al., 2019; Radman, 2015; Srdanović et al., 2018; Zlatić, 1997). These semantic and syntactic differences are ubiquitous in many languages, while the morphological differences between process and result deverbal nominals vary from language to language, depending on the richness of morphology of the language in question.

Morphological Distinction between Deverbal Nominals in Serbian

All Slavic languages are well–known for their rich morphology, which makes them perfect candidates for research of morphological effects in morpho–lexical

processing. Previous studies interested in the theoretical explanation of deverbal nominalization in Serbian suggest that this phenomenon is morphologically very complex (Ignjatović, 2012; Matracki & Kovačić, 2016). In Serbian, process and result deverbal nominals differ in various morphological characteristics, which means that there are a lot of derivational suffixes related to deverbal nominals (e.g., *–nje*, *–ba, –ija, –aj, –nja, –ak* etc.), as well as the presence/absence of the infixes (e.g., *–va*) in deverbal nominals. Following these morphological differences, three subtypes of process and result deverbal nominals can be distinguished in Serbian: (i) result deverbal nominals have the zero suffix, and the process deverbal nominals have the deverbal suffix *–nje* (e.g., *let/letenje* [eng. *flying*]); (ii) result and process deverbal nominals differ in the presence of the *–va* infix (e.g., *rešenje/rešavanje* [eng. *solving*]); (iii) process nominals end with the deverbal suffix *–nje*, while the result nominals end with other deverbal suffixes (e.g., *rotiranje/rotacija* [eng. *rotation*]). As previously mentioned, to the best of our knowledge, there are no previous empirical studies interested in the examination of deverbal nominals processing with respect to these morphological differences.

Cognitive Processing of Deverbal Nominals

Having in mind the fact that this phenomenon has been intriguing to researchers in the field of theoretical linguistics for years, it is quite astonishing that a minimal interest has been devoted to deverbal nominalization in the domain of psycholinguistics. The first study interested in the examination of the influence of syntactic complexity of deverbal nominals on the processing of entire sentences with the deverbal nominals was conducted in English (Kennison, 1999). The results of this study suggested that sentences with the deverbal nominals with simpler linguistics structure were processed faster than those with the complex syntactic structure. Similar study was conducted in modern Greek with the final results suggesting that the more complex the syntactic structure of deverbal nominals was, the longer time was needed for their processing (Manouilidou, 2006). Taken together, previously described studies supported the idea that semantic and syntactic complexities played the dominant roles in the cognitive processing of deverbal nominals. Furthermore, previous empirical studies interested in the syntactic and semantic differences of process and result deverbal nominals were also conducted in Serbian (Gatarić et al., 2019; Radman, 2015). These studies were designed as a visual lexical decision task (Radman, 2015), as well as the self–paced reading task (Gatarić et al., 2019) with the process and result deverbal nominals as stimuli. The final results of both researches suggested that semantically and syntactically more complex deverbal nominals (process deverbal nominals) were processed slower than those with the simpler linguistic structure (result deverbal nominals). Moreover, a methodologically different study with naturalness judgments and continuation judgments tasks was performed in English (Smirnova, 2015). This study was interested in the comprehension process of

English deverbal nominals, and the final results suggested that deverbal nominals with the more complex linguistic structure were rated as less acceptable according to participants (Smirnova, 2015). Put it differently, it is possible to implicitly conclude that participants perhaps would need more time to process deverbal nominals that are less acceptable to them, namely those that are syntactically more complex in English. Those results go in line with the previous findings in English (Kennison, 1999), modern Greek (Manouilidou, 2006), and Serbian (Gatarić et al., 2019; Radman, 2015). However, it is important to note that neither of the mentioned studies is interested in the examination of the influence of strictly morphological differences of deverbal nominals on their lexical processing, and all of them control (and vary) only for the syntactic and semantic features of deverbal nominals. Also, neither of these studies control for the eventual morphological effects that could affect the lexical processing of deverbal nominals, which leavet an open question about the influence of morphological differences in the domain of cognitive processing of process and result deverbal nominals.

Different Perspectives in the Processing of Morphologically Complex Words

The morphological complexity of words has intrigued and inspired researchers in the field of psycholinguistics to propose a model that could explain the cognitive processing of morphologically complex words in any language. On the one hand, there is a group of authors who propose the traditional models of morphological processing, like for example Decomposition model (Taft, 2004; Taft & Forster, 1975). These lexicon–based models accentuate the importance of the characteristics of single morphemes in the lexical processing, and according to the authors of these models, morphemes are represented as independent lexical units in the mental lexicon. Put differently, these models emphasize that morphological characteristics (e.g., suffix frequency, suffix ambiguity etc.) affect the cognitive processing of the whole words, phrases or sentences (Taft, 2004; Taft & Forster, 1975). Although this perspective counts a large number of supporters, it cannot explain many phenomena observed in the languages with rich morphology (e.g., Serbian) (Kostić, 2010). On the other hand, there is a group of authors who propose an a–morphous perspective in the morpho–lexical processing. They suggest that morphemes do not play an important independent role in the lexical processing (Anderson, 1992; Bybee, 1985), and they are not present as a single level of processing per se, but as a product of mapping a form to meaning. Following this theoretical perspective, psycholinguists have proposed a few models for the interpretation of results observed in the empirical language studies. One of the most popular models, the one with the greatest success in interpreting a large number of morpho–lexical effects, is Naïve Discriminative Learning (NDL) model (e.g., Baayen, 2011; Milin, Feldman, Ramscar, Hendrix, & Baayen, 2017). This model is a learning–based model, and it

successfully explains various morpho–lexical phenomena in different languages (e.g., Gatarić, 2019; Milin, Divjak, Dimitrijević, & Baayen, 2016; Milin, Feldman, Ramscar, Hendrix, & Baayen, 2017; Plag & Winter Balling, in press). Also, it is important to mention that historically, in the domain of psycholinguistics, Manelis and Tarp (1977) proposed a very similar model of processing morphologically complex words many years before previously mentioned a–morphous morphology models. This model was the first one which declined the existence of decomposition in the morpho–lexical processing (Manelis & Tarp, 1977), suggesting that single morphemes characteristics do not influence the whole–word processing. However, this model has not experienced great popularity among researchers interesting in this topic. Last but not least, it is important to mention that a–morphous perspective in the lexical processing is very similar to distributed morphology, the theoretical perspective from derivational morphology (Halle, 1990, 1997). Both perspectives reject the existence of the lexicon, the existence of the single morpheme characteristics effects in the lexical processing, and highlight the importance of semantic and syntactic features.

The Present Study

Guided by the fact that there are no previous similar studies dealing with this topic, the main aim of this study was to examine whether the specific morphological features of Serbian deverbal nominals affected their processing. The morphological differences of deverbal nominals in Serbian were classified in three groups: (i) result deverbal nominals have the zero suffix, and the process deverbal nominals have the deverbal suffix *–nje*; (ii) result and process deverbal nominals differ in the presence of the *–va* infix; (iii) process nominals end with the deverbal suffix *–nje*, while the result nominals end with other deverbal suffixes. According to these differences, three self–paced reading tasks were created, consisting of the three aforementioned subgroups of Serbian deverbal nominals. Furthermore, the second aim of this study was to answer which of the two perspectives in the morpho–lexical processing, lexicon–based perspective or a–morphous morphology perspective, would be supported by the results of this research.

Experiment 1

The current experiment was aimed at answering whether the specific morphological features of Serbian deverbal nominals affected their processing. In the Experiment 1 process and result nominals differed because the result nominals ended with the zero–morpheme, and the process nominals ended with the deverbal suffix *–nje*, the most frequent deverbal suffix in Serbian (Matracki & Kovačić, 2016). Put it differently, the process nominals had an extra morpheme (deverbal suffix) in this particular subgroup of deverbal nominals, which means that they

were more complex in nature than the result deverbal nominals. The stimuli were presented in the sentence context in the self–paced reading task in all three experiments conducted in this study, following the suggestions from the previous studies about the importance of sentences context in the examination of morpho–lexical processing (e.g., Bertram, 2011; Gatarić, 2019; Rayner, 1989).

Method

Participants. Participants in this experiment were undergraduate students from the Faculty of Philosophy, University of Novi Sad (*N* = 70; mostly female), who participated in this experiment voluntarily. Every participant signed the consent form (approved by the Ethical Committee of the Faculty of Philosophy, University of Novi Sad)[3], and all of them were native speakers of Serbian, with normal or corrected–to–normal vision.

Stimuli. The stimuli in this experiment were 48 sentences with the Serbian process and result deverbal nominals. The first step was a selection of the 24 pairs of deverbal nominals (one was process, and the other one result deverbal nominal) with the same stem, but different endings. Each noun used as a stimulus in the experiment had its pair: 24 result nominals ended with the zero morpheme (e.g., *žubor* [eng. *burble*]), and 24 process nominals ended with the deverbal suffix *–nje* (e.g., *žuborenje* [eng. *burble*]).[4] The pairs of deverbal nominals were used in order to control the effects that could arise from the characteristics of a stem (e.g., morphological family size etc.). Then, the next step was to design identical sentences where both deverbal nouns from the pair (e.g., *žubor*/*žuborenje* [eng. *burble*]) fit great. Having all this in mind, there were created sentences of the same length, and with the following syntactic structure: the subject was always in the first place in the sentence (e.g. *Jovana*), followed by an auxiliary verb (e.g., *je* [eng. *is*]) and a verb (e.g., *čula* [eng. *heard*]). Furthermore, a deverbal nominal appeared always in the fourth position (e.g., *žubor* [eng. *burble*]), and the end of the sentence was reserved for the complement/argument (e.g., *vode* [e.g. *water*]) as illustrated in (1).

1_a) Jovana je čula *žubor* vode.
1_b) Jovana je čula *žuborenje* vode.
[eng. *Jovana heard the burble of water*.]

The same number of filler sentences was created, and all the stimuli were randomly divided into two experimental groups with the Latin square design. Also identical sentences (for one pair of deverbal nominals) were selected as stimuli in

[3] The current research was done while the first and the second author were affiliated with the Faculty of Philosophy, University of Novi Sad, which was the reason why this research was approved by the Ethical Committee of that institution.

[4] A small number of stimuli was selected because it was not possible to find more appropriate deverbal nouns in Serbian, and this was also the case in the following two experiments.

all the experiments, in order to control syntactic effects that could arise from the sentence differences, which was a main difference in comparison to all previously conducted research in Serbian.

Design. The factor that was manipulated in this experiment was the type of deverbal nominals (process or result) that differed in some morphological features (zero morpheme, versus *–nje* suffix). In addition, the word length and lemma frequency were included as the control variables. The lemma frequencies were retrieved from *srWac* corpus (Ljubešić & Klubička, 2016), while the word length was calculated according to the number of letters. The dependent variable in this experiment was the reading time of deverbal nominals (measured in milliseconds).

Procedure. The stimuli were presented in a self–paced reading task created in the software *OpenSesame* (Mathôt, Schreij, & Theeuwes, 2012), on a standard PC configuration (Pentium(R) Dual–Core CPU E6600 processor/3.06 GHz/2.00 GB RAM, with monitor set to 75Hz vertical refresh rate and 1600x1200 pixels resolution). All words from the sentences (including both stimuli and filler sentences) were presented single, one–by–one, at the centre of the screen. The participants were verbally instructed to read the words presented at the screen as quickly as possible, and to press button *ENTER* (on the keyboard) when they read the presented word. The presentation of every trial was preceded by a 500 ms fixation point, which remained on the screen until the participants' response, or until 1500 ms had passed. The interstimulus interval was 500 ms. Control questions (about the previous sentence) were given on the screen on several occasions, in order to check whether participants read sentences carefully and with understanding. The stimuli were written in white (font mono), capitalized, and presented on the black screen. The stimuli materials were preceded by five practice trial sentences, and excluded from the statistical analysis. The order of stimuli presentation was randomized for each participant.

Results

The first step in the preparation of data for the statistical analysis was the exclusion of errors, which represented 2% of the total data. The data were analyzed in free statistical software *R* (R Core Team, 2017), by using the packages *mgcv* (Wood, 2006; 2011) and *itsadug* (van Rij, Wieling, Baayen, & van Rijn, 2016). Following Baayen and Milin (2010), reading times were transformed by applying a log–transformation, as well as the covariates lemma frequency and word length. Moreover, numeric predictors order of trial presentation, lemma frequency, and word length were standardized by centring to zero and dividing by the standard deviation (Gelman & Hill, 2007). Also, the collinearity between numeric predictors was checked, and the Cohen's kappa coefficient (Belsley, Kuh, & Welsch, 1980) shown that it was low (κ = 11.79). The data were analyzed with the Generalized Additive Mixed Model (Wood, 2006, 2011), statistical analysis which was

the least sensitive to collinearity among the predictors, which undoubtedly existed in psycholinguistic studies (Baayen, 2008). In addition, in order to test the significance of the fixed effects, two random effects were controlled: the random effect of stimuli and the random effect of participants. The random effect of participants was included with by–participant factorial smooths over trials from the experiment (Table 1), which increased the level of control of the effects that could result from the trials characteristics in the case of different participants from the experiment. In the final version of GAMMs model, standardized residuals that exceeded the range of –2.5/+2.5 standard units were excluded. Furthermore, the model criticism was applied to the model following the procedure proposed by Baayen and Milin (2010). The best final refitted GAMMs model is presented in the Table 1.

Table 1
Coefficients from the Generalized Additive Mixed Model fitted to transformed response latencies from Experiment 1

Parametric coefficients	Estimate	Std. Error	*t*	*Pr(>|t|)*
Intercept	6.23	.04	125.41	.00***
Type of deverbal nominals = result	–.04	.02	–1.62	.10
Trial order	–.00	.00	–.63	.52
Word length	.01	.01	1.31	.18
Lemma frequency	–.01	.00	–2.25	.02

Smooth terms	edf	Ref.df	*F*	*p*
s(Stimuli)	4.18	44	.10	.29
s(Trial order, Subject)	67.978	629	7.33	.00***

Notes. s – thin plate regression spline smooth.
*** $p < .0001$.

As expected, the final model suggests an inhibitory effect of word length, which means that longer deverbal nominals are processed slower than shorter ones. Also, the same model suggests the existence of the facilitatory effect of lemma frequency. Moreover, the same model suggests that the trial order effect is not statistically significant. In the end, the final model suggests that the main effect of the type of deverbal nominals is not statistically significant, which means that the certain morphological differences between Serbian process and result nominals do not influence their lexical processing.

Experiment 2

This experiment also aimed at answering the same question as the Experiment 1, with a distinction that the stimuli differed in the type of morphological characteristics of Serbian deverbal nominals. Unlike the previous experiment, where the differences were related to suffixesprocess and result nominals in the Experiment 2 differed in the presence of the affix *–va*, namely process nominals had the infixes, but result nominals did not.

Method

Participants. Sixty–five undergraduate students (mostly female) from the same university participated voluntarily in this experiment. As in the Experiment 1, every participant signed the consent form, and all of them were Serbian native speakers with normal or corrected–to–normal vision. None of the participants from the Experiment 2 participated in the Experiment 1.

Stimuli. In this experiment, the stimuli consisted of 44 sentences with the deverbal nominals, where the process and result deverbal differed in the presence of infixes. Firstly, 22 pairs of deverbal nominals differing in the presence of the infix *–va* (but have the same stem and the suffix *–nje*) were collected: result deverbal nominals (N = 22) did not have the infix *–va* (e.g., *isključenje* [eng. *cut*]), while the process deverbal nominals (N = 22) had the infix *–va* (e.g., *isključivanje* [eng. *cut*]). The stimuli sentences were created with the identical syntactic regulations as in the Experiment 1.

1_a) Elektrovojvodina je najavila *isključenje* struje.
1_b) Elektrovojvodina je najavila *isključivanje* struje.
[eng. *The Electric Distribution Company announced power cuts*.]

Like in the Experiment 1, the same number of filler sentences were included in the experiment, and all stimuli were randomly divided into two experimental groups with the Latin square design.

Design and Procedure. The two–level factor was a type of deverbal nominals (process or result), where these two types of deverbal nominals differed in the presence/absence of the infix *–va*. The same control variables and dependent variable as in the Experiment 1 were included in the design of this experiment. The procedure was identical as in the Experiment 1.

Results

The first step in the preparation of data for the statistical analysis was the exclusion of errors, which represented 3% of the total data. The data were analyzed with the same software and packages as in the Experiment 1. Accordingly,

the whole process of the preparation of the data for the statistical analysis was the same as in the Experiment 1. After preparation of the data for the statistical analysis, processing latencies were fitted with the Generalized Additive Mixed Model (Wood, 2006, 2011), with the same random and fixed effects as in the previous experiment. The final GAMMs model, standardized residuals that exceeded the range of –2.5/+2.5 standard units were excluded, and model criticism was applied to that model (Milin & Baayen, 2010). The final GAMMs model is presented in the Table 2.

Table 2
Coefficients from the Generalized Additive Mixed Model fitted to transformed response latencies from the Experiment 2

Parametric coefficients	Estimate	Std. Error	*t*	*Pr(>|t|)*
Intercept	6.29	.05	124.10	.00***
Trial order (order of presentation)	–.00	.00	–.61	.53
Type of deverbal nominals = result	–.04	.02	–1.90	.07
Word length	.01	.00	1.37	.16

Smooth terms	edf	Ref.df	*F*	*p*
s(Lemma frequency): Type of DN (process)	1.000e+00	1.00	2.29	.13
s(Lemma frequency): Type of DN (result)	2.181e+00	2.55	2.43	.12
s(Stimuli)	5.643e–04	39	.00	.61
s(Trial order, Subject)	7.337e+01	629	6.94	.00***

Notes. Type of DN – type of deverbal nominals; *s* – thin plate regression spline smooth.
*** $p < .0001$.

The final model suggests that the effects of covariates (trial order, lemma frequency and word length) are not statistically significant. One of the possible explanations for the lack of this effect can be that the stimuli in this experiment are linguistically more similar to each other, in comparison to those from the previously described experiment, which neutralize the existence of processing differences between the two types of deverbal nouns. Furthermore, the main effect of the type of deverbal nominals is not statistically significant, which suggests that certain morphological features do not influence the processing time of process and result deverbal nominals that differ in the presence of infix.

Experiment 3

Like two previously described experiments, this one had the same research question. Differently, process and result nominals in the Experiment 3 differed in a deverbal suffix in which they ended: process nominals ended with the most frequent deverbal suffix *–nje*, while the result nominals ended with other deverbal suffixes (*–ba, –ija, –aj, –nja, –ak, –idba*).

Method

Participants. Sixty–eight undergraduate students (mostly female) from the Faculty of Philosophy, University of Novi Sad participated voluntarily in this experiment. As in the previous experiments, every participant signed the consent form, and all of them were Serbian native speakers with normal or corrected–to–normal vision. None of the participants participated in the previous two experiments.

Stimuli. The sentences (N = 48) with the pairs of process and result deverbal nominals, which differed in the derivational suffixes which they had, were stimuli. The nouns from the same pair had the identical stems, but they ended with the different deverbal suffix: 24 result nominals ended with some of many deverbal suffixes (e.g., suffix *–aj* in deverbal noun *premeštaj* [eng. *relocation*]), and 24 process nominals ended with the deverbal suffix *–nje* (e.g., *premeštanje* [eng. *relocation*]). In the same manner as in the previous experiments, all the other parts of the stimuli design were the same, and sentences presented as the stimuli were created with the identical syntactic regulations

1_a) Fakultet je najavio *premeštaj* kancelarije.
1_b) Fakultet je najavio *premeštanje* kancelarije.
[eng. *The faculty announced the relocation of the office.*]

Design and Procedure. All variables were the same as in the Experiment 1 and Experiment 2. The procedure of this experiment performance was identical to the Experiment 1 and Experiment 2.

Results

The first step in the preparation of the data for the statistical analysis was the exclusion of errors, which represented 2% of the total data. The data were analyzed with the same software and packages as in the Experiment 1 and Experiment 2. Furthermore, the whole process of preparation of the data for the statistical analysis was the same as in the previous experiments. The same statistical analysis was applied, as well as the process of model criticism. The final GAMMs model is presented in the Table 3.

Table 3
Coefficients from the Generalized Additive Mixed Model fitted to transformed response latencies from the Experiment 3

Parametric coefficients	Estimate	Std. Error	*t*	*Pr(>|t|)*
Intercept	6.26	.05	124.39	.00***
Trial order (order of presentation)	.00	.00	.17	.85
Type of deverbal nominals = result	.00	.01	.18	.85

Smooth terms	edf	Ref.df	*F*	*p*
s(Word length)	2.50	2.88	6.27	.00**
s(Lemma frequency)	1.14	1.22	.68	.49
s(Stimuli)	14.65	44	.51	.01*
s(Trial order, Subject)	70.55	629	7.07	.00***

Notes. s – thin plate regression spline smooth.
* $p < .01$. ** $p < .001$. *** $p < .0001$.

As expected, the final model suggests an inhibitory effect of the word length, which means that longer deverbal nominals are being processed slower. The effect of covariates lemma frequency and trial order are not statistically significant, as well as the main effect of the type of deverbal nominals. This suggests that certain morphological features that vary in this experiment do not contribute to the appearance of a difference in the processing of process and result deverbal nominals.

Discussion

The current research was primarily aimed at examining whether different morphological characteristics of deverbal nominals affected their lexical processing in Serbian. Three experiments with the self–paced reading tasks were carried out in order to get an answer to this research question. Morphological differences of Serbian deverbal nominals were classified into three subgroups, according to which the stimuli for the three experiments were created. The stimuli in the Experiment 1 were sentences with the following type of deverbal nominals: result deverbal nominals had the zero suffix, and the process deverbal nominals had the deverbal suffix *–nje* (e.g., *žubor/žuborenje* [eng. *burble*]). In the Experiment 2, the stimuli were result and process deverbal nominals that differed in the presence of the *–va* infix (e.g., *rešenje/rešavanje* [eng. *solution*]). Moreover, the stimuli in the Experiment 3 were process deverbal nominals that ended with the deverbal

suffix –*nje*, and the result deverbal nominals that ended with other deverbal suffixes (e.g., *rotiranje*/*rotacija* [eng. *rotation*]). Another aim of this research was to answer which of the two perspectives in the morpho–lexical processing would be the most appropriate for the explanation of this phenomenon. The data analysis of all three experiments suggests that there is no effect of morphological characteristics in the cognitive processing of deverbal nominals in the Serbian language. These results support the a–morphous perspective in the lexical processing, as well as the distributed morphology perspective from the theoretical linguistics.

Semantic and syntactic complexity of deverbal nominals drew attention of a number of language scientists who dealt with both theoretical and empirical research approaches to the lexical processing. Grimshaw (1990) proposed a division of deverbal nominals in English into result deverbal nominals, process deverbal nominals, and simple event nominals, while in Serbian only two relevant categories existed: result and process deverbal nominals (Gatarić et al., 2019; Radman, 2015; Srdanović et al., 2018; Zlatić, 1997). Most of the previous theoretical and empirical studies were interested only in the syntactic and semantic effects on cognitive processing of deverbal nominals. Almost all of these studies suggested identical results that the syntactic and semantic complexity of deverbal nominals affected their cognitive processing, and the more complex deverbal nominals were, the longer time they needed to be processed (Gatarić et al., 2019; Kennison, 1999; Manouilidou, 2006; Radman, 2015; Smirnova, 2015). However, none of the mentioned studies dealt with the question of the influence of morphological characteristics of deverbal nominals on their processing. Although theoretical studies in Serbian show that there was a certain morphological complexity of deverbal nominals in this language (Ignjatović, 2012; Matracki & Kovačić, 2016), morphology itself was not the subject of empirical research interested in the processing of deverbal nominals neither in Serbian nor in any other language. Additionally, a discussion that has been going on for years in the morphological research circle is whether morphemes themselves affect processing time of the whole word (equivalent to the traditional approach to morphology) (Taft, 2004; Taft & Forster, 1975), or morphology itself has no impact at all on the lexical processing (equivalent to the a–morphous morphology and distributed morphology) (e.g., Anderson, 1992; Baayen, 2011; Bybee, 1985; Halle, 1990, 1997; Milin et al., 2017). Following that discussion, this study is secondly aimed at answering the question whether the final results of this study goes in line with the traditional perspective to morphology, or it supports the a–morphous morphology perspective.

The results observed in the Experiment 1 suggest that there are no differences in the processing of two types of deverbal nominals that differ because the result nominals end with the zero–morpheme, and the process nominals end with the deverbal suffix –*nje*. This finding is in line with the a–morphous morphology and distributed morphology perspectives in the language science (e.g., Anderson, 1992; Baayen, 2011; Bybee, 1985; Halle, 1990, 1997; Milin et al., 2017). More precisely, these results support the idea of the non–existence of the influence of the

single morphemes characteristics in the processing of deverbal nominals. One of the most interesting parts of the results obtained in the Experiment 1 is the fact that there are no differences in the processing time of derived nouns with zero–morpheme (derived nouns with only the root) and regular suffix (*–nje*). This could be one of the most prominent pieces of evidence that a–morphous perspective is present in the lexical processing even in the case of derivational morphology, hence confirming the importance of syntactic and semantics characteristics in the processing of deverbal nominals (the one that is highly controlled in this study). Furthermore, the results from the Experiment 2 and Experiment 3 go in line with those results. In case of the Experiment 2, the results suggest that there are no differences in the processing of process and result nominals that differ in the presence of the affix *–va*. Those results also support the a–morphous perspective in the language processing, and go in line with the previous finding that additional morphemes (infixes in this particular case) do not affect the lexical processing time. The final results of the Experiment 3 suggest that there are no differences in the processing time of deverbal nominals that differ in type of deverbal suffix in which they end. Once again, these results are consistent with the a–morphous perspective in the language processing, and confirm the idea of this perspective which suggests that the characteristics of single morphemes (e.g., suffix frequency, suffix ambiguity, suffix length etc.) do not affect the morpho–lexical processing, especially not when the semantic and syntactic characteristics are highly controlled. Thus, this research undoubtedly supports an a–morphous perspective in the case of cognitive processing of deverbal nominals in Serbian. Also, all the mentioned results are coherent with the distributed morphology (Halle, 1990, 1997), a perspective from the theoretical linguistics, which is complementary to the a–morphous morphology language perspective (Anderson, 1992; Bybee, 1985).

Conclusion

Taken together, the results observed in this study suggest that the cognitive processing of deverbal nominals in Serbian is not affected by the morphological differences of deverbal nominals itself. Moreover, these results go in line with the previous studies that highlight the importance of semantic and syntactic differences in the processing of deverbal nominals in Serbian, and propose the idea that the morphological features of deverbal nominals are not of crucial importance for the appearance of differences in the processing time of process and result deverbal nominals in Serbian (Gatarić et al., 2019; Radman, 2015). Furthermore, these results go in line with the a–morphous perspective in the lexical processing, as well as with the distributed morphology perspective from theoretical linguistics, therefore provoking the traditional view in the morpho–lexical processing.

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DA LI MORFOLOŠKE ODLIKE UTIČU NA KOGNITIVNU OBRADU DEVERBALNIH IMENICA U SRPSKOM JEZIKU?

Cilj ove studije bio je da se ispita da li različite morfološke karakteristike srpskih deverbalnih imenica utiču na njihovu leksičku obradu. Prema morfološkim razlikama, postoje tri podvrste procesnih i rezultativnih deverbalnih imenica u srpskom jeziku: (i) rezultativne imenice koje se završavaju nultim sufiksom, dok se procesne imenice završavaju deverbalnim sufiksom –nje (npr. žubor/žuborenje [eng. burble]); (ii) rezultativne imenice se razlikuju od procesnih u prisustvu infiksa –va (npr. rešenje/rešavanje [eng. solution]); (iii) procesne imenice se završavaju deverbalnim sufiksom –nje, dok se rezultativne završavaju nekim drugim derivacionim sufiksima (npr. rotiranje/rotacija [eng. rotation]). Finalni rezultati tri eksperimenta sa zadatkom čitanja slobodnim tempom pokazuju da različite morfološke odlike ne utiču na obradu deverbalnih imenica, što podržava a–morfni pristup morfo–leksičkoj obradi, kao i distributivno–morfološku perspektivu iz oblasti teorijske lingvistike.

Ključne reči: a–morfna morfologija, derivirane imenice, deverbalna nominalizacija, distributivna morfologija, morfo–leksička obrada