

Context influence on lexical decision

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INTRODUCTION

Realisation of man – machine communication based on natural language is extremely complex and difficult task. To be realized one has to solve a large number of problems which belong to, at first sight, very different scientific disciplines. That's why this task must be treated as a multidisciplinary one in which solution linguists, engineers, psychologists and other experts have to take part in.

One of the first step in this way is to try to learn and to understand how the language information is processed by mind. The most of investigations in this field are carried out in USA, that means the English language is focused. If we wish that in future we and our descendants continue to live in the multilingual world it is necessary to learn computer to «understand» native languages.

The syntactic function of entities in a sentence can be identified by means of three devices:

- word order,
- inflection,
- prosody

which are more or less important depending on the language of interest. Serbian is an inflectional language and, therefore, the word order effect is less significant than in some analytically constrained languages, say, like English. The relative order of subject (S), verb (V) and object (O) is flexible. All six of the permutations of those elements have identical words, meaning and voice, and all six are grammatically acceptable. Nonetheless, our investigations show that word effects are apparent in Serbian – SVO is the dominant form (Urosevic et al. 1986, 1), (Urosevic et al. 1988, 2).

In a series of experiments for the sake of identification which elements are significant for the rate of sentence perception and comprehension, one group of tests were dedicated to research the influence of the context length on the rate of lexical decision.

SUBJECTS

A total of 150 (75 in each experiment) school seniors from the Fifth Belgrade Gymnasium served voluntarily as subjects.

MATERIALS

Tests were reported on the three-word sentences SVO (for example: DETE JEDE JABUKU – A CHILD EATS AN APPLE). All words, consisting of two or three syllables, were singular in number. Verbs were transitive in the third person present tense. Subjects were nouns in the nominative case while objects were nouns in the accusative case. Nouns were chosen so that these case inflections were distinct.

DESIGN

The subject's task was to decide if the presented target was word or nonword. The context that precedes the target was:

- two words,
- one word,
- row of asterisks (***)

The asterisk context was our base line. The Experiment 1 was limited to verb targets in SO, OS, O or S contexts or in isolation (preceded by row of asterisks). For example:

<i>context</i>	<i>target</i>	<i>syntactical structure</i>
DETE JABUKU	JEDE	(SO)V
JABUKU DETE	JEDE	(OS)V
JABUKU	JEDE	(O)V
DETE	JEDE	(S)V
***	JEDE	V

The Experiment 2 was limited to object target in SV, VS, V or S contexts or in isolation (preceded by row of asterisks). For example:

<i>context</i>	<i>target</i>	<i>syntactical structure</i>
DETE JABUKU	JEDE	(SO)V
JEDE DETE	JABUKU	(VS)O
JEDE	JABUKU	(V)O
DETE	JABUKU	(S)O
***	JABUKU	O

As we can see, in both experiments there were five different situations which had to be investigated. Basic material in both tests was a set of 50 three-word sentences. Five lists, each consisting of 5 different situations with 10 stimuli in each one, was formed from this basic set.

To make a balance between the different context length our basic material was enlarged by ten targets in isolation which formed the sixth situation and those 10 stimuli were identical in all five lists. Because each subject saw 6 situations with words as targets, it was necessary to add six situations with identical structural design but with nonwords as targets. Those added six

situations with nonwords were identical in all five lists. So, each list consists of 12 situations (see Figure 1) with 10 stimuli per situation. The type of context was randomised over trials.

In both experiments two-word context and target form complete closed semantically plausible sentence (SOV or OSV). One-word context and target form incomplete closed sentence (OV or VO) or open sentence (SV or VS).

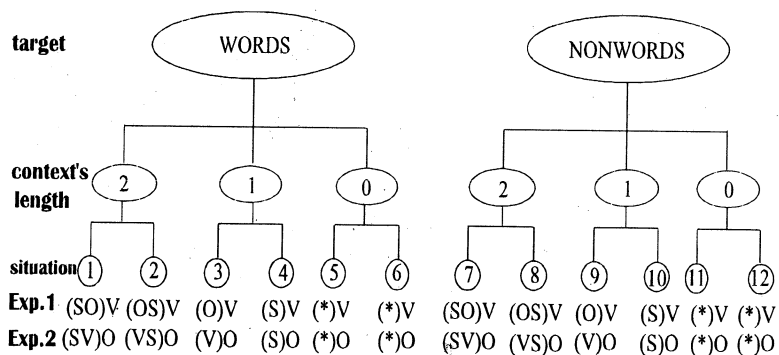


Figure 1: Test design

PROCEDURE

A subject was seated before CRT of an APPLE IIe in a dimly lit room. A fixation cross was centered on the screen. On each trial, the fixation point disappeared and a centred context appeared for 900 msec followed by an interstimulus interval of 100 msec before the target was presented, also in the centre of the screen, for a maximum of 1500 msec. All letter strings appeared in upper case Roman. Subjects were instructed to read the context and decide as rapidly as possible whether or not the target was a word. In order to ensure that subjects were reading the contexts, they were asked periodically (on average, every ten trials) to say the sentences aloud after the target decision had been made. Decisions were indicated by pressing a telegraph key with both thumbs for a "no" and a further key with both forefingers for a "yes" response. Latencies were measured from the onset of the target. In the event of an error, a message appeared on the screen, and the trial was repeated (but its decision time was discounted). The experimental sequence was preceded by a practice session in which subjects had to achieve an error rate of less than 10% over 30 trials.

RESULTS

Minimum and maximum acceptable latencies were set at 400 msec and 1500 msec respectively.

Average lexical decision latencies to verb target (Experiment 1) are presented in Table 1 and on Figure 2.

Table 1: Average Lexical Decision Latencies (RT) in msec to Verb Target as a Function of Context Length and Word Order.

(context)/verb	RT
(SO)V	734
(OS)V	725
(O)V	731
(S)V	767
(*)V	770

Average lexical decision latencies to object target (Experiment 2) are presented in Table 2 and on Figure 3.

Table 2: Average Lexical Decision Latencies (RT) in msec to Object Targets as a Function of Context Length and Word Order.

(context)/object	RT
(SV)O	682
(VS)O	675
(V)O	684
(S)O	714
(*)O	704

Figure 2: Graphical representation of Table 1.
 1. Remark: Line (*)V – (*)V is formed by one value, that is from the situation 5.

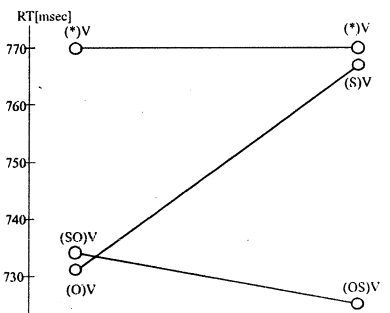
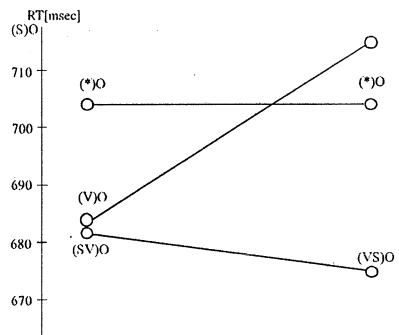


Figure 3: Graphical representation of Table 2.
 2. Remark: Line (*)O – (*)O is formed by one value, that is from the situation 5.



Results of statistical analyses on the latencies are presented in Table 3 (for Experiment 1) and in Table 4 (for Experiment 2).

Table 3: Results of Statistical Analysis on the Latencies in Experiment 1

(SO)V/(O)V	3.74	$F(1,148) = 0.24$	$P < 1$
(SO)V/(*)V	-34.46	$F(1,148) = 20.88$	$P < 0.001$
(O)V/(*)V	-38.4	$F(1,148) = 25.62$	$P < 0.001$
(OS)V/(*)V	-42.14	$F(1,148) = 30.85$	$P < 0.001$
(OS)V/(S)V	-41.98	$F(1,148) = 30.62$	$P < 0.001$
(*)V/(S)V	0.16	$F(1,148) = 0$	$P < 1$
(SO)V/(OS)V	8.09	$F(1,148) = 1.14$	$P < 0.286$
(O)V/(S)V	-37.79	$F(1,148) = 24.81$	$P < 0.001$

Table 4: Results of Statistical Analysis on the Latencies in Experiment 2

(SV)O/(V)O	-1.58	$F(1,148) = 0.09$	$P < 1$
(SV)O/(*)O	-21.74	$F(1,148) = 17.46$	$P < 0.001$
(V)O/(*)O	-20.15	$F(1,148) = 15.01$	$P < 0.001$
(VS)O/(S)O	-39.06	$F(1,148) = 56.38$	$P < 0.001$
(VS)O/(*)O	-29.0	$F(1,148) = 31.07$	$P < 0.001$
(S)O/(*)O	10.06	$F(1,148) = 3.74$	$P < 0.055$
(SV)O/(VS)O	7.26	$F(1,148) = 1.95$	$P < 0.164$
(V)O/(S)O	-30.22	$F(1,148) = 33.74$	$P < 0.001$

DISCUSSION AND CONCLUSION

Experiment 1. When the context was S the rate of lexical decision was the same as with the target in isolation. When the context was O or two-word context, the lexical decision was hastened relative to a neutral context ($p < 0,001$). The experiment did not find the two-word contexts, SO or OS, to differ.

Experiment 2. When the context was S the rate of lexical decision was the same as with the target in isolation. When the context was V or two-word context, the lexical decision was hastened relative to a neutral context ($p < 0,001$). Experiment did not find the two-word contexts, SV or VS, to differ.

The position of a pair of points (SO)V/(O)V (Figure 2) and (SV)O/(V)O (Figure 3), between which there are no significant difference could suggest the conclusion that only the first preceding word influences lexical decision. Such conclusion is negated by the position of a pair of points (OS)V/(S)V and (VS)O/(S)O. In both cases there were significant effects on the lexical decision latencies ($p < 0.001$).

Let us illustrate it with our example:

DETE JEDE JABUKU – (A CHILD EATS AN APPLE).

RT is statistically the same in the situations 1, 2 and 3.

In Experiment 1 these situations are respectively:

		<i>English</i>
(SO)V	(DETE JABUKU) JEDE	(A CHILD AN APPLE) EATS
(OS)V	(JABUKU DETE) JEDE	(AN APPLE A CHILD) EATS (that means: An apple by child is eaten)
(O)V	(JABUKU) JEDE	(AN APPLE) EATS (that means: An apple is eaten)

In Experiment 2 these situations are respectively:

		<i>English</i>
(SV)O	(DETE JEDE) JABUKU	(A CHILD EATS) AN APPLE
(VS)O	(JEDE DETE) JABUKU	(EATS A CHILD) AN APPLE
(V)O	(JEDE) JABUKU	(EATS) AN APPLE

In those three situations RT is significantly hastened than in the situations 4 and 5.

In Experiment 1 situations 4 and 5 are respectively:

		<i>English</i>
(S)V	(DETE) JEDE	(A CHILD) EATS
(*)V	(***) JEDE	(***) EATS

In Experiment 2 situations 4 and 5 are respectively:

		<i>English</i>
(S)O	(DETE) JEDE	(A CHILD) AN APPLE
(*)O	(***) JABUKU	(***) AN APPLE

The lexical decision is hastened by context if the context and target form closed sentence or incomplete closed sentence without subject, but in which the subject is predictable. If the context and target form open sentence the context does not influence lexical decision. To resume, in one-word context, lexical decision depends on the word function in the sentence.

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