GRAMMATICAL PRIMING DOES FACILITATE VISUAL WORD NAMING, AT LEAST IN SERBIAN

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Abstract: Starting from the seminal work in 1980s to more recent findings, literature review suggests grammatical priming to be an elusive fenomenon, reliably obtained mostly in a lexical decision task and only rarely in naming task. Prevalent conclusion derived from the aforementioned fact suggests the effects of grammatical priming to be of less importance for online word processing as reflected by naming. However, this goes against intuitive notion of grammatical information being especially valuable in processing richly-inflected, free-word ordered language such as Serbian. The conclusion was challenged in a naming task in which prepositions and personal pronouns were employed to prime target nouns and verbs. We also tested the effect of prime-target asynchrony at 600ms and 250ms intervals, as the variable is known to invertly influence effects of language priming. Delayed naming condition was used to provide a purer estimate of target processing time afforded at the two asynchrony intervals in online naming. Analyses suggest effects of grammatical priming to be both substantial and robust. The facilitation of 22 ms (25 ms at 600 ms asynchrony, 20 ms at 250 ms asynchrony) provided by grammatical information was roughly twice as large as obtained in comparable studies in English. The facilitation effect was not qualified by interaction with SOA and therefore should not be attributed to some major strategic process associated with the longer SOA. We conclude grammatical priming in naming to be possible, at least in case of richly-inflected, free word-ordered language, and more than one word class primed. Online-delayed average latencies difference indicated slightly wider time window for target processing at the shorter asynchrony. The fact requires caution in grammatical priming effects loci interpretation.

Keywords: grammatical priming; word naming.

ACM Classification Keywords: I.2 Artificial Intelligence; I.2.7 Natural Language Processing – Language parsing and understanding.

Introduction

The research presented re-examines effects of grammatical information provided by single-word grammatical priming in word naming. The evidence of robust effects of such priming in Serbian word naming will be laid out along with certain considerations and further steps in the fenomenon investigation.

Grammatical priming could be considered a special case of syntactic priming, in which single, usually but not necessarily, function word acts as a prime to constrain some open-class target word grammatical properties. For

instance, in English the definite article *the* constrains following target word class to nouns (e. g. *the law*, but not *the judged*); in Serbian prepositon *kroz* (through) constrains both the target word class (noun) and the case (accusative). Starting from the seminal work of 1980s to more recent research, literature review suggests grammatical priming to be reliably obtained mostly in a lexical decision task and rarely in naming task. Goodman et al. were the first to demonstrate grammatical priming in lexical decision, employing single function-word primes [Goodman et al., 1981]. They used words with the function similar to that of articles and pronouns in English to prime either congruously *(it tied, no bread)* or incongruously *(no tied, it bread)* target verbs and nouns. The effects of such grammatical priming were 15-19ms in magnitude, i.e. more than twice weaker than the effects of semantic priming obtained in the same study. Seidenberg was able to replicate Goodman's findings using the same stimuli only in a lexical decision task. Grammatical priming had only marginal effects in naming task [Seidenberg et al, 1984]. Seidenberg et al. discussed the finding in terms on pre- and postlexical loci of word processing, stipulating that grammatical priming operates only at the level of postlexical processing required by lexical decision. West and Stanovich [1986] further validated the notion of grammatical priming effects restricted to postlexical processing. In their study syntactic priming was employed on the same materials in both lexical decision and naming task. Materials were taken from Wright and Garret's study [1984]. West and Stanovich used sentence fragments ending either with modal verb (e. g. *could, would*) or with preposition (e. g. *of*, *through*) to prime target verbs and nouns either congruously or incongruously. In series of experiments they varied procedural variables (reading priming context silently or overtly, pace of context presentation, materials employed, etc.) to reach the conclusion that syntactical priming effects are robust and comparable in magnitude in both word processing paradigms. Stronger priming effects on naming were obtained in Experiments 1 and 2 where average naming latencies were longer than in Experiments 3 and 4. West and Stanovich were prone to conclude naming task not to be immune to postlexical processing in cases of prolonged naming latencies, thus assigning syntactical priming effects in naming to that type of processes. Establishing the loci of language priming effects was the purpose of Sereno's study, in which graphemic, associative and grammatical priming in backward masked primed lexical decision and naming was employed [Sereno, 1991]. A single set of procedural variables and an extremely short prime exposition of 60ms was employed in the three types of language priming. The short exposition was introduced to limit possible strategic influences not directly associated with online word processing, such as generating expectancies about the target, etc. Sereno showed that grammatically congruous priming (verbs with modal verbs, nouns with determiners or possessive pronouns) facilitated only lexical decision by 28ms, while there was no analogue effect on target word naming. Such an outcome further favors the notion of grammatical priming effects being postlexical in nature. Bowey in her more recent study examined single-word grammatical priming in children word naming [Bowey, 1996]. While there is a general agreement of semantic context effects to be greater for poor readers than for good readers [Perfetti et al., 1979; Simpson et al., 1983] and for children than for adults [Simpson & Lorsbach, 1983; West & Stanovich, 1978], little is known of grammatical context effects in those groups. Subjects in Bowey's study were fourth-grade children (average CA 9 years 3,75 months), target stimuli were uninflected and inflected nouns and verbs primed by pronouns and

numerals (nouns) or by modal verbs (verbs) in grammatically constrained condition. In the grammatically unconstrained condition target words of both types were primed by conjectures *and/or*, which did not preclude neither target word class nor its form. Priming effects were evaluated at three different SOAs: 750ms (Experiment 1), 700ms and 400ms (Experiment 2). The facilitation obtained by priming in grammatically constrained condition was respectively 16ms, 13ms and 9ms, respectively in three stimulus onset asynchrony (SOA[1]) conditions. Difference of facilitation obtained under 700ms SOA condition and 400ms SOA condition proved not to be significant, leading to the conclusion of grammatical priming effects not likely to be attributed to some major strategic process associated with longer SOA. Finding that inflected and uninflected target word forms naming was equally facilitated by grammatical priming led to a tentative conclusion that the primary purpose of grammatical context is to constrain the target word class.

Initial research of grammatical priming in Serbian was published briefly following the paper of Goodman et al. [1981]. The research was guided by the idea of replicating and further exploring grammatical priming in language of rich inflectional morphology, with almost entirely free-word ordered syntax. In the first of two papers, Lukatela et al. [1982] demonstrated grammatical priming of inflected verb forms by congruent personal pronouns at SOA of 300ms (63ms effect) and at SOA of 800ms (96ms effect) in lexical decision task. The next study demonstrated similar effects of congruous priming of inflected noun forms by prepositions in which the prime exposition was paced by subjects [Lukatela et al., 1983] . In both studies facilitation by congruous priming was estimated with respect to the situation of incongruous priming of the same target stimuli (verbs primed by incongruous personal pronouns, nouns primed by incongruous prepositions). The hypothesis derived from the volume of research described was that grammatical priming in Serbian occurs at the level of inflexions – suffixes which specify open-class word forms thus specifying their grammatical properties. In research to follow the same group of researchers further explored the hypothesis outlined by employing properties of Serbian inflectional morphology. In the first of two studies of such type, Gurjanov et al. [1985a] primed target nouns by adjectives consistent with respect to the noun gender, number and case all marked with inflectional suffix (LEP*A* ŽEN*A* – beautiful woman).The task employed was lexical decision, again self paced as in Lukatela et al., 1983 [Gurjanov et al., 1985a]. Facilitation by congruous priming was measured against the condition of incongruous priming (primes and targets not matching in inflection, thus not matching in grammatical properties stated). Similar facilitation was observed when adjectives and adjectives looking like pseudowords with congruous or incongruous inflexions, primed target nouns. Such outcomes further favored the notion of grammatical priming acting upon a level of Serbian word inflexions. In the following study, possessive pronouns were used to prime target words in lexical decision task [Gurjanov et al., 1985b]. Facilitation by congruent priming (MOJA LOPTA – mine ball) was observed against the situation of priming the same targets with a look a like but nonsense pseudopronouns (MEJA LOPTA). The finding of nouns primed by congruent possessive pronouns was replicated in Lukatela et al. research [1987]. Further, it was observed that priming of target pseudonouns is also possible, as long as they share the same

[1] Interval of prime exposition plus latency between prime offset and target onset

inflections with possessive pronoun primes. In a more recent research, Serbian feminine nouns in nominative were primed by neutral visual prime *** and in the accusative case either by the same neutral visual prime or by congruent prepositions in a lexical decision task [Katz et al., 1995]. Congruent accusative priming yielded an effect of roughly 25ms facilitation as compared to a neutral situation defined by priming the same case with ***. However, the research of Katz et al. could not be regarded as a strictly grammatical priming study despite the materials employed, since the primes and targets were *simultaneously* visually presented.

The only study to directly compare effects of grammatical priming in lexical decision and naming task was the one by Carello et al. [1988] . In Experiment 1 effects of associative and grammatical priming of nouns by congruent and incongruent possessive pronouns in lexical decision and naming were contrasted. Carello et al. found both tasks to be sensitive to associative priming but only lexical decision to be sensitive to grammatical priming. Experiment 2 employed the same materials as it was employed in Lukatela et al's initial study in Serbian [Lukatela et al., 1982]. The effects Lukatela et al. [1982] obtained on identical materials in lexical decision were 63ms (300ms SOA) and 96ms (800ms SOA) were among the strongest grammatical priming effects. At the SOA of 600ms Carello et al. were not able to establish differences between naming latencies in situations where either target verbs or pseudoverbs were primed by congruous pronoun, incongruous pronoun or by pseudopronoun, respectively. Carello et al. [1988] concluded grammatical priming to be a phenomenon restricted to a lexical decision task. Naming, in their opinion, appears to be immune to automatic postlexical prime-target coherence check that influences lexical decision [Carello et al., 1988, p. 193].

Evidence on the effects of grammatical priming on word recognition is not restricted to data obtained in experimental paradigms employing strictly visual prime presentation. There is ample evidence of grammatical priming effects in cross-modal priming studies conducted in several languages other than English: Italian [Bentrovato et al., 1999; Bates et al., 1996; Bates et al., 1995], German [Hillert & Bates, 1996], Russian [Akhutina et al., 1999] and Chinese [Lu et al., 2000]. However, variations in methods employed and differences in the respective languages' syntax and morphology make such evidence rather suggestive than conclusive.

Prevalent conclusion derived mainly from studies in English of grammatical priming acting upon postlexical processing since it has been reliably observed only in lexical decision task and therefore being of less importance for online word processing, would seem premature in light of the evidence already presented. First, besides failed attempts, several studies indicated grammatical priming to affect visual word naming in English. Second and arguably more important, it seems premature to disregard the phenomenon of grammatical priming in word naming on account of mixed results obtained predominantly in one language. Grammatical properties of Serbian favor another scenario, we believe. The Serbian morphology, unlike the English morphology, is a highly inflected one. All open class words, as well as some types of closed class words, consist of a stem to which inflexional affix is appended to specify the word's grammatical attributes (e. g. noun's case, grammatical number and gender). Each inflexion specifies several possible word's thematic roles in a sentence (e. g. subject, object). At the same time, the Serbian sentence word order is almost entirely free. Unlike the English or German syntax, for instance, it means that a word's position within a sentence does not convey much information about its thematic

role. Grammatical agreement – of a preposition with a noun, of an adjective with a noun, of a personal pronoun with a verb, to mention but the few examples employed in the aforementioned research in Serbian – should therefore provide a powerful tool in thematic role of the single word disambiguating or in sentence parsing.

The aim of our research was to establish grammatical priming effects in Serbian word naming by employing what seems to be the crucial common feature of the studies which obtained such effects in naming. Following the implications of research in English succeeding in demonstrating grammatical priming in naming [e. g. Bowey, 1996; West & Stanovich, 1986], we primed two target word classes: nouns and verbs. Priming nouns with consistent prepositions and verbs with personal pronouns unequivocally constrained both the target word class and the form in the constrained condition. In the unconstrained condition, conjectures I/ILI (and/or) were employed. Such linguistic primes did not preclude neither the target word class, nor its form. Targets were chosen from a low frequency range, target frequency being suspected to be invertly related to priming effects [Bowey, 1996]. Two SOAs were employed: one of 600ms and the other of 250ms. The longer SOA could be considered a standard in the research in Serbian and was employed in the only grammatical priming in Serbian naming study [Carello et al., 1988]. Priming at the more than twice shorter SOA was introduced in order to test robustness of the phenomenon under scrutiny. Finally, the delayed naming condition was introduced to account for extra linguistic performance components in online primed naming and therefore to provide a more precise estimate of processing time afforded at two different online naming SOAs.

Experiment Subjects

Subjects were 60 psychology sophomores at the Faculty of Philosophy of Belgrade University, predominantly female. All of the subjects had Serbian as the mother tongue and vision either normal or corrected to normal. Participation in experiment was one way of fulfilling the course of Memory and Thinking requirements. All of the subjects had previous experience with visual word processing experiments. Each subject was assigned to one of two prime-target SOA interval conditions according to her/his order of appearance at the laboratory and was presented one of two sets of materials.

Materials

48 target nouns and 48 verbs were chosen from low frequency range in Serbian [Kostić, 1999]. One half of each target classes were 5-letter words and the other half 6-letter words of matching average frequency. All of the target nouns were female in gender, presented in two grammatical forms marked by the inflexional suffix: half with the inflexion –E (LOPTE, ball), the other half with the inflexion –U (LOPTU). All of the target verbs were in present tense, half of them third person singular (ZABODE, stabs), the other half third person plural (ZABODU). The target verbs in third person singular had the unique inflexional suffix –E and in third person plural unique inflexion

–U which defined verb form. Words from both target classes had the same consonant-vowel structure: 5-letter target words were either CCVCV or VCVCV, while all of 6-letter targets were CVCVCV in structure. Target nouns and verbs were balanced with respect to number of items of each of the structures described.

In the constrained condition, target nouns were primed with consistent prepositions: nouns with the inflexion –E with ZBOG (because) and BEZ (without) specifying target noun to be in genitive case; nouns with the inflexion –U with KROZ (through) or UZ (along) specifying target noun to be in accusative. In the same condition, target verbs were primed by consistent personal pronouns: present third person singular verbs with ON (he) or ONA (she); present third person plural with ONI (they, male) or ONE (they, female). In the unconstrained condition, both target nouns and verbs were primed by conjectures I/ILI. Example of the materials is presented in Table 1.

Table 1

Typical prime-target pairs as a function of target word type, and constraint

	Constrained Condition		*Unconstrained Condition*	
	Primes	*Targets*	*Primes*	*Targets*
	ZBOG/BEZ	IVICE/TARABE	I/ILI	KREDE/PALICE
	(because/without)	(edge/fence)	(and/or)	(chalk/bat)
Nouns				
	KROZ/UZ	SCENU/TERASU	I/ILI	GLINU/KOLIBU
	(through/along)	(scene/terrace)	(and/or)	(clay/cottage)
	ON/ONA	SNUJE/RUKUJE	I/ILI	GREBE/ZABODE
	(he/she)	(dreams/handles)	(and/or)	(scratches/stabs)
Verbs				
	ONI/ONE	TRUJU/DIRAJU	I/ILI	UKINU/DOVEDU
	(they m./they f.)	(poison/touch)	(and/or)	(eliminate/bring)

Two sets of materials were constructed. Half of the each of four target word types was randomly selected to be presented in constrained and unconstrained condition in the first set. In the second set of materials, targets that were in the first set presented in constrained condition were assigned to the unconstrained condition while the targets presented in the unconstrained condition in the first set were assigned to constrained condition. Within both of the sets, half of targets presented in grammatically unconstrained condition were primed by neutral prime

I, while the other half was primed by neutral prime ILI. In both of sets in constrained condition half of randomly selected target nouns with the inflection –E were primed by preposition ZBOG, the other half in the same condition with preposition BEZ; half of randomly selected target nouns with the inflection –U were primed by preposition KROZ, the other half in the same condition with preposition UZ. The same principle in set composing was applied to target verbs: half of randomly selected verbs present third person singular were primed with personal pronoun ON, the other half in the same condition with personal pronoun ONA; half of randomly selected verbs present third person plural were primed with personal pronoun ONI, the other half in the same condition with personal pronoun ONE. Each prime-target pair in both constrained and unconstrained condition constituted semantically acceptable syntagm.

Each set comprised an equal number of the four type prime target-pairs. Targets were arranged in a quasirandom order within the first list and primes were assigned to them as described above. Target order was retained in the second material set while the primes in the set were counterbalanced. Half of the subjects saw the first set and the other half of subjects saw the other set of stimuli at both of the SOAs. Each target was presented only once within a set, in the first set in constraining and in the second set in unconstraining grammatical context. Each subject therefore read each target only once, in one of two grammatical contexts. Both sets were presented to an equal number of subjects.

Subjects were given 16 practice trials before the set presenting, to adjust to the experimental procedure.

Procedure

Experiment was run by AT 486 PC connected to 14" CRT monitor. Stimuli exposition and naming latencies recording were controlled by SuperLab Pro 2.0 software. Naming latencies were collected with a Genius PC microphone with fixed stand. Subjects were reminded in the course of experiment to keep the distance from the microphone constant by holding chin above the line drawn on the table 30cm from microphone. Latencies were measured from the onset of the target word until subject's voice has reached predefined loudness threshold. All the stimuli were presented in capital Times New Roman Latin letters.

In online naming task, each trial started with warning signal sign ! which remained on the screen for 750ms. Following the warning signal, a prime was presented in the same line. In the 600ms SOA condition, prime exposition was 500ms followed by 100ms blank screen period; in 250ms SOA condition prime exposition was 150ms followed by 100ms blank screen. After the SOA expired, target was presented in the same line warning signal and prime were previously displayed. Target remained on the screen until subject vocalized and loudness reached threshold. Position of the prime's last letter and target's first letter was held constant, thus preserving the same prime-target distance in all of trials. Interval between two successive trials was 1s.

Subjects were tested individually, in a quiet room. Before experiment commencing, each subject read the instructions from the screen, afterwards to be briefly summarized by experimenter. Instructions equally stressed importance of speed and naming accuracy. Subjects were warned that they will be asked at random to repeat a prime read silently, which happened on average after eight experimental trials. In case of prime missed or not correctly repeated, subjects were again politely asked to read primes carefully.

Cases of target mispronunciation and some sound other then subject's voice microphone (e. g. cough) triggering were hand coded by experimenter. Experimenter also noted cases of target read not loud sufficiently to trigger the microphone and cases of prime missed or not repeated correctly. Errors in target naming (mispronunciations) were analyzed in error analyses. All the other trials described were treated as technical errors and excluded from reaction time analyses. Mispronunciations and technical errors put together constituted spoiled trials.

Delayed naming task was conducted briefly after the online naming, in the same experimental session. In this task subjects named targets presented in online naming. Subjects were warned with the ! signal of 750ms duration before each trial started. All targets were displayed in center of the screen and remained there for 1500ms after which period they were put in brackets. Brackets were cue for subject to pronounce the word. Intertrial period was 1s. Instructions displayed on the screen and afterwards summarized by experimenter asked subjects to read word silently immediately after presented, to prepare pronunciation and to pronounce it only after the brackets around the word appeared. Errors were recorded as in online naming. It took on average 25 minutes for the whole experimental session to be completed.

Results

Latencies in excess of 1400ms and less than 300ms were excluded from reaction time (RT) analysis and added to spoiled trials. Data from 387 (6,7%) trials were discarded as spoiled trials. Out of these, 63 trials (1,1%) represented target naming errors (mispronunciations); 296 trials (5,1%) represented technical errors while naming latencies in 28 trials (0,5%) fell out of the RT range specified. Spoiled trials were treated as missing data in subject and item RT means calculations and were not replaced. Average online naming latencies are presented in Table 2.

Table 2

Target word online naming latencies (in milliseconds) and [SD] as a function of Word Class, SOA, and Constraint

	SOA 600 ms		*SOA 250 ms*	
	CONSTRAINED Mean [SD]	*UNCONSTRAINED* Mean [SD]	*CONSTRAINED* Mean [SD]	*UNCONSTRAINED* Mean [SD]
NOUNS	696 [82]	724 [96]	750 [97]	770 [102]
VERBS	682 [84]	703 [87]	743 [92]	761 [95]

Statistical analyses (by subjects and by stimuli) were conducted using univariate ANOVAs. The ANOVA for subjects included the following factors: SOA (between factor, levels: 600ms and 250 ms), Grammatical Constraint (within factor, levels: constrained, unconstrained), and Word Class (within factor, levels: nouns, verbs). The ANOVA performed on the subjects online RTs indicated significant main effects of SOA [F(1, 58) = 5,47, p<0,05], Grammatical Constraint [F(1, 58) = 58,23, p<0,0001], and Word Class [F(1, 58) = 22,43, p<0,0001]. None of the interactions was significant. In the subject analysis main effects of SOA (within factor) was significant [F(1, 94) = 7,68, p<0,01], Grammatical Constraint (within factor) was significant [F(1, 94) = 65,63, p<0,0001)] and also was the between factor Word Class [F(1,94) = 34,28, p<0,0001)].

Main outcome of the online naming latencies analysis was that grammatically constrained targets were named 25ms faster than unconstrained targets at the SOA of 600ms, and that the 20ms effect of such facilitation was observed at the shorter SOA of 250ms. The facilitation effect was not qualified by SOA x Grammatical Constraint interaction in neither of analyses. Word Class effect of verbs being pronounced more rapidly than nouns is not of central interest, since not qualified by any of interactions.

Table 3 summarizes average error rates in online naming.

Table 3

Average error rates (in %) and [SD] as a function of Word Class, SOA, and Constraint

	SOA 600 ms		*SOA 250 ms*	
	CONSTRAINED Mean % [SD]	*UNCONSTRAINED* Mean % [SD]	*CONSTRAINED* Mean % [SD]	*UNCONSTRAINED* Mean % [SD]
NOUNS	0,6 [1,5]	0,7 [1,6]	1,8 [3,1]	0,4 [1,3]
VERBS	1,0 [1,9]	0,9 [2,1]	3,0 [3,6]	0,9 [1,8]

In the error analysis with the same factors as in ANOVA for average latencies, main effect of SOA [Subjects: F(1, 58) = 4,88, p<0,05; Stimuli: F(1,94) = 5,12, p<0,05], Word Class [Subjects: F(1, 58) = 12,58, p<0.001; Stimuli: F(1,94) = 14,56, p<0,001] and interaction of SOA x Word Class [Subjects: F(1, 58) = 12,86, p<0.001; Stimuli F(1,94) = 13,97, p<0,001] were significant. Again, SOA did not interact with Grammatical Constraint, but approached significance [Subjects: F(1, 58) = 3,06, p>0.09; Stimuli: F (1,94) = 4,11, p>0,07].

Overall error rate in the experiment (1,1%) could be considered fairly small. Main SOA effect and SOA x Grammatical Constraint interaction approaching significance are apparently due to more errors committed in the *constrained* condition at the SOA 250ms, as the Table 3 points out. SOA x Word Class interaction also has no important implications, since it stems from the same counterintuitive unconstrained condition advantage more pronounced in case of verb targets. Inspection of individual subjects data suggest such outcome could be ascribed to the data from five subjects who have committed significantly more errors (up to 9%) in the constrained

condition. However, closer inspection of their naming latencies hinted no speed-accuracy trade off or any other anomaly in performance.

Finally, we present the delayed naming analyses. Average delayed naming latencies are presented in Table 4.

Table 4

Target word delayed naming latencies (in milliseconds) and [SD] as a function of Word Class, SOA, and Constraint

	SOA 600 ms		*SOA 250 ms*	
	CONSTRAINED Mean [SD]	*UNCONSTRAINED* Mean [SD]	*CONSTRAINED* Mean [SD]	*UNCONSTRAINED* Mean [SD]
NOUNS	578 [106]	571 [112]	571 [102]	569 [99]
VERBS	578 [112]	578 [101]	575 [107]	576 [103]

In delayed naming RT analyses parallel to those conducted on the online naming RTs and errors no significant effect was obtained. Average delayed naming latency at the 600ms SOA and at the 250ms SOA were 577ms and 573ms, respectively. Mispronunciations rate of 0,3% (spoiled trials 1,3%) rendered delayed naming error analysis uninformative.

Discussion and Conclusion

The obtained results show average 22ms facilitation of word naming by grammatical priming. Such effect can be considered substantial, being roughly equal to or larger than effects in grammatical priming studies with English adult readers but in which a lexical decision task was employed (15-19ms Goodman et al., 1981; 13ms Seidenberg et al., 1984). Bowey obtained weaker effects (9-16ms) in naming task, with less than proficient English readers (Bowey, 1996). Our study was conservative since only facilitative effects of grammatical priming were investigated. Unlike most priming studies conducted in Serbian, we have measured only facilitation provided by congruent priming with respect to a neutral situation. Studies in Serbian typically estimated facilitative effects of congruous grammatical priming with respect to a situation with incongruous grammatical priming [e. g. Lukatela et al., 1983; Lukatela et al., 1982], thus failing to distinguish facilitation effects from inhibition effects. In other studies in Serbian facilitation was estimated with respect to a neutral situation in which target words (and for that matter pseudowords) were primed by nonlinguistic stimuli such as *** [e. g. Katz et al., 1995; Carello et al., 1988], known to inflate effects of language priming when used in a baseline condition [deGroot et al., 1982]. In the neutral condition we employed linguistic primes as well as real target words across all situations.

Facilitation in our experiment can also be considered robust as obtained both at standard 600ms SOA (25ms effect) and at a brief SOA of 250ms (20ms effect). Bowey, for instance, obtained grammatical priming effects at the longer SOAs of 750ms, 700ms, and 400ms. The effect of grammatical priming was not qualified by interaction

with SOA interval in our experiment, suggesting that manipulation with this procedural variable, i. e. long SOA, was not likely to be the source of facilitation. Such outcome should be interpreted with caution, nevertheless. Certain authors hold the opinion that long prime-target SOAs are associated with attentional expectancies forming and with some strategic postlexical processes, like target word properties and prime agreement checking [e.g. Sereno, 1991; Seidenberg et al., 1984]. Short prime-target SOA apparently reduces chances for conscious expectancies or for any other strategic process to operate. However, average naming latency at the 600ms SOA in our experiment was 701ms while at the 250ms SOA it was 756ms. Average delayed naming latencies of subjects performing under the 600ms SOA were 577ms and at the 250ms SOA statistically equaled 573ms. Delayed naming was to provide control for performance factors in online naming not involved in pure visual word processing and for the voice key (microphone) sensitivity. When subtracted from online naming latencies, delayed naming latencies left time window of 125ms at the 600ms SOA and 183ms at the 250ms SOA for target processing. Almost 60ms longer time allowed for word processing at the shorter SOA leaves open the possibility of any strategic processes arguably acting at the longer SOA to take part also in naming with the shorter SOA interval. Notably, West and Stanovich [1986] obtained stronger syntactical priming effects in naming experiments with longer average latencies leading them to the conclusion naming task not to be immune to postlexical processing.

The crucial point of departure of our experiment from the only study of grammatically primed naming in Serbian [Carello et al., 1988] seems to be that we have primed two target word classes instead of only one. Carello et al. [1988] primed verb forms and failed to obtain grammatical priming effects in naming. A tentative conclusion from the fact would be that grammatical information provided by single word priming serves primarily to constrain a target word class, and only thereupon to specify target word properties within the class. A similar conclusion was put forward and corroborated in Bowey's study [1996]. This argument could be verified by contrasting outcomes of the experiment presented with two experiments in which target nouns and verbs we have employed would be grammatically primed in isolation. Priming of only one word class should diminish grammatical priming effects. The argument validity would reside solely on (priming) effects tests; experiments therefore should be planned with the a priori statistical power sufficient to detect or to reject presumably small effects. The next sensible step in grammatical priming investigation would be exploring lexical variables known to influence word naming. Target frequency and target length would constitute immediate candidates, both of them appearing to be invertly related to word recognition [West and Stanovich, 1986]. Thus, grammatical information should be of less importance in frequent and short words naming, and vice versa. However, main variable to influence grammatical priming in our opinion would be objectively registered prime-target coocurence frequency and subjectively assessed prime-target associative strength. If the variables could be proven to be of major influence in grammatical priming, that might add a contribution to the ongoing debate on the real nature of lexical priming. Namely, if semantic priming effects could be reduced to an associative priming mechanisms [e. g. Balota et al., 2006], the point of reducing grammatical priming to the same mechanisms would also seem viable in view of the type of evidence outlined above.

Acknowledgments

Research presented was partly supported by Republic of Serbia's Ministry for Science and Technological Development grant "Education Quality and Availability Improvement in Serbia's Modernization Processes" no. 47008 (2001-2014) awarded to the Institute for Pedagogical Research from Belgrade.

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