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EXPLORING ALTERNATIVES FOR VISUAL WORD GRAMMATICAL PRIMING PROCEDURE: AN ERP STUDY[2]

In search of the optimal method for assessing grammatical context effects on the visual word processing, we designed a study to demonstrate that in a simple task of reacting to "oddball" word pairs, subjects read and linguistically processed both the function and the content word simultaneously presented in a given pair. Properties of the oddball ERP paradigm allowed for stipulation that word pairs would evoke P300 potentials, and that properties and differences between potentials evoked by grammatically congruent and grammatically neutral pairs would indicate a type of stimuli processing. To test such prediction, we paired a noun and a verb with a congruent preposition and a personal pronoun respectively, preceding them to create a grammatically constrained condition, or with the conjunction preceding both target words to create unconstrained condition. The stimuli were employed in the two-stimulus oddball paradigm. Main outcome of our experiment was that the stimuli chosen evoked clear P300 potential as deviants in three out of four situations. More interestingly, in each of the situations P300 peaked well after 400 ms, falling near the upper limit of P300 range as usually reported. Such P300 latencies marked semantic processing (Polich, 2007), and indicated subjects read and linguistically processed both words in pairs. Our results suggested that in order to study effects of the grammatical context on the visual word processing, the standard priming procedure in which primes temporally preceded targets might not be required, or that it could at least be complemented by methods involving simultaneous primes and target presentation less burdened by technical issues.

Key words: grammatical priming, oddball paradigm, ERP

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Visual word processing is the topic considered as one of the most investigated in the whole realm of cognitive psychology (e.g., Lupker, 2005), in some opinion even in the fields of cognitive sciences and neurosciences (e.g., Zevin & Seidenberg, 2006). Effects of the linguistic context on the word processing are usually explored by means of a priming paradigm, in which a prime word is presented followed by a target word that requires a response from a subject. Priming is qualified by the type of a prime–target relation, hence we talk about semantic, associative, orthographic, phonological, grammatical priming, etc. Each type of priming can be coupled with one of several psycholinguistic tasks posing different demands to the subject, lexical decision, naming, categorization (e.g. semantic, grammatical), being the most frequently employed. Recent literature review suggests semantic, orthographic, and phonological priming to be the robust phenomena (Cortese & Balota, 2013). On the other hand, grammatical priming appears to be more elusive to the point of not even being included in some recent authoritative reviews of the research on the word processing (Cortese & Balota, 2013; Yap & Balota, 2015).

We will use the term 'grammatical priming' to denote all the instances of the target content word (noun, verb or adjective) primed by a single function word (preposition, pronoun, determiner or conjunction). Priming of targets with larger than word language segments, sentences, or sentence fragments pointing out to certain target's grammatical property (word class, word form, etc.), would constitute syntactic priming. The first research on grammatical/syntactic priming in English was published by Goodman, McClelland, and Gibbs (1981), who were able to show that the lexical decision to nouns and verbs was facilitated by congruent (e.g., it tied, no bread), which was contrasted to incongruent grammatical priming (no tied, it bread). Effects of comparable magnitude were obtained in Seidenberg's et al. replication of Goodman et al. study, but only in the lexical decision task, not in naming (Seidenberg, Waters, Sanders, & Langer, 1984, Experiment 1). Wright and Garret (1984) obtained syntactic priming effects by priming nouns and verbs with sentence fragments ending either congruosly (prepositions to prime nouns, and modal verbs to prime verbs), or incongruously in the lexical decision task. West and Stanovich (1986) replicated and extended Wright and Garret's study in a series of experiments that varied some procedural variables, but notably used a lexical decision and a naming task with the same materials to obtain similar priming effects of syntactic priming in both tasks. By using backward masked priming, Sereno (1991) demonstrated the effect of grammaticaly congruous priming in a lexical decision task, but not in naming. However, Bowey (1996) did obtain facilitation of nouns and verbs primed by pronounus, numerals, and modal verbs respectively, to constrain a target word class in the naming task, in non-skilled readers though (the fourth grade children).

In the first study, which was in line of grammatical priming research in Serbian, Lukatela et al. (1982) demonstrated priming of inflected verb forms by congruent personal pronouns in the lexical decision task. In the next study,

there were obtained similar effects of priming inflected noun forms by congruous prepositions (Lukatela, Kostić, Feldman, & Turvey, 1983). In the years to follow, the same group of researchers demonstrated priming of nouns by adjectives matching in gender, number, and case (Gurjanov, G. Lukatela, K. Lukatela, Savić, & Turvey, 1985), and nouns by matching possesive adjectives (Gurjanov, Lukatela, Moskovljević, Savić, & Turvey, 1985). The latter finding was replicated by Lukatela, Kostić, Todorović, Carello, and Turvey (1987). Carello, Lukatela, and Turvey (1988) chose stimuli from the experiment with reportedly the strongest grammatical priming of the lexical decision (Lukatela et al., 1982), to contrast effects of priming on the lexical decision and the naming task. They failed to obtain grammatical priming in the word naming (Experiment 2).

What seemed to be the crucial common feature of all the studies conducted in English in which grammatical/syntactic priming was obtained in naming was that targets from not a single word class, but at least from two word classes, were primed. Lalović (2010; 2006) used Serbian noun and verb inflected forms to prime them either with grammatically congruous primes, nouns with prepositions (e.g., bez cigare – without a cigar), or verbs with personal pronouns (e.g., ona neguje – she nourishes). A neutral situation was created by using conjunctions as primes which precluded neither target word class, nor its form. Concerning the facilitation by congruent priming in Serbian word naming, Lalović obtained a fall in range of 19–25 ms, being approximately as twice as large as the effects obtained in English word naming, and was not influenced by the prime exposure duration (Lalović, 2010).

A tentative conclusion that might be drawn from this brief summary would be that grammatical priming can be demonstrated in the visual word recognition, and the reasonable question then would be not if it occurs , but under which conditions the grammatical priming occurs. However, grammatical priming is heavily influenced by factors critically constraining conclusions and theorizing on its effects, and for that matter, effects of all the other kinds of linguistic priming on the word processing.

Despite its apparent simplicity, at least two major factors[3], a type of psycholinguistic task and stimulus onset asynchrony, critically influence conclusions to be drawn from the grammatical priming experiment. One of two workhorses in the word processing research, to borrow Cortese and Balota's term (2013), is a lexical decision task. This task has been clearly the first researchers' choice in grammatical/syntactical priming studies, as the literature review suggests. The lexical decision is a binary decision task which requires from a subject to decide as quickly as possible whether the letter string presented is a word or not. As such, the task includes a decision phase that is obviously not included in the online word process-

[3] We find choice of an adequate prime (e. g. linguistic or graphic) to construct a neutral situation in linguistic priming, and establish an adequate reference base line for priming effects estimation to be the factors of equal importance with the two we have discussed. However, they fall out of scope of the present study.

ing. Besides over exaggerating the role of word frequency in the lexical access, the decision phase is strongly influenced by nonwords proportion and characteristics (e. g. Balota & Chumbley, 1984). Evidence suggest that the lexical decision promotes a strategic process of backward prime-target congruency checking, when employed in the linguistic priming paradigm (Neely, Keefe, & Ross, 1989), as a logically viable option for reaching the (lexical) decision, since non-words can never be related to the primes. On the other hand, a naming or pronunciation task is thought to primarily tap the processes of recognizing a letter string as a word, or spelling-to-sound translation (Yap & Balota, 2015), as it is more clearly implicated in the on-line word processing. When obtained in the linguistic priming, naming latencies should predominantly reflect such prelexical processes.

Another important factor in priming is stimulus onset asynchrony (SOA), the time frame of a prime exposition, which follows the prime-target blank interstimulus interval. In terms of Posner-Snyder classic dichotomy (Posner & Snyder, 1975), shorter SOAs are generally assumed to favor automatic processes of facilitation, while longer SOAs invoke controlled strategic processes of inhibition in case of incongruous priming or target guessing in congruous priming (e.g., Neely, 1991). Longer SOAs therefore clearly promote processes of lesser relevance for the real time visual word processing. In search of the optimal method for assessing grammatical context effects on the visual word processing, we believe that departure from a standard priming paradigm could be fruitful. An optimal method should be free of equivocalities, which bears a choice of word processing task and SOA. The task should also be applicable in other language research paradigms, most importantly in eye tracking, with as less as possible modifications of stimuli presentation procedure, that make results comparisons across different paradigms difficult, if meaningful at all. Presenting prime and target simultaneously with the linguistic task of silent reading would meet those requests nicely. Obvious pitfall in such procedure would be a question of subjects attending both primes and targets. We choose to approach the problem by using event related potentials (ERP) in the oddball paradigm (Donchin, 1981).

Oddball is one of the oldest (Sutton, Braren, Zubin, & John, 1965) and most employed ERP paradigm. Typically, it is run in two-stimulus variant, in which an infrequent target (a "deviant") is presented in a background of frequent "standard" stimuli, deviant requiring response from the subject (Polich, 2012). Discriminating deviants from the standards reliably evokes P300 ERP component. Defining feature of this late positive component is its latency, i.e. time elapsed from the stimulus onset to the moment when the component's amplitude reaches its peak. P300 peaks within relatively broad time window of 250–500 ms, depending on the stimulus modality, task and the subject's age (Polich, 2007), but usually at some 300 ms. In most cases, P300 amplitude gets larger with the task difficulty, but this relation is not straightforward as being mediated by several variables (Luck, 2014). Regardless of subtleties in theorizing about the exact nature of processes reflected by P300, it is widely accepted that P300 latency is an index of

categorization speed (e. g. Luck, 2014; Polich, 2012). Stimuli manipulations that make target classification more difficult will prolong P300 latency and postpone the onset time of the difference in the brain activity between standards and deviants (Luck, 2014; Polich, 2012). There is an ample evidence that semantic-rooted differences between stimuli produce longer P300 latencies compared to non-semantic (e.g. spatial) stimuli differences (Renault, Ragot, Lesevre, & Remond, 1982; Ritter, Simson, & Vaughan, 1983).

Properties of the oddball paradigm stated above allow for stipulation that grammatical primes and targets presented simultaneously would evoke P300 potentials of latencies longer than those typically evoked by non-verbal stimuli not requiring reading for detection, if linguistically processed in a simple task of deviants detecting,. To test such stipulation, we employed word pairs constructed after Lalović's grammatical priming experiments (2010; 2006) to present them in the two-stimulus oddball paradigm. We further expected wave amplitudes to be larger for grammatically neutral than for grammatically congruent word pairs, reflecting more effortful detection in the former case.

Method

Participants

Fifty two participants, students of the Department of Power, Electronics and Communications, Faculty of Technical Sciences, University of Novi Sad, who obtained the course credits for their participation, and who signed the Informed Consent prior to their participation in the study, took part in the experiment.

The ERP instrument

For the purposes of measurement of ERPs we used NeuroIM-1 system developed at the Faculty of Technical Sciences, University of Novi Sad. NeuroIM-1 system was intended for extracting ERPs on the base of recordings from electrodes positioned on international 10–20 system locations. (For the detailed description of NeuroIM-1 system see Sovilj, Davidović, Beljić, & Ković, 2011).

Design and Procedure

Participants were seated in front of a monitor in a small, quiet room, approximately 80 cm away from the experimental monitor. Prior to the experiment, participants were informed that the study was aimed at testing neural activities during various experimental conditions, and that they would take part in the oddball paradigm task, which was known to be sensitive to participant`s expectancies of the frequency of the stimuli appearance.

Stimuli for the constrained and unconstrained grammatical condition were chosen after Lalović's (2010; 2006) experiments at random, i.e. as they came as the examples of the conditions in the authors' discussions of the future research. The noun "lopta" was presented in a form "loptu", preceded by a congruent preposition "na" (na loptu – on ball), the verb "piti" was presented in a form "pije" preceded by the third person masculine pronoun "on" (on pije – he drinks) in the constrained condition. The preposition and the pronoun both pointed to the following word class and a specified case of the noun (Accusative Singular), and tense and person of the verb (the third person Present of the verb). The same noun and verb forms were preceded by a conjunction "ili" (or), which precluded neither target word class nor its morphological properties in the unconstrained grammatical condition. Thus two pairs of materials type were presented: a noun in the constrained/unconstrained condition and a verb in the constrained/unconstrained condition. Each subject responded by key pressing to one of the stimulus in pair described as to the deviant (i.e. infrequent stimulus with 20 per cent occurrence in stimuli sequence, total of 20), while the other in pair served as a standard (i.e. frequent stimulus with 80 per cent of occurrence, total of 80). Subjects were assigned to one of four experimental conditions in order in which they appeared in the experimental room. The number of participants per condition were: 11, 15, 14 and 13 in "ili loptu", "ili pije", "na loptu" and "on pije" experimental conditions, respectively. Stimuli (two words one next to the other) were presented in the center of the experimental 17-inch monitor to avoid eye or head movements in order to prevent confounds in the ERP signals.

We used the following sequence of stimuli presentation: initially, participants would see a fixation cross for a variable amount of time: 500±100 ms. The jittering (variation of ±100 ms) was used in order to prevent preparatory motor responses and masking effects in the ERP signals due to participant's getting into the rhythm of the task (Luck, 2005). After presentation of the fixation cross, participants were presented with a visual stimulus for the duration of 400 ms. subsequently, a blank screen was presented to them for 500 ms with a jitter of ±100 ms.

The EEG data were recorded continuously from the CZ electrode and subsequently analysed.

Together with the on-set and clean-up of the ERP methodology, the experiment lasted approximately 40min per participant. Participants were instructed to keep their right index figure on the keyboard and press the target button every time they see the deviant stimuli. By doing so, they did not need to move their gaze away and back to the monitor, but they focused on the stimuli only. So, the explicit instruction was to keep the index finger on the keyboard throughout the experiment, and press the target button (marked on the keyboard) only upon seeing the deviant stimuli.

After the completion of the experiment, participants were given a brief explanation about the purpose of the experiment.

Results[4]

Reaction Time Analysis

Data from total of 52 participants were analyzed. Means, standard deviations and median reaction times in four situations named after deviants were the following respectively: "na loptu": M = 413.77, SD = 46.54, MD = 410.52; "ili loptu": M = 407.08, SD = 40.19, MD = 410.90; "on pije": M = 415.49, SD = 35.69, MD = 408.55; "ili pije": M = 408.90, SD = 44.27, MD = 399.25; overall across all the situations: M = 410.91, SD = 41.13, MD = 408.00. ANOVA with two between-subjects factors (Nouns–Verbs; Constrained–Unconstrained Group) revealed that there were neither significant main effects ($F(1, 49) = 0.02$; $p = 0.88$, $F(1, 49) = 0.32$; $p = 0.57$, for Nouns–Verbs, Constrained–Unconstrained groups, respectively), nor the interaction effect ($F(1, 49) = 0.00$; $p = 0.99$). Thus, participants did not differ according to the speed with which they detected deviant stimuli.

ERP analysis

The recorded ERPs were cut into the epochs for all experimental procedures and all the participants,. All the epochs that contained the noise (including participants' motor movements, eye-blinks, drifts etc.) were manually eliminated from the subsequent analysis. The percentage of the elimination of the noise was less than a 5% for all the participants. The baseline for the epochs was 200 ms prior the stimuli presentation.

Initially, all of the epochs were cut into 20 ms windows intervals, so that the total number of the analysed intervals was 44 (2 prior to presentation of the stimuli, and 42 after the stimulus presentation). Given the multiple comparisons, Bonferroni corrections were also applied. Finally, the significant differences were reported only when the neighbouring 20 ms bins were significant at the $p < .05$ level (Eddy, Schmid, & Holcomb, 2006).

ERP latencies

Nouns.

For nouns, 20– by –20 ms analysis revealed that there were a number of intervals within which there were significant differences in the ERP amplitude between standard and deviant stimuli. For the group of participants who had "ili loptu" as a deviant stimuli, t-tests revealed that there were subsequent significant differences starting from the time window of 360–380 ms to the time window 420–440 ms (see Table 1a and Figure 1a). For the group of participants who had "na loptu" as a deviant stimuli, t-tests revealed that the subsequent significant dif-

[4] All of the raw data (RT and ERP) will be available at the OSF site upon acceptance of this publication.

ferences started latter, from the time window of 420–440 ms to the time window 460-480 ms.

Table 1a

Intervals with the significant differences between standards and deviants according to the t-test analysis for the 20 ms interval bins (N = 52)

Deviant	–200–360	360–380	380–400	400–420	420–440	440–460	460–480	480–
"ili loptu"		*	**	*	*			
"na loptu"					*	*	*	

Note. $*p < .05$; $**p < .01$.

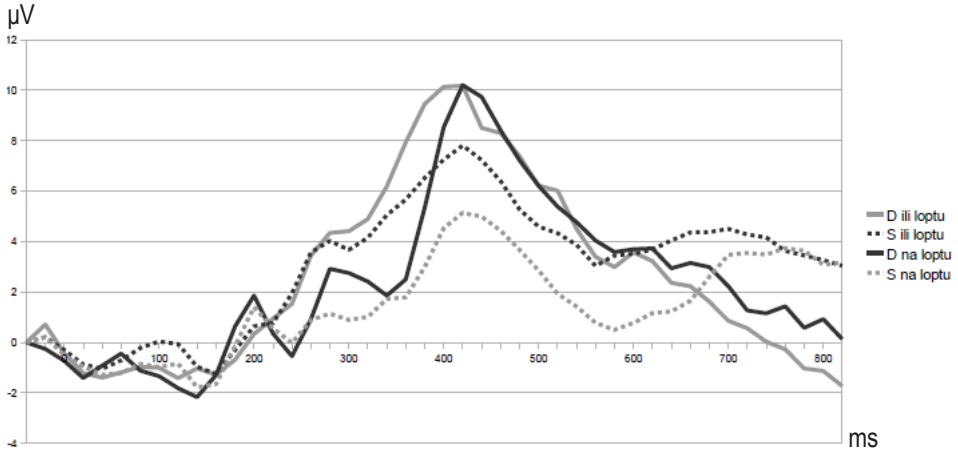

Figure 1a. ERP profiles for the Deviant–Unconstrained/Standard Constrained and Deviant–Constrained/Standard Unconstrained noun conditions.
*Note. F*ull lines for the Deviant stimuli, dashed lines for the Standard stimuli; light grey for the Unconstrained stimuli, and dark grey for the Constrained stimuli.

Verbs.

For verbs, 20– by –20 ms t-test analysis showed that for the group of participants who had "ili pije" as a deviant stimuli, there were subsequent significant differences starting from the time window of 440–460 ms to the time window 480–500 ms, as well as from 540–560 ms to 600–620 ms (see Table 1b and Figure 1b). For the group of participants who had "on pije" as a deviant stimuli, *t*-tests revealed no significant differences between standard and deviant stimuli.

Table 1b

Intervals with the significant differences between standards and deviants according to the t-test analysis for the 20 ms interval bins (N = 52)

Deviant	–200–440	440–460	460–480	480–500	540–560	560–580	580–600	600–620	620–
"ili pije"		*	*	*	*	*	*	*	
"on pije"									

Note. ∗$p < .05$.

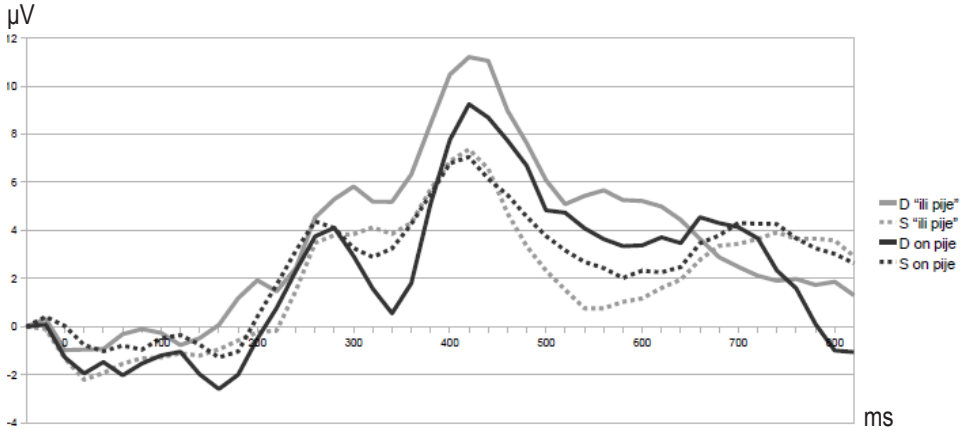

Figure 1b. ERP profiles for the Deviant–Unconstrained/Standard Constrained and Deviant-Constrained/Standard Unconstrained verb conditions.
*Note. F*ull lines for the Deviant stimuli, dashed lines for the Standard stimuli; light grey lines for the Unconstrained stimuli, and dark grey lines for the Constrained stimuli).

ERP amplitudes (difference waves)

Mixed factors ANOVA for the time-window 360–500 ms with Standard–Deviant as a within-subject factor and Noun–Verb and Constrained–Unconstrained groups, as between-subject factors revealed a significant main effect of Standard–Deviant ($F(1, 49) = 9.04$; $p < 0.01$, $\eta^2 = 0.16$, Greenhouse-Geisser corrected), but no significant effects of Noun–Verb factor ($F(1, 49) = 0.01$; $p = 0.91$), or Constrained–Unconstrained group factor ($F(1, 49) = 1.86$; $p = 0.18$). Also, none of the two-way or three-way interactions were significant (Standard–Deviant X Noun–Verb: ($F(1, 49) = 0.18$; $p = 0.68$), Standard–Deviant X Constrained–Unconstrained ($F(1, 49) = 0.18$; $p = 0.67$), Noun–Verb X Constrained–Unconstrained ($F(1, 49) = 0.11$; $p = 0.74$) and Standard–Deviant X Noun–Verb X Constrained–Unconstrained ($F(1, 49) = 1.31$; $p = 0.26$). Thus, apart from the P300 effect (difference between standard and deviant stimuli across the conditions), there were no other amplitude differences across above listed experimental conditions (see Figure 2).

Figure 2. Difference waves for the Noun–Verbs Constrained/Unconstrained word groups.
Note. Lines for the four experimental conditions are marked according to the deviant stimuli; light grey for Nouns and dark grey for Verbs).

Discussion

Championing the idea of P300 serving as a measure of the stimulus processing independent of overt motor responses, Kutas, McCarthy, and Donchin (1977) were able to track it down to Woodworth (1938), who expressed hope that ''brain waves" might be used one day as the indeces of the exact mental processes timing. Median reaction times, which we obtained in our oddball experiments, fell in range of two-choice reaction times median (e.g., Luce, 1986), failing to reflect any effect of stimuli manipulation. However, evoked potentials analyses revealed a different scenario for the pairs of linguistic stimuli employed processing. The first significant outcome of our experiment was that nouns as the deviants evoked clear P300 potential both in a constraning and unconstraining context, and verbs did it in the unconstraining context. More interestingly, in each of four situations P300 peak latency was well above 400 ms, falling near the upper limit of P300 range, as usually reported. Such outcome indicated that the semantic processing took place in the case of stimuli we chose to represent grammatically constraining and unconstraining context (see Polich, 2007 for a P300 latency interpretation). No other earlier ERP component was obtained, suggesting differences in the perceptual processing or attentional bias to some of stimuli. In comparison, using exactly the same apparatus and the same oddball design in our laboratory, Ković, Sovilj, and Gvozdenović (in preparation) obtained P300 of the average 200 ms latency for purely graphic stimuli ("Packman") in a visual search task. Therefore, we were prone to conclude that both of words in the word pairs creating constraing and unconstraining conditions were linguistically processed, i.e. that the preceding close class word in each pair influenced the following open class

word processing in a simple task of silent reading. Our expectation for detection of grammatically neutral word pairs to be more effortful than detection of grammatically congruent pairs in terms of the recorded neural activity, was not corroborated by difference waves analysis.

Priming is defined almost invariably by the temporal prime-target relation across various fileds in which the concept is debated (e.g., Houdé, 2004). Our results show that in order to study effects of the grammatical context on the visual word processing, a standard priming procedure in which primes precede targets might not be required, or that it could at least be complemented by methods apparently bearing less burden of the technical issues. Such method would obviously be a simultaneous presentation of what would be called primes and targets within a standard priming paradigm, coupled with any of the psycholinguistic tasks. A method we advocate could be readily implemented in a gaze-contigent eye-tracking procedure, yielding data comparable across behavioural, ERP and eye-tracking studies. There is already evidence that eye fixation and naming measures are similarly sensitive to word frequency, which hold somewhat less for eye fixation and lexical decision data (Shilling, Rayner, & Chumbley, 1998). Evidence as such, obtained on single words processing measures, makes our prediction that eye fixations would be shortened in grammatically constrained condition viable. The procedure of presenting simultaneously what would be called primes and targets within a standard priming paradigm has been employed at least in one research in Serbian, to our knowledge. Katz, Rexer, and Peter presented feminine Serbian monosemous and polysemous nouns in the nominative case preceeded by 3 asterisks to which they refered as to a neutral "prime", in the accusative case precedeed by the same prime, and in the accusative case precedeed by the preposition matching the case (Katz, Rexer, & Peter, 1995; Experiment 2). Lexical decision was speeded by some 27 ms[5] to monosemous accusative nouns precedeed by prepositions compared to the same nouns precedeed by asterisks, while the same context effect was approximately 36 ms for polysemous nouns. Such an outcome lended further support for our argument.

Conclusion

Our study has been designed to demonstrate that in a simple task of reacting to simultaneously presented "odball" word pairs, which theoretically could be acomplished without word reading and processing, subjects read and linguistically process both the function and the content word in a given pair in rather Stroop-like manner (Stroop, 1935). Principal limitations of our study stem from different logic behind odball and typicall psycholinguistic experimental design. In the odball experiment usually a small number of stimuli is presented numerous times,

[5] Katz et al. did not provide any of RT central tendency measures, the effect was visually estimated after Figure 2 (p. 95).

while in a psycholinguistic experiment, e.g., naming, or lexical decision, a larger set of stimuli is selected to represent the respective stimuli population. Stimuli we employed have been deliberately chosen in a quasirandom manner, only to demonstrate linguistic processing that takes place in a simple task not necesserily requiring such processing, nor exploring conditions under which it occurs. Given that we have presented a noun and a verb constrained with only one preposition and one personal pronoun respectively, our experiment cannot account for certain differences in the wave latencies across noun and verb conditions, as it is not aimed at comparing those conditions. It can be speculated that frequency of the noun and the verb chosen, and especially preposition–noun, conjunction –noun, pronoun–verb, and conjunction c-verb coocurence contributed to the pattern of the obtained results. We would expect differences in frequency of words pairs coocurrence in the constrained/unconstrained condition to critically determine the odball effects we have obtained. Frequency and proximity (the average number of words interpolated in a discourse) of the function – open class words would significantly affect grammatical priming effects in general beyond single words frequencies, in our oppinion. Boundary conditions under which grammatical context on the word processing effects occur should be further examined in psycholinguistic experiments with carefully chosen larger set of stimuli controled for all the relevant linguistic variables. Our study indicates that the task of simple silent reading could be sucessfully employed instead, or in addition to, primed naming task for that purpose.

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ISTRAŽIVANJE MOGUĆNOSTI ZA GRAMATIČKO PRIMOVANJE VIZUELNO PRIKAZANIH REČI POMOĆU ERP-A

U potrazi za optimalnim metodom proučavanja efekata gramatičkog konteksta na obradu pojedinačnih reči, izveli smo istraživanje kojim smo pokazali da u jednostavnom "odball" zadatku sa vizuelnim prikazivanjem ispitanici čitaju i jezički obrađuju obe reči u simultano prikazanim parovima. Karakteristike ERP "odball" paradigme dopuštaju pretpostavku da će parovi reči pobuditi potencijal P300, te da će fine razlike između potencijala evociranih gramatički saglasnim i gramatički neutralnim parovima ukazati na svojstva njihove kognitivne obrade. Imenica i glagol upareni su sa saglasnim predlogom, odnosno sa ličnom zamenicom, radi kreiranja gramatički ograničavajućeg konteksta, ili sa gramatički neutralnim veznikom radi kreiranja slobodnog konteksta. Takvi stimulusi prikazani su u "odball" paradigmi sa dva stimulusa. Glavni ishod našeg eksperimenta je da su odabrani parovi reči pobudili jasan potencijal P300 u tri od četiri eksperimentalne situacije. Interesantno je da je u svakoj od tih situacija P300 dostigao vrhunac tek nakon 400 ms, što je otklon koje se približava gornjoj granici uobičajenog javljanja P300 i smatra se obeležjem semantičke obrade (Polich, 2007). Ovakav rezultat pokazuje da su ispitanici pročitali i jezički obradili obe reči u parovima. Naši nalazi sugerišu da u cilju proučavanja efekata gramatičkog konteksta na obradu vizuelno prikazanih reči standardni postupak primovanja, u kojem reči-primovi prethode prikazu reči-meta, nije nužan. U najmanju ruku može se zaključiti da postupak jednovremenog prikazivanja reči korišćen u ovoj studiji, uz zadatak čitanja u sebi, može predstavljati dopunu ili zamenu postupka primovanja u istraživanjima delovanja gramatičkog konteksta na obradu pojedinačnih reči, budući da je poznato da postupak primovanja nosi sa sobom metodološke teškoće.

Ključne reči: gramatičko primovanje, "odball" paradigma, ERP