

FACTORS OF THE SENTENCE COMPREHENSION IN SERBO-CROATIAN

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The article investigates the influence of the factors: Animacy, Case inflection, and Noun-verb agreement on sentence comprehension. 54 simple transitive sentences were presented to the each subject and their task was to pick out the actor in the sentence. Six psychology students participated in the experiment. The results indicate that the strategy of decoding case inflectional information is used more often than the strategy of decoding agreement or animacy information. In the situation where the inflectional information is not present or is ambiguous, then the strategies of decoding the other kind of information are dominant.

INTRODUCTION

For a long time ago there has existed an interest in the research of speech. That interest hasn't been limited to research in the developmental stage only; that research investigated different aspects of speech amongst the adult population. As a result of all these interests there are a large number of experimental and theoretical works about the nature and sources of the speech ability. The research has shifted from the investigations of the problem: (1) how and why is the need for speech developed, to (2) how speech interpretation is organized (which factors influence speech interpretation)? The listener's interpretation of speech is the main problem of the present work, so the work is limited to that part of the possible explanations of this aspect of language ability. The comprehension ability of discourse from the listener's point of view has been a long time in the focus of scientific interests. The breadth of possible explanations of this phenomena have ranged from nativistic ideas about innate abilities which are responsible for sentence processing, to empiristic ideas that this ability is one of the abilities which are developing through the period of maturation. There is a large quantity of research in this area, but we concentrated our interest on the field of »strategies« which have been used by the subject during sentence interpretation. This problem was investigated in developmental psycholinguistic, but we have limited our interest to the research and

analysis of the »interpretation strategies« which have been used during the sentence interpretation of the adult population. So, there was a question: which factors determine a sentence interpretation? From this question comes another question: does the native speaker rely more on semantic or syntactic information during sentence comprehension? The answers to these questions can not have a general importance, because the role of semantics and syntax is not on the same level in the different languages. Different languages have different semantic/syntactic limitations. If some language has syntactic limitations which enact its interpretations, it is possible that this type of syntactic limitations is not important in the other language. For example, the importance and influence of the syntactic factor »case inflection« (case marking) is more important in Russian or Croatian than it is in English or German. This means that »case inflection factor« is much more developed in Russian than in English. The same situation is, for example, if we look at the importance and influence of the factor »word order«, where we can notice the apparent and certain influence of »word order« in English which is significantly higher than in Russian or Croatian. This is entirely logical if we know that the Russian or Croatian are languages which do not depend on »word order« (word order in the sentence is relatively free). Conversely, in English the interpretation of the sentence is mostly assigned by »word order«, which means that the location of each word in the sentence is a more invariant »cue« than in some other languages. In cross-linguistic research by MacWhinney, Bates & Kliegl (1984), which was done on the English, German and Italian language, the results showed that there is a significant effect of the »word order« on the English and Italian language, but there wasn't a significant effect of »word order« on the sentence interpretation in German. These results are in accordance with results found by Bates (1982) in English. Her conclusion related to the evidence that there is a strong tendency to choose a first noun as an »actor« in the sentence like NVN (noun-verb-noun). In the sentence like VNN (verb-noun-noun) or NNV (noun-noun-verb) there is a strong tendency to choose a second noun in the sentence as an »actor«. The evidence of reaserch in Italian is very similar, although the effect of the »word order« (in sentence interpretation) is lower. The evidence of experiments in the German language gave us information that subjects had a general tendency to choose the first noun as an »actor« without regarding the »word order« (NVN, NNV, VNN). Because there was no difference between three situations of »word order« »where the first noun in the sentence was chosen as the »actor«, it seems logical to assume that the German native speakers don't base their sentence interpretation on the »word order«. The »word order« was the first linguistic generalization which emerged in »language comprehension strategies«. Many authors pointed out the strategy of »word order« as the most important of all the stategies. Pinker (1981) proposed the acquisitional universal in this form: »For

case inflected languages, children will utter sentences in the dominant »word order«, and will use the dominant word as a in comprehending sentences, before they have mastered their language's morphology«. Similar conclusions were proposed by Brown (1973), Keeney & Wolfe (1973).

Nevertheless, there is a high number of experimental results which provide us with arguments that the »word order« strategy doesn't have an advantage over the other strategies during sentence comprehension (»case inflection strategy« or »strategy of decoding the semantic information«). The majority of these works are related to the developmental period. Hakuta (1982) reported that young Japanese children acquire »word order« and »inflectional cues« simultaneously and cannot use one in the absence of the other. In the Polish language, Weist (1983, 1984, 1985, and personal communication with the author) found that 2-years-olds can make highly reliable use of both, the »case marking« and the »word order« in sentence interpretation. Still the strongest evidence against the universalist arguments and perspectives comes from a study of sentence interpretation in four languages by Slobin & Bever (1982) and an investigation of sentence interpretation in Hungarian by MacWhinney, Pleh & Bates (1985). The results of these investigations show us that 2'5 years olds (in the Turkish and Hungarian language) had attained almost a perfect use of the suffixes marking the nominative/accusative distinction without regard to the word order. The results of the investigation by MacWhinney, Bates & Kliegl (1984) which was realized with adults on the English, Italian and German language, give us a »hierarchy of strategies« which subjects used in sentence processing. Their data show the rank of the strategies as follow: (a) English language: 1. word order, 2. word stress, 3. animacy (of the noun); (b) Italian language: 1. word stress, 2. animacy, 3. word order; (c) German language: 1. animacy, 2. word stress, 3. word order. It is entirely clear that there is a different hierarchy of using different strategies in sentence comprehension (depending on different languages).

In the first part of our current work we have discussed the syntactic factors which can determine sentence comprehension, and some language universals which can emerge from them. As we know, each sentence is built from words and each word is related to the meaning (semantic dimension). It is logical to assume that the semantic factor affected sentence interpretation. According to some authors, the semantic factor is the primary factor in the parsing system which determines sentence interpretation. In that case, the decoding process of syntactic information has a secondary meaning, and becomes important in the situations when semantic information are on an equal level and none of them has an advantage. Some of the proposed assumptions about semantics can be included in the well known »Competition model« proposed by Bates & MacWhinney (1982a, 1982b), Bates et al. (1982), MacWhinney (1983). A large number of authors assume that in the early

stage of the child's development there is a domination of the strategy which decodes semantic information, but after the early period there is an absolute domination of the strategies which decode syntactic information. There is another interesting approach to this question, where the early emergence and importance of using the semantic strategy depends upon the relations of the words and their meaning to the child's early experience with them (and their meaning). If the relations between the words (from sentences) are close to the subject's own experience they have a propensity to use the semantical strategy for sentence interpretation, but if it isn't they will have a propensity for using the syntactic strategy for sentence interpretation. Now we have the apparent assumption about the persistence of two »parallel strategies« which are based on the decoding of semantics and syntax and thereby preclude the dominance of any other strategy (e. g. strategy based on decoding prosody). This assumption is put forward according to Bever (1970), Strohner & Nelson (1974), Chapman & Kohn (1978), Sinclair & Bronckart (1972).

The next question concerns the influence of these syntactic/semantic factors in the sentence interpretation of the Croatian language. Mimica (1986) reported about the absolute domination of the semantic factor over syntactic factor at age level 3—5 years olds. At the age level of 6 years there begins the giving of advantage to the strategies based on decoding syntactic information. It seems that we cannot give an advantage to any of the syntactic strategies (at age level of 6 years olds), because which strategy of decoding the syntactic information will dominate depends on the concrete, real situation. In the situation where one kind of syntactic information is absent the subject's interpretation is governed by the other syntactic information, and conversely. It seems that in the Croatian language there is something like the »equality« of syntactic information which older children (older than 5 years) use in the sentence comprehension process.

METHOD

Subjects

Six adults participated in the study. Everyone was native Croatian speaker. The average ages were 19y., and all subjects were students of Department of psychology at Zadar.

Experimental materials

54 three word sentences were presented to each subject. Each sentence had two nouns and one verb. We varied three variables in each sentence: (a) case inflection (with situations: Nominative-Accusative,

Accusative-Nominative, Without-Without case endings), (b) agreement of noun-verb endings in gender, number; agreement of 2nd noun-verb endings in gender, number: without agreement of 1st or 2nd noun with verb in gender, number), (c) animacy (with situations of noun animacy: Animate-Inanimate, Inanimate-Animate, Animate-Animate). All verbs were given in the third person singular. The animate nouns were taken from a set of 18 names for familiar animales (dog, chicken, cat, cow, etc.) The inanimate nouns were taken from a set of nine simple objects (rock, ball, pencil, key, etc.). The verbs were selected from a group of nine verbs representing simple action (eat, hit, push, chase, etc.). Every sentence was constructed taking care that every factor (in one of given forms) participated in each sentence. There were 27 different sentences (each sentence twice) in a 3 X 3 X 3 experimental design.

Procedure

All subjects were tested individually. The experimenter began the testing session by introducing the experimental toys to subjects, asking them to name each one. Then the experimenter explained that he will say one sentence and the subject has to show who/what is the actor in the sentence. Before each stimulus, the two associated objects for that item were placed on the table in front of subject's eyes. The objects were small toys which presented each noun used in the experiment. To minimize the bias introduced by place-directed responses (e. g., picking the animal on the left side), the toys were placed on the table in random positions following a clockwise circular pattern across the trials. Each sentence was read aloud to the subject, and after hearing the sentence, the subject had to show with the toys who/what was the actor in the sentence. The experimenter signed in the protocol which noun in the sentence was chosen as the actor. The dependent variable (or criterion variable) was the number of choices of the first noun in the sentence as the actor. This procedure had been used in a large number of similar experiments in this area (Zurif & Carmazza, 1976, Bates et al., 1984, Smith & Mimica, 1984, Mimica & Takšić, 1985, Mimica 1986).

RESULTS AND DISCUSSION

As we can see Table 1. presents the relation between two variables: Animacy versus Case inflection. There is a significant difference between the categories of animacy. Post-hoc comparisons showed that the difference is mostly determined by the second level of the animacy factor (e. g., Inanimate-Animate, »jaje gura janje«). The difference between the first and third level of this factor is not significant ($Q = 2.75$, $p > 0.05$, Newman-Kuels criteria). However, the second level of animacy

has an influence and gives a significant difference in the situation of the natural case inflection only, in the situation where we don't have any information from case inflection (the situation without-without case inflection endings). This result does not agree with the results that Mimica (1986) reported about children aged 3—6 years. In any case children preferred semantic (pragmatic) information (especially the relation Animate-Inanimate) without paying attention to case inflectional information (except sample of 6—years). Adults have the same preferences, but only in the situation when the information about case inflection is absent.

There is a significant difference between different categories of case inflection. Post-hoc comparisons showed that this difference is between all categories of this factor. The difference between sentences like Acc. — Nom. versus sentences Nom. — Acc. or Without-Without is higher than the difference between sentences like Nom. — Acc. versus Without-Without. It is evident that the case inflection strategy is an absolutely dominant strategy for the decision who/what is an actor in the sentence. In the situation without case inflection information, the choice of the actor is not accidental, and apparently, the choice of the first noun in the sentence is determined by some other strategy, in this situation by the strategy of decoding semantic information (where the sentence like A-I has an absolute advantage). As Mimica (1986) reported, children aged 3—6 years were able to distinguish case inflection (morphology), although they didn't use that ability except in the situation of the equality of the other semantic/syntactic information. Adults distinguish case inflection and they use that information in a very effective way when deciding about the actor in the sentence, without taking care about semantic (pragmatic) information.

TABLE 1. The analysis of variance between animacy and case inflection

SOURCE	DF	F	P
A (animacy)	2	21.80	< .001
B (case inf.)	2	245.90	< .001
A × B	4	23.91	< .001

The interaction between these two variables (animacy-case inflection) is significant (see Fig. 1 and 2). This means that adults don't interpret the sentence so well (or wrong) paying attention to the animacy and not mentioning the case inflectional endings (and conversely). The sentence interpretation where the only important factor is animacy is

Fig. 1. The relation between animacy and case inflection

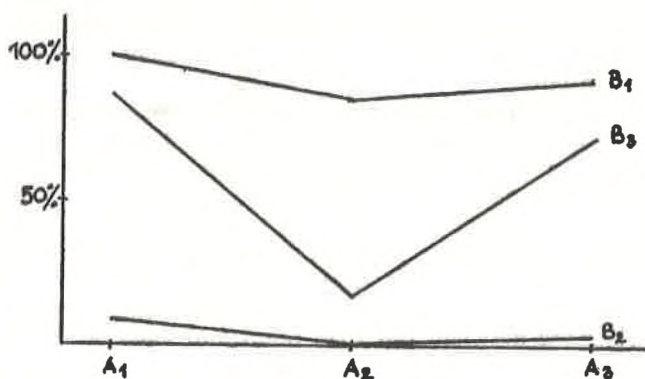
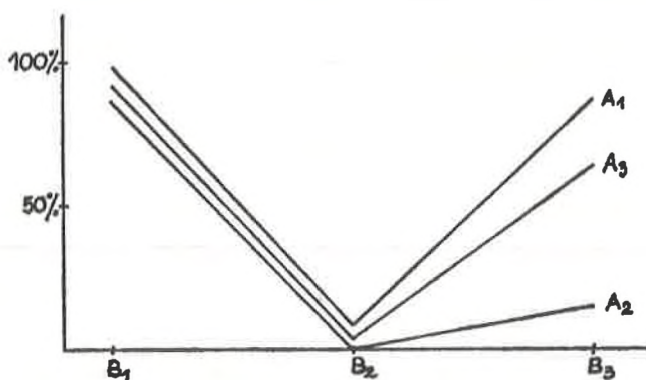


Fig. 2. The relation between case inflection and animacy



possible in the situation where all the other syntactic information are »equal« (e. g. »janje gura jaje«, where very often »janje« is chosen as Actor and there is no information about Agreement relations). This situation is an »ambiguity« according to syntactic information, but it is not ambiguous according to pragmatic information. In all the other situation there are great differences in sentence comprehension, where the primary factors which determine comprehension are cues about the case inflection, and where the semantic information is not important.

Table 2 presents the relations between variables: Animacy and Agreement. There is a significant difference between all categories of animacy. Post-hoc comparisons showed that this difference is mostly caused by second level of the animacy factor (e. g. Animate-Inanimate).

This assumption is acceptable in the situation where we don't have an agreement in the sentence (like the earlier explanation about the case inflection, e. g. »kocku je gurao krokodila«, where the second placed noun »krokodila« which is not in Nom., the subject will choose as the actor of this sentence).

There is a significant difference between the categories of agreement. The highest difference is between the first and second level, and between second and third level of this factor. The difference between the first and third level is not statistically significant (i — level = agreement 1st noun-verb, ii — level = agreement 2nd noun-verb, iii — level = without agreement). This apparently means that in the situation of agreement between the second noun and verb the number who chose the first noun as an actor is significantly higher than in the situation of agreement between the first noun and verb or in the situation without agreement. We assume that here we have the same or similar reason and mechanisms to which we ascribed the functioning of the case inflectional endings. This mechanism is an absolutely dominant strategy in relation to the »pragmatic-semantic« strategy of animacy. (Tab 2, Fig 3 i 4)

TABLE 2. The analysis of variance between animacy and agreement

SOURCE	DF	F	P
4 (animacy)	2	16.11	< .001
B (agreement)	2	59.61	< .001
A × B	4	0.73	> .05

Fig. 3. The relation between animacy and agreement

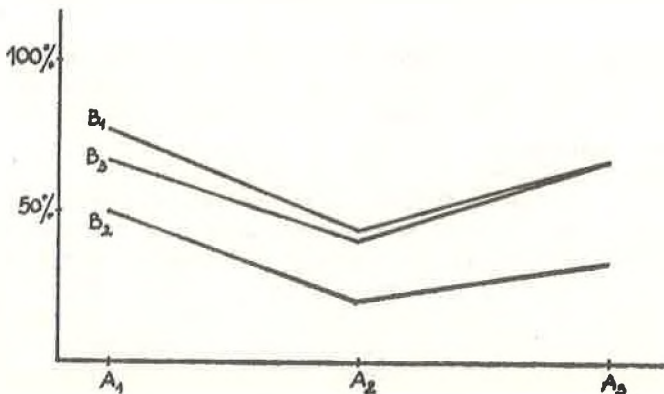
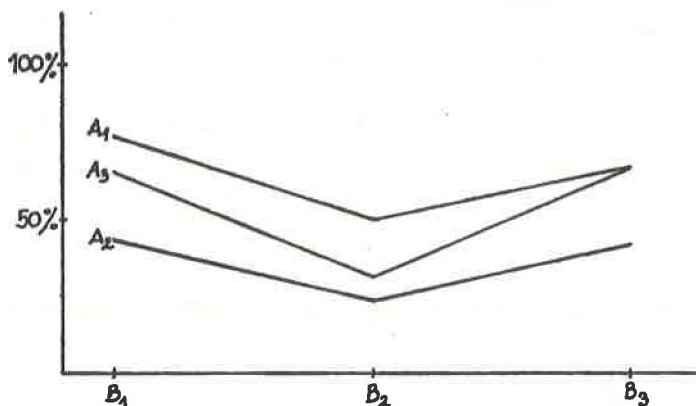


Fig. 4. The relation between agreement and animacy



The animacy-agreement interaction is not significant (see Fig. 3 and 4). This means that in general Croatian adults have to interpret sentence well enough by paying heed to animacy without paying attention to agreement, and vice versa. We explained that this assumption is acceptable, except in the situation without agreement where the semantical (pragmatical) factor determines the comprehension. In the other situations the agreement factor is dominant over the semantical factor (but that is not enough to give a significant interaction between them).

From Table 3 it is possible to see the relation between the variables: case inflection and agreement. There is a significant main effect of case inflection. The difference between the categories of case inflection is ascribed to the second level of that factor (II — level = Acc. — Nom.). The difference in the number of those choosing the first noun as an actor is higher between the sentences like Acc. — Nom. versus Nom. — Acc., and Acc. — Nom. versus Without-Without, than the difference between the sentences like Nom. — Acc. versus Without-Without. The only exception is in the situation where we don't have a morphological cue (e. g. Without-Without), and in that situation the subjects have to be ruled to the agreement in the sentence. Post-hoc comparisons reveal that the most important cause for that differences between the categories of case inflection is just a second level of this factor (II — level = Acc. — Nom.) There is also a significant difference between the categories of agreement. The apparent cause of that difference is the second level of agreement (II — level = agreement between 2nd noun and verb). The difference in the number of those choosing the first noun as an actor between the first and third level of this factor is not significant ($Q = 1.32$, $p > 0.10$, Newman-Kuels criteria).

TABLE 3. The analysis of variance between case inflection and agreement

SOURCE	DF	F	P
A (case inf.)	2	148.13	< .001
B (agreement)	2	59.61	< .001
A × B	4	7.41	< .001

Fig. 5. The relation between case inflection and agreement

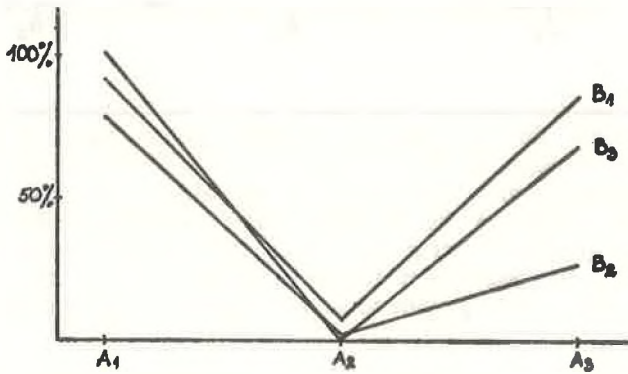
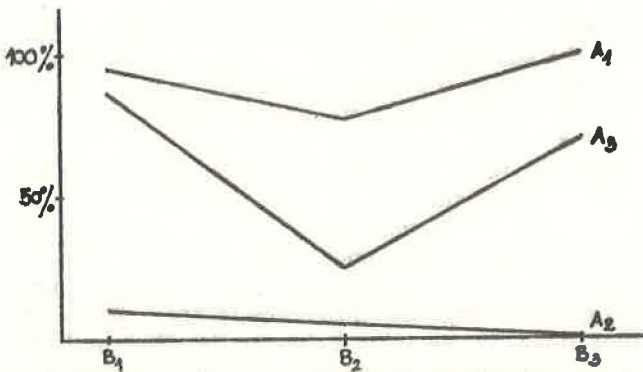


Fig. 6. The relation between agreement and case inflection



The interaction between the case inflection and agreement is significant (see Fig. 5 and 6). So, we gave an advantage to the strategy of decoding the agreement. The possible reason why we gave an advantage to the case inflection strategy is because we assume that these two strategies are parts of the same grammatical system, and the differences between them are not so clear. The agreement system could be some kind of subsystem of the inflectional system. Nevertheless, some authors assume (Kostić, and personal communication with the author) that the inflectional system is not part of the NOUN system, but that the inflectional system is part of the VERB sistem. Unfortunately, we didn't find any experimental data to accept this hypothesis.

CONCLUSION

Our results are only in partial accordance with the results of other authors. It seems that the strategy of case inflectional information during the sentence comprehension process is the most important strategy in the competition between three strategies. The next important strategy is the strategy of decoding the agreement, and on the last plane is the strategy of decoding the semantical (pragmatical) information. The strategy of decoding the semantic information is only relevant in the situation where the information about case inflection and agreement is not present (e. g. »janje gura jaje«). Some differences are evident between the strategies which use the child and those that use the adult during sentence comprehending. We can't generalize the results of this kind of research, because the Croatian language has some specific rules in the comparison to other similar or different languages. Nevertheless, future investigations will give us more concrete answers to these questions.

REFERENCES

- Bates, E. (1976): *Language and context: Studies in the acquisition of pragmatics*. New York, Academic Press.
- Bates, E., MacWhinney, B. (1982): *Functionalist approaches to grammar*. In E. Wanner & L. Gleitman (Eds.), *Language acquisition: The state of the art*. New York, Cambridge Univ. Press.
- Bates, E., MacWhinney, B. (1982): *Second language acquisition from a functionalist perspective: Pragmatic, semantic and perceptual strategies*. In H. Winitz (Ed.), *Annals of the New York Academy of Sciences, Conference on Native and Foreign Language Acquisition*. New York, New York Academy of Sciences.
- Bates, E., McNew, S., MacWhinney, B., Devescovi, A. & Smith, S. (1982): *Functional constraints on sentence processing: A cross-linguistic study*, *Cognition*, 11, 245—299.
- Brown, R. (1973): *A first language: The early stages*. Cambridge, Mass., Harvard University Press.

- Bever, T. G. (1970): The cognitive basis for linguistic structures. In J. R. Hayes (Ed.), *Cognition and the development of language*. New York, Wiley.
- Chapman, R. S., Kohn, L. L. (1978): Comprehension strategies in two and three year olds: Animate agents or probable events?. *Journal of Speech & Hearing Research*, 21, 746—761.
- Hakuta, K. (1982): Interaction between particles and word order in the comprehension of simple sentences in Japanese children. *Developmental Psychology*, 18, 62—76.
- Keeney, T., Wolfe, J. (1972): The acquisition of agreement in English. *Journal of Verbal Hearing and Verbal Behavior*, 11, 698—705.
- MacWhinney, B. (1983): Basic syntactic processes. In S. Kuczaj (Ed.), *Language acquisition: Syntax and semantics*. Hillsdale, N. J., Erlbaum.
- MacWhinney, B., Pleh, C., Bates, E. (1985): The development of sentence interpretation in Hungarian. *Cognitive Psychology*, 17, 178—209.
- Mimica, I., Takšić, V. (1985): Utjecaj semantičkih i sintaktičkih faktora na razumijevanje rečenica kod Broca-afazičara. *Radovi Filozofskog fakulteta Zadar*, 24 (1), 159—170.
- Mimica, I. (1986): Utjecaj nekih semantičkih i sintaktičkih faktora na razumijevanje rečenica kod djece predškolske dobi. *Zbornik radova »Dani psihologije«*, vol. 2, 109—118.
- Pinker, S. (1981): A theory of the acquisition of lexical interpretative grammars. In J. Bresnan (Ed.), *The mental representation of grammatical relations*. Cambridge, Mass., MIT Press.
- Sinclair, H., Bronckart, J. (1972): SVO-a linguistic universal? A study in developmental psycholinguistic. *Journal of Experimental Child Psychology*, 14, 329—348.
- Slobin, D., Bever, T. (1982): A cross-linguistic study of sentence comprehension. *Cognition*, 12, 229—265.
- Strohner, H., Nelson, K. E. (1974): The young child's development of sentence comprehension: Influence of event probability, nonverbal context, syntactic form, and their strategies. *Child Development*, 45, 567—576.
- Weist, R. (1983): Prefix versus suffix information processing in the comprehension of tense and aspect. *Journal of Child Language*, 10, 85—96.
- Weist, R. & al. (1984): The defective tense hypothesis: on the emergence of tense and aspect in child Polish. *Journal of Child Language*, 11, 347—374.
- Weist, R., Konieczna, E. (1985): Affix processing strategies and linguistic systems. *Journal of Child Language*, 12, 27—35.

Ivo Mimica: UTJECAJ NEKIH FAKTORA NA RAZUMIJEVANJE REČENICA U HRVATSKOM ILI SRPSKOM JEZIKU

SAŽETAK

U ovom radu istraživali smo utjecaj tri faktora na razumijevanje (interpretaciju) rečenica kod odraslih govornika na hrvatsko-srpskom govornom području. Ti faktori su: padežni nastavak, imenično/glagolsko slaganje i ži-
vost imenice. U eksperimentu je sudjelovalo šest (6) studenata prve godine psihologije. Svakom ispitaniku su redom prezentirane 54 jednostavne tranzitivne rečenice, a zadatak ispitanika je bio da odredi tko/što je vršilac radnje u rečenici. Rezultati su pokazali da ispitanici, pri interpretaciji rečenica, najčešće upotrebljavaju strategiju dekodiranja padežne morfološke informacije. U situaciji odsustva ove informacije (npr. rečenica: »Jaje gura jaje«) ispitanik u hrvatsko-srpskom govornom području upotrebljava strategije dekodiranja drugih sintaktičkih ili semantičkih informacija.