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**PARSING AND ACQUISITION:
EVIDENCE FROM SERBO-CROATIAN**

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Thesis submitted to
the School of Graduate Studies and Research
in partial fulfilment of the requirement for
the Ph.D. degree in Linguistics

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Instead of dedication

*U mojim venama davni sever samuje
i ja ponekad ne znam šta mi je.
Što luduje, od sreće tugu tka
moja prosta duša slovenska.*

(Đole)

... zato što je ...

bila jednom jedna zemlja

(D. Kovačević)

... a sad ...

*Moji su drugovi, k'o biseri rasuti
po celom svetu,
i ja sam selica, pa ih ponekad
sretnem u letu,
Da l' je to sudbina, il' ko zna šta li je,
kad god se sretnemo uvek se zalije,
uvek se završi s' nekom od naših pesama.*

(Bajaga)

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LIST OF ABBREVIATIONS

Nom	nominative case
Acc	accusative case
Dat	dative case
Inst	instrumental case
Amb	case ambiguous
Fem	feminine gender
Masc	masculine gender
Neut	neuter gender
P	person
Sg	singular
Pl	plural
Past	past tense
CZ	Czech
I	Italian
D	Dutch
G	German
SG	Swiss German
SC	Serbo-Croatian
SL	Slovenian

ABSTRACT

The goal of the thesis was to examine the processing of different types of filler-gap dependencies in Serbo-Croatian. The Active Filler Strategy (Frazier 1987) and its extension, the Minimal Chain Principle (de Vincenzi 1991), formulated as ambiguity resolution strategies in the processing of empty categories, predict that subject extractions are easier than the object ones. Other strategies, such as the Syntactic Prediction Locality Theory (Gibson 1998), although formulated as a more general theory of sentence processing, make very similar predictions about the processing of wh-extractions.

The thesis consists of different experiments in Serbo-Croatian, in which a number of predictions based on the AFS, the MCP and potentially the SPLT were tested. Three on-line reading time experiments were carried out: the scrambling, koji and što experiments. In the scrambling experiment the processing of different word orders was tested. In the koji ("who/which") relative clause experiment the processing of filler-gap dependencies in relative clauses was tested. The third experiment, the što experiment, presents an innovative contribution to the study of the filler-gap processing. As object binders always precede the subject binders, object što relatives are predicted to be easier to process than the subject ones.

The results from the scrambling experiment indicate that there is a strong preference to interpret an initial ambiguous NP as the subject. The results from the koji experiment show that the parser prefers to postulate the gap in the first grammatically available position, making subject relatives easier to process than the object ones. In što relatives, the locality asymmetry, based on a structural difference, is reflected in processing: object što relatives are easier to process than subject relatives. In sum, the results from the on-line experiments indicate that the parser searches actively for the gap/binder in the processing of filler-gap dependencies in Serbo-Croatian.

Additionally, the adult study has been extended to testing children's comprehension of different types of relative clauses. Results from act-out tasks and an elicited production task show a trend towards preference for an object interpretation in što relatives, as well as a subject interpretation in koji relatives. Results from both adult and child experiments are examined within a model of parsing in which syntactic and semantic information are factored in at different levels.

1.1.i INTRODUCTION

Although sentences appear to be perceived in a linear fashion, either auditorily or visually, the process of sentence comprehension is not linear in nature. It has been argued that sentences are assigned structural representations on-line, in accordance with the rules of the grammar. Furthermore, the human sentence parsing mechanism is argued to be guided by psychologically motivated parsing strategies which are independent of the grammar. The role of the grammar is viewed as providing a competence model against which structural representations are checked, yet it is independent of the actual processes by which those representations are assigned.

One of the most important questions that the theory of sentence parsing was set to answer was whether an element postulated by the grammar yet having no phonological or orthographic representation would have psychological reality. Empirical data obtained in the last two decades show that empty categories, especially traces created by wh-movement, are not only actively searched for and interpreted during on-line comprehension, but also that the strategies used for on-line gap location are based on a psychologically motivated and linguistically justifiable set of principles applying in a systematic fashion in different types of derivations across different language types.

Although the theory of human sentence parsing in general supports the universality of some of the parsing strategies proposed in the literature, the precise formulation of these strategies is strongly influenced by the particular model within which the processes involved in on-line comprehension are examined. The three major models of sentence comprehension are a Parallel Model, a Delay Model and a Serial Model. The Parallel Model predicts that in

cases of structural ambiguity the parser will compute all the structural analyses available, not adopting one over another until it is warranted by the data (Gorrell 1989; Gibson 1991, etc.). This process may proceed either in a fully parallel fashion, or different analyses may be ranked according to a number of factors, but there is no postulation of one and only one analysis on the initial parse without first checking its compatibility with the incoming material and discarding other potential analysis. The Delay Model, on the other hand, presupposes a cautious and error-free process of comprehension, as no final analysis, and corresponding interpretation is assigned to the sentence until it is confirmed by the data (Marcus 1987; Pritchett 1992). And finally, there is the Serial Model of sentence processing, which is the framework on which the predictions of this thesis were based (Kimball 1973; Fodor, Bever and Garrett 1974; Frazier and Fodor 1978; Frazier 1987; Frazier and Clifton 1989, among others). The parser neither computes all the possible analyses nor delays its assignment, but it adopts one analysis as soon as any potential structural ambiguity is encountered. The decision as to which analysis is to be the preferred one is made on the basis of a number of parsing strategies developed within this model. Although adopting one analysis very early on speeds up on-line processing in general, and thus places less burden on our limited working memory capacity, it also predicts that potential mistakes in interpretation are unavoidable in those structures in which the initial analysis is not the correct one. This is exactly what happens in so-called "garden-path" sentences, which generally pose a problem for the parser because the less preferred analysis, predicted on the basis of both structural complexity as well as processing difficulty, turns out to be the correct one. For example, in the following garden-path sentence:

(1) The cotton clothing is made of comes from Mississippi.

the initial analysis under which the verb "made" is interpreted as the main clause verb has to be revised upon encountering the verb "comes" and discarded in favour of a correct reduced relative clause analysis. This results in garden-path effects, which arise at the position at which the parser becomes aware of the fact that it has been misled down the garden path by adopting a simpler, yet incorrect analysis. One of the major goals of the theory of human sentence processing is to explain not only the relatively unproblematic comprehension of the majority of structures in human languages, but also to account for the causes of a processing break down as noted for sentences such as (1) above. In short, one can draw conclusions from "mistakes" that arise during comprehension, correlating the length of time needed to assign the correct interpretation with what strategies the parser uses in the processing of other structures where no such problems are present. Several strategies have been proposed within the Serial Model, all of which presuppose that the preferred analysis is the one which involves the least structural and/or processing complexity. Some of the most discussed are Minimal Attachment and Late Closure (Frazier 1978; Frazier and Fodor 1978).

Minimal Attachment: Attach incoming material into the phrase marker being constructed using the fewest nodes consistent with the well-formedness rules of the language under analysis.

In brief, Minimal Attachment predicts that the preferred analysis is the one under which no extra unnecessary nodes are postulated. For example, under Minimal Attachment, the preferred analysis for (2) is the one in which the prepositional phrase "with the telescope" is attached to the VP (2a), rather than the NP (2b), because the former attachment requires

fewer syntactic nodes.

(2) John saw the boy with the telescope.

a. John [[saw]_V [the boy]_{NP} [with the telescope]_{PP}]_{VP}

b. John [[saw]_V [[the boy]_{NP} [with the telescope]_{PP}]_{NP}]_{VP}

Similarly, Minimal Attachment predicts that garden-path effects that arise in sentences such as (1) above are due to the fact that since a reduced relative clause analysis requires projecting a number of additional syntactic nodes it is never postulated on the initial parse.

Late Closure: When possible attach incoming material into the constituent currently being parsed.

Since Late Closure predicts that the parser tries to keep the current sentence open as long as possible, the difficulties observed with the processing of sentences such as (3) below are caused by the initial preference to interpret "the sock" as the direct object of the main clause verb rather than the subject of a completely new clause.

(3) While Mary was mending the sock fell off her lap.

Both the Minimal Attachment and the Late Closure strategy were initially thought to be universal, and the experimental data seemed to be compatible with these assumptions. Yet both strategies were later criticized for a number of different reasons. Minimal Attachment was criticized for its incompatibility with more recent models of structural representation based on binary branching, under which the predictions about processing differences based on the number of syntactic nodes hold no more. Second, the semantic and pragmatic neutrality of the examples in which the effects of parsing preferences based on Minimal Attachment were observed was seriously questioned (Taraban and McClelland 1988). As for

Late Closure, cross-linguistic data from a number of languages other than English seemed to argue in favour of an "early closure" preference, thus challenging the assumptions about its universality (Cuetos and Mitchell 1988).

Although these strategies appear to have fallen out of favour within the current theory of sentence processing, their contributions to our understanding of how sentences are comprehended are still great. From the time both Minimal Attachment and Late Closure were formulated, principles that guide the construction of a sentence have been viewed as choosing to postulate an analysis that costs the least effort in terms of computation. This has led to the development of a number of processing strategies which are to a great extent psychologically motivated, and whose major concerns evolve around the issues of minimizing processing costs involved in on-line sentence comprehension.

1.1.ii The Active Filler Strategy and the Minimal Chain Principle

Apart from different types of structural ambiguities, such as (1) through (3) above, which generally increase processing load, structures that involve empty categories are predicted to pose additional problems for the parser. Empty categories are syntactically postulated elements without any phonetic or orthographic representation and the parser must be able to deduce both their presence in a structure, as well as the properties relevant for interpretation. For example, wh-movement, used for question and relative clause formation, as illustrated in examples (4) and (5) below, moves an element out of its base-generated position into a clause-initial position, leaving an empty category (wh-trace) in the gap position.

(4) Who_i did Mary talk to t_i at the party?

- (5) Mary talked to an old friend whom_i she has not seen t_i in years.

The parser has to not only recognize the existence of an empty category in the gap position, but also to interpret it in relation to the moved element (filler) within real-time constraints and with the limited working memory resources available. Simple strategies, such as postulate the gap in the sentence final position, are not adequate to account for the processing of a wide range of wh-constructions, as the linear position of the trace is governed by both the argument structure of the verb and the thematic role assigned to the wh-filler. An efficient parser must thus adopt a strategy that will be independent of specific properties of either the construction or the language under consideration, and that will at the same time minimize the processing cost involved. Frazier (1987b) has provided a formalized account of the observed higher processing difficulty of object wh-constructions, as opposed to subject questions and relative clauses, by proposing the Active Filler Hypothesis. This strategy was initially formulated as:

The Active Filler Hypothesis: Empty HOLD as soon as possible.

where HOLD is assumed to be a special memory buffer in which unstructured material is temporarily stored. In structures derived by wh-movement out of the subject position, HOLD will be emptied very early on (cf. example (6) below), as opposed to movement out of the object position in which the filler remains unassigned (uninterpreted) for a longer period of time (cf. example (7) below).

- (6) the girl who_i t_i spoke at the meeting

- (7) the girl who_i the president spoke to t_i at the meeting

The Active Filler Hypothesis correctly predicts the existence of a preference for subject

interpretation of relative clauses, and it was initially formulated to account for such a preference observed in the Dutch ambiguous relatives clauses (Frazier 1987b), as illustrated in example (8) below.

(8) Jan houdt niet van de Amerikaanse die de Nederlander wil uitnodigen.

John liked not the American who the Dutch person wants to invite

a. John didn't like the American that wants to invite the Dutch person.

b. John didn't like the American that the Dutch person wants to invite.

(D Frazier 1987b)

Experimental data supported the prediction based on the Active Filler Hypothesis that the preferred interpretation would be the subject interpretation (8a).

The Active Filler Hypothesis was later reformulated as the Active Filler Strategy (AFS) (Frazier and Flores d'Arcais 1989).

The Active Filler Strategy: Assign an identified filler as soon as possible; i.e. rank the option of a gap above the option of a lexical noun phrase within the domain of an identified filler.

In brief, the AFS presupposes two main points. First, the parser is able to easily identify the filler, and second, as soon as the filler has been identified, it is assigned to the first grammatically available position, usually the subject position. Both predictions have been supported by the data. The parser processes differently sentences with and without a filler, anticipating the gap only in the structures in which a filler is present (Crain and Fodor 1985, Stowe 1986). In sentences in which a gap may be potentially located at an earlier, but

incorrect position, the parser chooses to do so (Frazier and Clifton 1989). And finally, although the AFS is a processing strategy which guides initial parsing preferences, when parsing strategies and rules of grammar are in conflict with one another, the grammar wins (Stowe 1986; but cf. Goodluck et al. 1992 for an alternative interpretation of the data).

In sum, the AFS has been formulated to account for the processing of filler-gap dependencies only, and it has successfully done so. Second, only those filler-gap dependencies in which some kind of ambiguity is present, either temporary or global, were predicted to be subject to the AFS. Thus the limited range of environments in which the AFS is applicable has made it susceptible to various modifications, revisions and criticisms.

Based on the processing of different types of questions and other types of empty categories in Italian, de Vincenzi (1991) proposed the Minimal Chain Principle (MCP), partially an extension of the AFS.

Minimal Chain Principle: Avoid postulating unnecessary chain members at S-structure, but do not delay *required* chain members.

The MCP combines postulating movement as last resort with an active search for a required gap, by extending parsing principles used in processing filler-gap dependencies to processing different types of empty categories. When subjects were presented with structurally ambiguous wh-questions of the form "WH-V-NP", illustrated in (9) below,

(9) Chi ha chiamato Giovanni ?

(I de Vincenzi 1991)

(who has called Giovanni ?)

- a. Chi_i t_i ha chiamato Giovanni ? ("Who has called Giovanni?")
- b. Chi_i e_j ha chiamato t_i Giovanni_j ? ("Who did Giovanni call?")

the preferred interpretation of the wh-word chi was the subject interpretation (as in (9a)). These results were consistent with the predictions based on the MCP (and the AFS), namely that when a filler has been identified, postulating the gap and thus completing the required chain is done as soon as possible, i.e. at the first grammatically available position. Furthermore, sentences which are ambiguous between having a null pronominal subject and a transitive verb (10a), or a null category bound by an inverted subject and an intransitive verb (10b):

- (10) Ha chiamato Giovanni. (I de Vincenzi 1991)
- a. pro has called Giovanni. ("S/he called Giovanni.")
 - b. e_i has called Giovanni_i. ("Giovanni called".)

were read faster when they were consistent with the null-subject interpretation (as in (10a)) than when disambiguating segment forced the parser into the inverted subject interpretation. These findings confirm the prediction that the parser prefers to postulate shorter chains, the shortest possible one being a singleton chain like *pro*, i.e. no chain at all. The MCP has unified the processing of different types of empty categories, but no attempt was made to account for the processing of either unambiguous or overt categories.

I.1.iii The Cost of Movement and the Syntactic Prediction Locality Theory

Several researchers have examined the problem of processing empty categories, especially traces of wh-movement, from a completely different perspective. The basic underlying assumption is that whatever is guiding parsing decisions in the processing of temporarily ambiguous filler-gap dependencies is reducible to independently motivated processes that are a part of the general cognitive mechanism involved in the processing of a wide range of different structures.

Schlesewsky et al. (1996), based on mean reading times and accuracy of responses, report an overall subject preference for the initial case-ambiguous wh-word in German. Wh-questions that are temporarily ambiguous between subject and object interpretations, as illustrated in (11 a-b) below, received subject interpretation for a locally ambiguous initial wh-word more than 70% of the time.

- (11) a. Welche Frau glaubst Du liebt **den** Mann? (G Schlesewsky et al. 1996)
 which woman believe you loves the_{ACC} man
 (Which woman do you believe loves the man?)
- b. Welche Frau glaubst Du liebt **der** Mann?
 which woman believe you loves the_{NOM} man
 (Which woman do you believe the man loves?)

The same preference for subject interpretation of question words also occurred in non-ambiguous questions in German, as illustrated in (12 a-b) below (Schlesewsky et al. 1997).

- (11) a. **Welcher** Musiker glaubst Du beeindruckte den Kritiker auf dem Opernball?
 which_{NOM} musician believe you impressed the_{ACC} critic at the opera ball
 (Which musician do you believe impressed the critic at the opera ball?)
- b. **Welchen** Musiker glaubst Du beeindruckte der Kritiker auf dem Opernball?
 which_{ACC} musician believe you impressed the critic at the_{NOM} opera ball
 (Which musician do you believe the critic impressed at the opera ball?)

Basing their arguments on the observation that the same preference is present even in the absence of any ambiguity, Schlesewsky et al. (1997) argue against the explanatory adequacy of the AFS, proposing a new parsing principle, the Cost of Movement, which performs syntactic ambiguity resolution by computing the cognitive costs that the two alternative analyses pose.

The Cost of Movement (CoM): The need to store a wh-phrase in memory
 creates cognitive costs slowing down parsing.

In brief, the CoM states that it is costly to keep moved items in memory. The relative difference in cognitive difficulty between subject- and object-initial wh-constructions is a function of the amount of time that the wh-filler has to be kept in memory. As object-extracted wh-fillers require more time to be assigned to their corresponding gap positions than the subject ones, increased difficulty observed in the processing of object-initial constructions follows directly from the CoM. Second, as observed by Schlesewsky et al. (1996), the processing of object-initial structures will always, irrespective of the position of the gap, involve the presence of one additional item in working memory, as compared to

subject-initial constructions. Thus the number of items to be kept in working memory and the amount of time needed to compute each of them determines the processing cost. Note that although some parts of the CoM are reminiscent of the initial formulation of the Active Filler Hypothesis (Frazier 1987), as well as the MCP (de Vincenzi 1991), the CoM is not directly linked to the presence of local ambiguity.

The processing difference between subject and object relatives is just one of the phenomena that the Syntactic Prediction Locality Theory (SPLT: Gibson 1998) has tried to account for. In short, the SPLT is formulated as consisting of two parts: an integration cost, and a memory cost, both of which access the same pool of working memory resources. The integration cost determines computational resources required to integrate syntactic elements into the structural representation. The memory cost is measured in terms of the number of predicted categories sufficient to complete the current input string as a grammatical sentence. Two main points relevant for our discussion may be derived from the way the SPLT is formulated. First, as the minimum number of predicted categories is two (one for the subject NP and one for the verb), subject-initial structures will by definition require fewer computational resources than object-initial ones. And second, as both memory and integration cost are discourse-based locality functions, a greater number of intervening categories between the *wh*-filler and an object gap, as opposed to a subject gap, is predicted to make object relatives harder to process.

Additionally, the prediction about increased difficulty involved in object-initial structures holds irrespective of the presence of empty categories. Any structures involving two arguments will be harder to process than those in which the verb takes one argument

only, as the number of predicted categories, be it overt or empty, is greater in the former. And finally, the SPLT does not make any specific predictions about processing different types of local ambiguities, as those fall under the general predictions based on the computation of memory and integration costs. The fact that ambiguity resolution strategies, such as the AFS, provide descriptive accounts of the processing differences between subject and object relatives, for example, follows directly not from the strategy by which a particular ambiguity is resolved, but rather from the preference derived on the basis of the number of computational resources required to analyze the input string. To account for cases of true linguistic ambiguity, Gibson (1998) proposes the Ambiguity Resolution Strategy: "If the SPLT memory and integration cost are controlled then lexical frequency and plausibility information will determine the preferred interpretation." (Gibson 1998, p. 54).¹ As the SPLT memory cost is never the same for subject and object relatives, the use of any ambiguity resolution strategy, either the AFS of Frazier and Flores d'Arcais (1989) or the Ambiguity Resolution Strategy of Gibson (1998), is unwarranted in this theory.

In summary, the SPLT states that both the AFS and its extension the MCP are reducible to the SPLT, as there is no need to formulate specific parsing strategies that will only apply in a limited range of environments. The fact that the AFS accounts best for the effects observed in the processing of temporarily ambiguous filler-gap dependencies does not exclude the possibility that the assumptions on which the AFS is based are built into a more

¹

Gibson (1998), however, provides experimental evidence against the arguments that frequency and plausibility may replace entirely the use of processing strategies. Only when the SPLT is similar for two structures, lexical frequency and plausibility play a crucial role.

general model of sentence comprehension, formulated at present as the SPLT. It remains to be seen how wide a range of phenomena the SPLT is capable of accounting for.

1.2. Serbo-Croatian experiments

1.2.i On-line reading time experiments

The major part of this thesis consists of on-line reading time experiments in Serbo-Croatian, in which a number of predictions based on the AFS, the MCP and potentially the SPLT were tested.² Serbo-Croatian offers a number of novel features for the study of on-line processing of discontinuous dependencies. First, although the language has a rich morphological system, in some cases morphological ambiguity allows for a potential local syntactic ambiguity to arise. Second, since the language has a relatively free word order, and it is, unlike German and Dutch, unrestricted with respect to the position of the verb, it is possible to create at least four configurations and examine the differences in the processing of different word orders. Third, the same word order variation may be carried over to the wh-constructions, such as relative clauses, in which the interaction of filler-gap dependencies and word order variation may be tested. Finally, the language uses, apart from the standard wh-relatives, *što* ("that") relatives with resumptive clitic pronouns, the processing of which has not been tested in any language so far.

Three separate experiments will be discussed: the *scrambling*, *koji* and *što* experiments. All three experiments involve structures that are temporarily ambiguous up to one point, usually the verb, which carries semantic and pragmatic information as to the correct theta-role assignment. In the *scrambling* experiment nouns that are morphologically

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Readers should keep in mind that the experiments reported in this thesis were designed and carried out before the SPLT was formulated. Any discussion of predictions and results in relation to the SPLT is thus a post-hoc addition to the original work.

ambiguous between a nominative and accusative form are used in four different word orders in embedded clauses, two subject-initial and two object-initial orders. The main question to be addressed by this experiment is whether subject-initial orders in Serbo-Croatian are easier than object-initial orders, as has already been established for a number of other languages, and what particular parsing strategy is used in the processing of word order variation, when all other clues, such as morphology and phonology, are unavailable to the parser.

The second experiment, the koji ("who/which") relative clause experiment, is primarily designed to test the processing of filler-gap dependencies in relative clauses. Apart from the standard subject and object relatives, the fact that Serbo-Croatian is a free word order language makes it possible to create two additional relative clause structures, a subject relative with an object scrambled into a preverbal position, and an object relative with a subject postposed into a postverbal position. Thus an interaction between a predicted difficulty involved in the processing of object relatives, as opposed to the subject ones, and the effects of necessary revisions due to the presence of scrambled elements, will be tested in the koji experiment. Additionally, because in this experiment the same set of sentence frames is used as in the scrambling experiment, it enables us to separate the effects of the processing of word order variation from those due to the processing of filler-gap dependencies.

The third experiment, the što experiment, examines a problem previously unaddressed in the study of the filler-gap processing. This type of relative clause is derived by an operator movement into a Comp position; the operator is coindexed with a resumptive clitic pronoun in all structural positions, except the subject position. As all clitic pronouns cliticize into the

clause-second position in Serbo-Croatian, adjoining in this case to the indeclinable complementizer što, object binders always precede the subject ones. This structural configuration leads to an interesting prediction for the processing theory, namely that object što relatives are easier to process than the subject ones. The main goal of this experiment is to test whether empirical data does in fact support this prediction, and to examine to what extent the AFS is reducible to the SPLT when the processing of što relatives is taken into consideration.

1.2.ii Experimental technique

The technique used in all three experiments was a self-paced reading task. All sentences were presented in phrasal chunks (two to four word chunks), to reduce, first, processing spillover effects (Mitchell 1984), and, second, the duration of the experiment. Reading times were measured at four crucial positions in each test sentence. Although subjects were instructed to read at a natural rate, they were told that after 5 seconds a new segment would automatically appear on the computer screen. They received written instructions, then did a practice trial. No subject saw more than one version of each sentence frame, and each test sentence appeared equally often in each condition.

The subordinate task was a repetition task, a structure-oriented strategy (Aaronson and Ferres 1984). Subjects were asked from time to time to repeat a sentence they had just read, within a ten-second time period. Only filler sentences were chosen for the repetition, and this task was tape-recorded for each subject.

1.2.iii Order of presentation

All three experiments were presented simultaneously in one single session. The whole procedure lasted for about 45 minutes. A within subject design was used, in which the order of presentation was counterbalanced. Each questionnaire consisted of 48 test sentences (16 for each experiment) and 48 fillers, which were randomized for each of the eight questionnaires created. A set of 32 sentence frames was used in the scrambling and koji experiments, through which the experimental conditions (see below) were rotated. A set of 16 sentence frames, two conditions in each, was created for što experiment. Each subject received four tokens of each sentence type in scrambling and koji experiments and eight tokens of each type in the što experiment.

1.2.iv Subjects

Subjects for all three experiments were 32 adult native speakers of Serbo-Croatian, aged 29 to 50, living in the Ottawa area, who use their first language as the only language of everyday communication at home. At the time of testing, none of the subjects had been living outside the former Yugoslavia for more than seven years.

2. SCRAMBLING EXPERIMENT

2.1 Word order variation in Serbo-Croatian

Serbo-Croatian is an SVO language with "free" word order, i.e. the following six word order combinations are possible: SVO, OVS, SOV, OSV, VSO and VOS. Different word orders are analyzed as derived by either Topicalization, Scrambling or Object Shift (Stojanović 1994; 1996). The main focus of the experiment reported below is to test how scrambled word orders in embedded sentences are processed. In brief, scrambling in Serbo-Croatian is an A-bar movement operation, similar in many respects to wh-movement, which moves scrambled phrases out of their base-generated position and adjoins them to either VP or IP (Stojanović 1994). Scrambled elements carry with them their case features, together with gender and person features, which generally allows for an easy interpretation of their theta roles and the corresponding functions they play in the sentence. As shown in (12 a-b) below, interpreting the sentence is determined by inflectional morphology of the nouns.

- (12) a. Dečak juri psa.
 boy_{NOM} chases dog_{ACC}
 (A/the boy is chasing a/the dog.)
- b. Dečaka juri pas.
 boy_{ACC} chases dog_{NOM}
 (A/the dog is chasing a/the boy.)

There is, however, a limited set of nouns whose morphological paradigms are deficient, i.e.

they are ambiguous between nominative and accusative forms. When these nouns are combined with word order variation, all six possible derivations are completely ambiguous, as shown in (14 a-f).

- (14) a. Dete juri kuće.
 child_{NOM=ACC} chases puppy_{NOM=ACC}
 (The boy is chasing the puppy / The puppy is chasing the boy.)
- b. Kuće juri dete.
- c. Dete kuće juri.
- d. Kuće dete juri.
- e. Juri dete kuće.
- f. Juri kuće dete.

Examples (14 a-f) show that inflectional morphology does not provide any clues as to how to disambiguate between the two possible readings for each of these sentences. The experiment reported below will test the processing of temporarily ambiguous structures in Serbo-Croatian. Temporary ambiguity is created by combining word order variation with absence of overt case morphology, and the disambiguating information is provided by the lexical semantics of the verb.

2.2.i Processing different word orders in Serbo-Croatian

Serbo-Croatian word order variation has received little attention in the processing literature,

and the two studies described below address only indirectly the nature of the mechanisms used in the comprehension of different word orders. Urošević et al. (1986) conducted a number of different experiments (using sentence verification, naming, and lexical decision tasks) testing three word sentences with morphologically unambiguous nouns. In the sentence verification task, for example, subjects had to verify the truth of the sentence based on the semantic plausibility of matches between the lexical semantics of the verb and the theta roles assigned to its arguments. The results from this task for the semantically plausible sentences for the six different word orders are illustrated in TABLE 1 below.

TABLE 1 (adapted from Urošević et al. 1986):
Responses in msec in sentence verification task for 4-letter words
in semantically plausible sentences³

SVO	1552 (1)	SOV	1554 (2)	VSO	1642 (3)
OVS	1774 (5)	OSV	1846 (6)	VOS	1690 (4)

Overall results show that SO orders are processed faster than OS orders. Generally speaking, subject initial utterances (SVO, SOV, VSO) took less time to be semantically evaluated and named than object-initial ones (VOS, OVS, OSV). In their third experiment, in which subjects had to decide whether a word or a pseudoword appeared in the sentence, the results from the sentence verification task and the naming task were not replicated. This inconsistency was, Urošević et al. (1986) argue, caused by the inadequacy of the lexical decision task to tap clause-level processing. Urošević et al. (1986) attributed the observed

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Numbers in parentheses indicate ranking of relative speed at which sentences are judged.

difference in the processing between SO and OS structures to a potentially marked status of the latter in the language.

In their second set of experiments (three lexical decision tasks), Urošević et al. (1988) also included a number of case-ambiguous nouns, in order to tease apart the effects of inflectional and word order strategy. Examples (15 a-f) illustrate the test conditions used, and the main results are presented in TABLE 2.

(15) an example of sentence frames used:

- | | | | | | | | | | |
|--|--------------------------|---|-------------------------|---|-------------------------------|---|---------------------------|----|--------|
| | ljubav | / | radost | / | sreća | / | nagrada | // | donosi |
| | love (N _{AMB}) | | joy (N _{AMB}) | | happiness (O _{ACC}) | | prize (S _{NOM}) | | brings |
- a. Ljubav radost donosi. (NNV=SOV)
- love_{AMB} joy_{AMB} brings
- (Love brings joy.)
- b. Nagrada radost donosi. (SNV=SOV)
- prize_{NOM} joy_{AMB} brings
- (Prize brings joy.)
- c. Ljubav sreću donosi. (NOV=SOV)
- love_{AMB} happiness_{ACC} brings
- (Love brings happiness.)
- d. Radost ljubav donosi. (NNV=OSV)
- joy_{AMB} love_{AMB} brings
- (Love brings joy.)

- e. Radost nagrada donosi. (NSV=OSV)

joy_{AMB} prize_{NOM} brings

(Prize brings joy.)

- f. Sreću ljubav donosi. (ONV=OSV)

happiness_{ACC} love_{AMB} brings

(Love brings happiness.)

TABLE 2 (adapted from Urošević et al. 1988):

Responses in msec in a lexical decision task

	S-marked	Unmarked	O-marked	Unmarked
SO	(SN) 759	(NN) 770	(NO) 715	(NN) 692
OS	(NS) 798	(NN) 779	(ON) 716	(NN) 714

In summary, object-initial inflection blocks the word order strategy more strongly than subject-final inflection, indicating that the word order strategy can be overridden by inflection. In the absence of inflections (N) only the word order strategy is available. But the results for the case-ambiguous nouns are far from clear-cut. The 9 msec difference (column 2) misses significance ($p > .05$). On the other hand, the 22 msec difference (column 4) is significant ($F(1,55)=9.86$, $p < .003$) as is the 39 msec difference (column 1) between SN and NS orders ($F(1,59)=7.84$, $p < .007$), in which the subject bears overt case morphology. Thus no clear-cut results were obtained with structures with both case-ambiguous nouns, in which neither inflectional nor word order strategy may help the parser in theta-role assignment.

In a study which tested similar phenomena in Croatian⁴, Mimica et al. (1994), using a sentence picture matching task, observed a strong preference to interpret an initial NP as subject. The experiment was designed to examine the strength of different cues (like morphological case, position, gender agreement and animacy) in on-line theta-role assignment. For conditions with both case-ambiguous nouns, subjects chose the first noun as agent 82% of the time. When the first noun agreed with the verb in gender features, subjects chose it as agent almost 90% of the time. When the gender features on the verb matched those of the second noun, it was chosen as agent 60% of the time. In sentences in which the first noun was animate, it was interpreted as subject almost 90% of the time, compared to 66% of the time for an initial inanimate noun. In summary, Mimica et al.'s (1994) results indicate that there is a strong tendency among native speakers of Croatian to interpret the first NP as subject even in the absence of any morphological cues, a strategy which is partially overridden by other factors like animacy features and agreement on the verb.

2.2.ii Studies on the acquisition of word order in Serbo-Croatian

In order to better understand various aspects of sentence parsing it may prove useful to examine the data from acquisition studies, as there appear to be similar processes going on. Radulović (1975) observed that Serbo-Croatian children produce a fixed SO order across

⁴

Croatian and Serbian, and consequently Serbo-Croatian, do not differ in any aspect of the syntactic phenomenon discussed at this point. As Mimica et al. observe "the language investigated in this project is the same language that is spoken in four former republics of Yugoslavia (Croatia, Serbia, Montenegro and Bosnia-Herzegovina), but in Serbia the language is called Serbian, and in Montenegro and Bosnia it is called Serbo-Croatian (Croato-Serbian)" p. 260.

early language development, although the position of the verb varies, as illustrated in TABLE 3 below.

TABLE 3 (adapted from Radulović 1975)
Spontaneous speech of one child aged 1,8-2,2

Word order	%	Word order	%	Word order	%
SVO	13	SOV	3	VSO	2
OVS	0.2	OSV	-	VOS	1
SV	34	OV	2	VO	27
SO	0.8			VS	17

As shown in TABLE 3, SVO is the predominant word order, verb-initial structures are quite frequent, unlike the verb-final ones, and OVS and OSV structures are hardly produced at this stage.

Slobin and Bever (1982) examined the acquisition and use of different word orders in a number of languages. TABLE 4 illustrates the spontaneous Serbo-Croatian data.

TABLE 4 (adapted from Slobin and Bever 1982)
The percentage of utterances analyzed as SVO, SOV and VSO
in spontaneous production in child-adult interaction in S-C

	Children	Adults
NVN (percentage of NVNs that are SVO)	99%	97%
NNV (percentage of NNVs that are SOV)	83%	67%
VNN (percentage of VNNs that are VSO)	79%	84%

As shown in TABLE 4, children prefer the subject-initial word order irrespective of the position of the verb, whereas adults allow for more variation, especially with verb-final structures. Slobin and Bever (1982) also conducted an act-out task combining different word orders and inflections. Examples (16 a-c) illustrate one of the sentence frames used and only those conditions in which both nouns are morphologically ambiguous between subject and object.

- (16) grebe // štene / mače / veverica
 scratches puppy_{AMB} kitten_{AMB} squirrel_{FemNOM+ACC}
- a. Štene grebe mače.
 puppy_{AMB} scratches kitten_{AMB}
- b. Štene mače grebe.
 puppy_{AMB} kitten_{AMB} scratches
- c. Grebe štene mače.
 scratches puppy_{AMB} kitten_{AMB}

Meaning 1: The puppy is scratching the kitten.

Meaning 2: The kitten is scratching the puppy.

The act-out results for the conditions in which both nouns are ambiguous between nominative and accusative form, as illustrated in (16 a-c), are shown in TABLE 5.

TABLE 5 (adapted from Slobin and Bever 1982)
 Percentage of choices of first noun as agent in Serbo-Croatian

Sentence type	
NVN	71%
NNV	60%
VNN	64%

The preference to assign a subject theta role to the initial NP is strongest in verb-medial structures, and it diminishes in structures in which ambiguous NPs are adjacent to one another, especially in verb final constructions. In general, apart from the overall preference to interpret an initial NP as agent in both inflected and uninflected forms, the location of inflection, in conditions in which one of the nouns is overtly marked for morphological case, seems to play an important role. As noted by Slobin and Bever (1982), initial object inflection overrides the word order strategy more strongly than the final subject inflection. Interestingly enough, this finding was replicated in off-line sentence processing experiments with Serbo-Croatian adults (Urošević et al. 1988) (cf. Section 2.1). Although the interaction of inflection and word order strategy has not been addressed in the Serbo-Croatian on-line experiments, German adult sentence processing studies have similar findings. Meng and Bader (1996) note that garden-path effects vary in strength depending on the mode of disambiguation, with verbal information producing stronger effects than case information on the second NP. It therefore seems that the salience of ungrammaticality (formulated as the Mismatch Effect in Meng & Bader 1996) plays a role in both children's and adults' comprehension of temporarily ambiguous clauses. Furthermore, Slobin and Bever (1982)

noted that "Early strategies of this sort seem bound to on-line processing, as evidenced by their sensitivity to a sentence-initial local cue on an object noun. More mature strategies will require deferral of interpretation until an entire clause has been received." (p. 251).

In sum, acquisitional data suggest that although the SVO order is the preferred one in child grammar, the interpretation of other word orders is guided by some of the sentence processing strategies used in adult grammar.

2.2.iii The processing of scrambling constructions in Russian

A more theoretically based study on the processing of word order variation in a Slavic language is that of Sekerina (1997).⁵ She conducted a number of experiments testing the processing of different types of scrambling in Russian, which shares its basic properties with Serbo-Croatian (cf. Budzhak-Jones 1994, Stojanović 1994). We shall concentrate here on scrambling of nouns that are morphologically ambiguous between nominative and accusative case. Sekerina (1997) examined Russian speakers' comprehension of word order contrasts illustrated in (17 a-d) below.

- (17) a. Trolleybus obognal **avtobus.**
 trolleybus_{NOM=ACC} passed bus_{NOM=ACC}

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There is a striking similarity between the main issues addressed in Sekerina's experiment on XP scrambling in Russian and the experiment reported here. The two studies were however carried out independently, as the Serbo-Croatian experiment was conducted in the spring of 1996, and I did not receive Sekerina's thesis until the summer of 1998.

- b. **Avtobus** obognal trolleybus.
 c. Trolleybus **avtobus** obognal.
 d. **Avtobus** trolleybus obognal.

Meaning 1 (object): "The trolleybus passed the *bus*."

Meaning 2 (subject): "The *bus* passed the trolleybus."

A paper-and-pencil task was used to rate the relative accessibility of both interpretations for both types of structures. For the NVN structures the preferred interpretation was SVO, and this result was statistically significant. As for the NNV structures, the initial noun was again interpreted as the subject most of the time. The preference for the SOV over the OSV interpretation is discussed in terms of the theory of the parameterized landing sites for scrambled phrases and the predictions made by the MCP.

The same syntactic contrasts were employed in an on-line reading time experiment. TABLE 6 illustrates sentence reading times and patterns of responses on the comprehension task.

TABLE 6 (adapted from Sekerina 1997) NOM/ACC Ambiguity:
 Sentence Reading Times (in seconds, percent timeouts in parentheses)
 and Question Response Preference (percent) as a function of Word Order

	Sentence RT	Response Preference	Response Preference
NVN	2.80 (0.4)	SVO 73.5	OVS 25.0
NNV	3.27 (1.5)	SOV 64.1	OSV 34.1

As shown in TABLE 6, the results replicated those from the off-line task, in which subjects

preferred to assign an SVO interpretation to an NVN structural ambiguity. Similarly, an SOV interpretation was chosen more often than the OSV one in the structures in which both nouns precede the verb. In summary, an initial case-ambiguous noun was consistently interpreted as the subject of the sentence in Russian. The differences in the relative strength of such preferences in two structures are caused by an additional difficulty the parser has with the processing of verb-final structures in which at least one scrambling chain has to be postulated. This difficulty is also reflected in longer overall reading times for NNV structures, compared to the NVN ones. To sum up, Sekerina's (1997) results indicate that speakers assign the subject interpretation to an initial NP in globally ambiguous sentences in Russian.

2.2.iv. The processing of subject-object asymmetries in Dutch and German

Languages that have been studied extensively with respect to subject/object preferences in the processing of basic and derived word orders in declarative sentences are Dutch and German. Frazier and Flores d'Arcais (1989), in an end-of-sentence grammaticality judgement task used the type of structural ambiguity in which the verbal inflection plays the disambiguating role, as illustrated by (18) and (19) below.

- (18) De patient **bezoekt** de dokters. (D Frazier and Flores d'Arcais 1989)
 (The patient visits the doctors.)
- (19) De patient **bezoeken** de dokters.
 (The doctors visit the patient.)

The results indicate that Dutch speakers have a strong preference to interpret the initial (case ambiguous) NP as the subject. Kaan (1997) created a similar syntactic contrast for a self-paced reading task, in which subjects' comprehension of the relevant structures was also tested.

- (20) De assistenten **hadden** de professor niet geholpen met het rapport. (D Kaan 1997)

the assistants had_{pt} the professor not helped with the report

- (21) De assistenten **had** de professor niet geholpen met het rapport

the assistants have_{sg} the professor not helped with the report

Comprehension question: Wie werd(en) niet geholpen?

who was (were) not helped

The results show that subject-object main clauses were read faster than object-subject clauses. Additionally, overall performance accuracy on the comprehension questions was better for subject- initial structures.

In a series of experiments, Hemforth (1993) found that German speakers show the same preference for subject interpretation of locally ambiguous initial NPs. Bader (1994a: self-paced reading) and Bader (1996: speeded grammaticality judgement) found higher reading times and a drop in grammaticality judgements in structures like (23), an indication of a processing difficulty caused by object-initial structural position in German embedded clauses.

- (22) Maria hat gesagt, dass sie die Eltern angerufen **hat**. (G Bader 1996)

Mary has said that she the parents phoned has

(Mary has said that she has phoned the parents.)

- (23) Maria hat gesagt, dass sie die Eltern angerufen **haben**.

Mary has said that she (=her) the parents phoned have

(Mary has said that the parents have phoned her.)

In an eye-tracking experiment, using ambiguous embedded clauses in which the disambiguation is carried by the case marking on the second NP, as shown in (24) and (25) below, as opposed to the number morphology of the verb (cf. (22) and (23) above), Scheepers et al. (1997) found that subject-initial structures are processed faster than the object-initial ones.

- (24) Man erzählte uns, dass die hungrige Füchsin **den** fetten Hahn sah.

they told us that the hungry fox_{AMB} the fat rooster_{ACC} saw

(They told us that the hungry fox saw the fat rooster.)

- (25) Man erzählte uns, dass die hungrige Füchsin **der** fetten Hahn sah.

they told us that the hungry fox_{AMB} the fat rooster_{NOM} saw

(They told us that the fat rooster saw the hungry fox.)

(G Scheepers et al. 1997)

In summary, based on various experimental findings from German and Dutch it can be argued that the parser has a strong preference to interpret an ambiguous initial NP in both main and

embedded clauses as the subject.

2.2.v Summary

Experimental data from a number of Slavic and Germanic languages indicate that, in the absence of any other clues, the parser prefers to interpret the initial NP as having the subject grammatical role. Although this tendency may be enhanced or weakened by other factors, such as morphology, animacy, type of disambiguation, etc., it clearly presents a strategy by which the parser is minimizing the processing cost involved in the computation of a temporary syntactic ambiguity.

The experiment reported below represents a partial replication of Urošević et al.'s (1988) experiments. It was designed to test the processing of different word orders in Serbo-Croatian in light of the predictions based on certain parsing strategies, such as the MCP.

2.3 Materials

Test conditions used are illustrated in (26 a-d), examples in which the semantics of the verb plays a disambiguating role. Subscripted numbers indicate positions at which reading times (RTs) were measured.⁶

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An empirical problem, due primarily to lexical restrictions, encountered in designing test sentences was the possibility of having end-of-sentence effects at the last position at which RTs were measured. It was next to impossible to create sentence frames in which the last segment was followed by another sentence constituent, and in only two out of 32 sentence frames this problem was eliminated.

(26) Celo selo je bilo svesno toga da je

whole village was aware of the fact that has

a. venčanje₁ / izazvalo₂ / divljenje₃ / čak i kod gostiju₄ / iz grada. (SVO)

wedding / caused / admiration / even in guests / from city

(The whole village was aware of the fact that the wedding has caused admiration

even in the guests from the city.)

b. divljenje₁ / izazvalo₂ / venčanje₃ / čak i kod gostiju₄ / iz grada. (OVS)

c. venčanje₁ / divljenje₂ / izazvalo₃ / čak i kod gostiju₄ / iz grada. (SOV)

d. divljenje₁ / venčanje₂ / izazvalo₃ / čak i kod gostiju₄ / iz grada. (OSV)

The same 36 sentence frames, eight conditions for each frame, were used for both the scrambling and koji experiments. Since both experiments rely on absence of any overt morphological distinctions between agent and patient theta roles, the choice of lexical items to be used was extremely restricted. Only a few masculine inanimate and neuter abstract nouns do not exhibit these overt distinctions, and an approximately equal number of both types of nouns was used across the sentence frames.⁷ In each sentence frame, however, only nouns belonging to the same type, i.e. masculine inanimate or neuter abstract, were used to retain the ambiguity needed. In order to eliminate plausibility of matches between lexical items and theta-roles, nouns were paired together, based on native speakers' linguistic

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This was especially important in the relative clause experiment, in which the relative pronouns, i.e. koji (for masculine animate) and koje (for neuter abstract), which exhibit the same type of case ambiguity, were used.

intuitions, so that both of them could be an equally plausible subject or object. Although this plausibility requirement was met, lexical restrictions, together with experimental manipulations, eliminated the possibility of having semantically reversible sentences. As the experiments relied on the lexical semantics of the verb to disambiguate the sentence, and no other disambiguation cue was used, reversibility would only enhance ambiguity.⁸ All nouns had the third person singular forms. In order to ensure that sentences were as natural sounding as possible, about two thirds of nouns were preceded by an adjectival modifier. Again, if any modifier was used for one noun, it was used for another in the same sentence frame. Although the length of these segments was not balanced across the sentence frames, it remained constant across all eight conditions within each sentence frame, which thus differed in syntactic contrast only. Since the whole design is dependent upon the position of the disambiguating segment, i.e the verb, the goal was to use a verb that would either semantically or pragmatically disambiguate the sentence. This was achieved in most of the sentence frames, and in only a few cases the disambiguation had to be carried over to the last segment in the sentence, i.e. the postverbal adverbial phrase.⁹

8

Initially, the idea of having two different types of verbs for each sentence frame was considered as a check against any pragmatic bias toward assigning a particular thematic role to a particular lexical item. Since this would yield 16 conditions in each sentence frame, and therefore result in creating 16 different questionnaires, in order to reduce experimental complexity, only one verb was used per each sentence frame.

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The number of sentence frames that was unbalanced with respect to one of the factors discussed is as follows: out of 32 sentence frames 21 had modified and 11 simple NPs; 17 had masculine inanimate and 15 had neuter abstract nouns; 24 sentences had verbal and 8 postverbal disambiguation; and only two sentences had one segment following the position 4. Specific analyses will be performed for each of these factors to check for

Unlike in the Urošević et al. experiments, which used only single nouns and simple tense, periphrastic tenses (past and future) were used in all sentence frames. Since both periphrastic tenses used consist of an auxiliary clitic and the main verb, presence of the auxiliary, which always follows the Comp position, was useful in relative clauses for reducing spillover effects. The use of embedded clauses automatically ruled out two verb initial word orders (VSO and VOS) since verb raising to a clause-initial position is blocked in this configuration. Additionally, these word orders are uninformative for on-line processing due to early disambiguation.

2.4 Predictions

The structural conditions used are repeated as (27a-d) below.

- (27) a. S / V / O / AdvP /
 b. O / V / S / AdvP / ...
 c. S / O / V / AdvP / ...
 d. O / S / V / AdvP / ...

Structure (27a) does not involve any overt movement operations whose chain formation is subject to computation. Structure (27b), on the other hand, is derived by two unrelated movement operations, both of which form chains between the moved element and the trace. The object NP is scrambled out of the VP into a higher structural position (either VP- or IP-

any interaction between these factors and syntactic structure (cf. Footnotes 15 and 21).

adjoined). The subject NP, on the other hand, moves to a postverbal position by some kind of right adjunction operation.¹⁰ Both of these movements create chains which have to be computed during processing.

Structures (27c) and (27d) are similar in their derivational complexity as they both involve object scrambling into preverbal positions, a VP-adjoined position and an IP-adjoined position, respectively. As both structures consist of only one movement chain, the difference between the two lies in the chain length rather than its complexity.¹¹

Let us examine the four structures discussed above in light of the predicted processing difficulty. According to the first clause of the MCP, there is a general preference

¹⁰

I am basing the predictions and discussion of results for this type of structure on the analysis of subject postposition along the lines of the rightward XP-scrambling analysis proposed for Russian (Sekerina 1997). This analysis allows for the Right Adjunction of subjects, presumably to the VP. Although this approach predicts the existence of two intersecting dependencies, increased processing load predicted for these structures cannot be reduced to this factor only, as the MCP predicts the initial subject preference and subsequent reanalysis at the position of the verb. Thus the fact that OVS structures contain intersecting dependencies, which are generally more difficult to process than nested dependencies, may just increase overall processing load but does not override the use of the MCP. Gibson 1998, however, offers an alternative analysis, based on Bach et al. (1986) study, arguing that nested dependencies are more difficult to process than the crossing ones. Note that for our study the issue of which type of dependency is more difficult is not crucial as it was not designed to examine this problem. The only relevant question is the way in which the presence of a crossing dependency in one type of structure interacts with the AFS/MCP.

¹¹

The analysis of scrambling adopted for the purpose of this study is based on Stojanović 1994 for Serbo-Croatian and resembles the one used in the Russian experiments (Sekerina 1997). The basic assumption is that both in SOV and OSV structures subject sits in the SpecIP, whereas object raises to adjoin to the VP and IP, respectively. Even if one adopts the assumption that subject raising to SpecIP (or SpecAgrS) is computed, the number of derivations involved remains the same for both structures.

for shorter chains. The parser will prefer to posit unmoved elements over moved ones, i.e. initially analyze all NPs as being in their argument positions. Thus the parser should have the least difficulty processing a structure like (27a)¹², as no movement chain has to be postulated.

(27b), on the other hand, is predicted to be most difficult to process, since a reanalysis is needed. If the parser follows the MCP and misinterprets the first NP as the subject, it will have to undertake a reanalysis at the point of disambiguation, i.e. the verb. The initial theta role assignment for the first NP will have to be changed so that patient theta role will be assigned to this argument, and subject theta role reassigned to the postverbal NP argument. Although this structure is the most complicated one in terms of chains involved (it consists of 2 two-member chains, one created by object scrambling and another by subject postposition), the fact that disambiguation comes at an early point may be crucial for easy recovery from the misanalysis before the head of the second chain is encountered.

As discussed above, (27c) and (27d) are equal in terms of chain complexity (i.e. both consist of one singleton and one two-member chain), although the doubleton chain in (27d) has a longer movement path. An additional difference between the two structures is that the former requires no reanalysis if the first NP, using the MCP, is interpreted as subject. (27d), on the other hand, is predicted to be more difficult to parse since a reanalysis is needed at the verb. The first NP will have to be reanalyzed as object and the second one as subject, causing reassignment of both initial theta roles. The critical contrast needed for testing the

¹²

Subject raising to SpecIP/SpecAgrSP, as well as object raising through appropriate projections for case checking is ignored here, assuming that the MCP is not sensitive to feature-checking moves.

use of the MCP is thus exemplified by (27c) and (27d), structures in which the disambiguation comes after both overt arguments. The question is whether theta-role assignment is done on-line or whether it is delayed, given two adjacent morphologically indistinguishable NPs. Furthermore, an interesting question that can also be noted is whether the fact that the two-member chain in (27d) has a longer movement path, i.e. has more intervening projections, than a similar chain in (27c) will in any way slow down parsing.

2.5 Results

Response times slower than 5000msec were treated as missing values. These values were substituted using mean RTs for corresponding positions in the same condition for that particular subject. Responses from all 32 subjects tested were included in the analysis.¹³ The repetition task was primarily introduced to keep subjects attentive to the task, thus these data were not analyzed statistically. As all subjects were consistent in accuracy of responses and no specific difficulty with this task is observed, the performance on this task will be regarded as successful.

TABLE 7 shows mean reading times for each position in the four conditions tested.

¹³

20 subjects had at least one missing value, with a maximum of 18 missing values for one subject. None was excluded from the tabulation as they all had at least one scorable response for each position in each condition.

TABLE 7:
Mean reading time (RT) for four conditions at four positions

POSITION	1	2	3	4	TOTAL
Cond. 1 (SVOAdv)	1123	1042	1114	1281	4560
Cond. 2 (OVSAAdv)	1113	1039	1236	1356	4744
Cond. 3 (SOVAdv)	1160	1311	1180	1253	4904
Cond. 4 (OSVAdv)	1147	1397	1209	1325	5024

The results of a priori planned comparisons, by analyses of variance (ANOVA), with both subject and item as random effects, are as follows:

- (i) Pairwise comparisons between conditions 1 and 2 (SVO and OVS) showed no significant effect at any of the positions tested:
- position 1 ($F_1(1,31)=1.35$, $p=.2547$; $F_2(1,31)=0.50$, $p=.4837$,
- position 2 ($F_1(1,31)=0.19$, $p=.6676$; $F_2(1,31)=0.08$, $p=.7752$,
- position 3 ($F_1(1,31)=3.40$, $p=.0749$; $F_2(1,31)=1.80$, $p=.1872$,
- position 4 ($F_1(1,31)=1.09$, $p=.3052$; $F_2(1,31)=0.63$, $p=.4323$).¹⁴
- (ii) Pairwise comparisons between conditions 3 and 4 (SOV and OSV) showed no significant effect at any of the positions tested:
- position 1 ($F_1(1,31)=0.46$, $p=.5038$; $F_2(1,31)=0.34$, $p=.5628$,
- position 2 ($F_1(1,31)=2.43$, $p=.1295$; $F_2(1,31)=1.54$, $p=.2238$,
- position 3 ($F_1(1,31)=1.53$, $p=.2255$; $F_2(1,31)=0.64$, $p=.4288$,

¹⁴

The only position that was close to significant was position 3 on the subject analysis ($F_1(1,31)=3.40$, $p=.0749$).

position 4 ($F_1(1,31)=1.80, p=.1897; F_2(1,31)=1.17, p=.2881$).

(iii) Condition 1 (SVO) was read faster than condition 3 (SOV)

($F_1(1,31)=4.56, p=.0407, F_2(1,31)=2.72, p=.1093$).

(iv) Condition 2 (OVS) was faster than condition 4 (OSV).

($F_1(1,31)=6.23, p=.0181, F_2(1,31)=4.77, p=.0366$).

(iii) There was no difference between subject-first orders (1 and 3) and object-first orders (2 and 4).

($F_1(1,31)=2.27, p=.1442, F_2(1,31)=0.81, p=.3756$).

When additional analyses were performed on the subset of items, i.e. only those sentence frames with a clear verbal disambiguation (see footnote 9), positions 3 and 4 were marginally significant on the subject analyses for both the SVO/OVS comparison, as well as the SOV/OSV comparison, but failed to reach significance on the item analyses (Condition 1 versus Condition 2 (SVO vs OVS): position 3 ($F_1(1,31)=3.42, p=.0739, F_2(1,17)=1.28, p=.2730$), position 4 ($F_1(1,31)=3.59, p=.0674, F_2(1,17)=1.48, p=.2408$); Condition 3 versus Condition 4 (SOV vs OSV): position 3 ($F_1(1,31)=4.16, p=.0499, F_2(1,17)=2.35, p=.1439$), position 4 ($F_1(1,31)=3.18, p=.0845, F_2(1,17)=1.24, p=.2819$).¹⁵

There was also a small trend in the predicted direction, i.e. some significance in the critical conditions 1 and 2, when a pairwise comparison was performed on the subset of data,

¹⁵

As for other non-syntactic factors that might have affected subjects' performance, no effects could be found of either types of nouns used (masculine inanimate vs neuter abstract), or complexity of noun phrases (with or without a modifier).

derived from the mean RTs of the five slowest subjects. For the five slowest subjects position 3 was significant in subject analysis ($F_{(1,4)}=19.70$; $p<.0113$), but did not reach significance in the item analysis.

2.6 Discussion

The results support the prediction that the parser uses some of the processing strategies discussed, assigning the subject theta role to the initial (case-ambiguous) NP. In condition 1 (SVO), however, the use of MCP cannot be distinguished from the use of the canonical strategy. Although the relative ease with which condition 2 (OVS) is processed may be caused by the presence of early disambiguation, the difference of 122 msec at position 3 between conditions 1 and 2 suggests that the parser does reanalyze the first NP in condition 2 as the shifted object. Note that the position 3 was close to the significance level of $p<.05$ on the subject analysis (cf. footnote 14) when both the complete data set and a subset of test sentences with clear verbal disambiguation were examined, and that, as noted above, it reached significance for the five slowest subjects. Under the assumption that reading ability (i.e. "slow readers") is indirectly linked to a reduction in working memory capacity, the fact that this position comes out as significant for slow readers is due to an additional processing difficulty involved in parsing OVS structures. The parser has to, first, reanalyze the initial thematic role assignment, which in itself can be a costly procedure, and second, it has to keep unassigned in working memory two unrelated "fillers" until the head of the second chain is encountered. The fact that these computations are performed without any apparent processing difficulty by the rest of the subjects may be attributed to a combination of factors,

such as their working memory capacity, presence of early disambiguation as well as strength of particular disambiguation manipulation used in the design.

As for the processing of SOV and OSV structures, the results replicate those of Urošević et al. (1988). The absence of a significant difference between conditions 3 and 4 suggests that, irrespective of the initial thematic role assignment, as soon as the parser encounters two NP arguments adjacent to one another, any further assignment is delayed until enough information is received to disambiguate the structure, as evidenced by the fact that in both the conditions 3 and 4 there is an increase in RTs at position 2 (second argument). The parser knows that one of the NPs is not a singleton chain, and chain postulation is delayed until it checks which one has been extracted. The analyses performed on the subset of data suggest that the parser does have more difficulty with structures in which a revision is required, such as the OSV structures, in comparison with the SOV structures. Although the difference seem to be in the predicted direction, additional data are needed in order to attribute the observed contrast to necessary revisions and chain length.

Thus, the predicted results for SOV and OSV structures were not obtained. The parser delays the analysis, as correctly hypothesized for adults by Slobin and Bever (1982) based on children's performance on the act-out task (cf. Section 2.2ii). Furthermore, it may be argued that the MCP is overridden in these structures due to their marked status in the language. The absence of a significant difference between SOV and OSV indicates that markedness is not so much valued in terms of OS vs. SO (as predicted by Urošević et al. 1988; and correctly postulated for German (Meng and Bader 1996) and Dutch (Kaan 1996))

as it is an effect of the verb final position.¹⁶ Note that the same observation was made by Sekerina (1997) based primarily on the fact that verb final structures (NNV) had longer overall reading times than the verb medial ones (NVN). The Serbo-Croatian results suggests that the observation made for Russian also holds in this language. The NNV structures (SOV and OSV) had mean overall reading times for the last four segments of 4.991 sec, as compared to the NVN structures (SVO and OVS) whose mean overall reading times were 4.654 sec. The difference of 337 msec suggest that verb final structures are generally more difficult to process, as the verb appears to surface in a marked position, due to other elements undergoing optional moving out of their base-generated positions. Thus the verb final position is marked in the sense that it signals the presence of at least one scrambling chain in the derivation, which has to be computed in on-line processing.

The results obtained here do not conform with those of Sekerina (1997) for similar structures in Russian. Sekerina's subjects interpreted the NNV structures in the Russian experiment as SOV structures 64.1% of the time. This may be attributed to different methodological decisions made. Note that the sentences in Sekerina's (1997) study were globally ambiguous, and in the on-line task subjects were asked to disambiguate between the two readings on the comprehension question following the presentation of a sentence. In the Serbo-Croatian study, on the other hand, temporarily ambiguous structures were used, in which disambiguation was introduced during the presentation of the sentence, and subjects'

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Verb initial structures, on the other hand, are quite frequent in SC, see TABLE 3 (Section 2.2.ii), with 47% verb initial vs. 5% verb final utterances.

comprehension of the structures was not tested. Furthermore, since in the Russian experiment only overall sentence reading times were measured, and the structures used were completely ambiguous, garden-path effects are not predicted to occur, as the parser is not forced into a reanalysis in the course of sentence presentation. The problem with the Serbo-Croatian experiment, on the other hand, is that the mode of disambiguation used may not have been strong enough to produce statistically significant effects. Taken together, the results from both Russian and Serbo-Croatian studies are very indicative of the preferences in interpretation, yet still inconclusive as to the exact nature of the parsing strategy used.

As for other non-syntactic factors involved, frequency effects regarding the status of SVO word order may be reflected in processing. On the other hand, although OVS structures are quite rare in natural speech¹⁷, they are not the most difficult structures to process, due to early disambiguation. A comparable result was obtained in Urošević et al.'s study, that is OVS order was faster than OSV (cf. TABLE 1). These findings seem to argue against the tuning model of sentence processing, which assumes that in cases of ambiguity the preferred analysis is the one compatible with the most frequent analysis in the language (Mitchell 1994).

And finally, as observed by Schlesewsky et al. (1996), declarative structures are not good for testing syntactic parsing strategies, due to problems related to marked status, frequency effects and the precise structural representations assigned to different derivations. As they note, in spite of overall freedom of word order in German, object initial orders have a marked topic-focus structure which is completely ignored in experimental conditions based on syntactic contrast only. Furthermore, subject-initial structures are much more frequent in

¹⁷ 0.2% by one child (cf. TABLE 4).

both the spoken and the written language, indicating that frequency may affect processing preferences in a very strong way. And finally, there is some disagreement among syntacticians as to the structural differences between subject-initial and object-initial declaratives in German, which may potentially affect the formulation of the processing predictions. All these facts combined indicate that as word order freedom is restricted by a number of factors, so is the processing account of observed differences between different structures.¹⁸ Furthermore, in the SC experiments a lexically restricted set of materials had to be used, potentially problematic from both the theoretical and empirical point of view.

2.7 Concluding remarks

The present results do not provide support for or against the use of the MCP in the processing of word order variation in Serbo-Croatian. The parser has the least difficulty with subject initial structures, which can be explained under any of the following approaches: the MCP, the SPLT, the canonical strategy, a markedness approach, a frequency theory, etc. When a temporary syntactic ambiguity as to the functional role interpretation is created by combining a number of factors, i.e. scrambled word order, absence of overt morphological case marking, NP adjacency, verb final position, etc., the data indicate that the parser delays the interpretation until more information is received during on-line processing.

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As Schlesewsky et al. (1996) correctly point out, *wh*-fillers, on the other hand, are not subject to such restrictions. *Wh*-questions, for example, are unaffected by focus assignment, there is a standard syntactic account of the type of derivation involved, and tuning to frequencies in the linguistic input does not seem to affect the processing of *wh*-fillers in any significant way.

The results reported here provide additional support for the existence of two distinct parsing modules within the human sentence parsing mechanism, i.e. a thematic and a syntactic processor. Carlson and Tannenhaus (1988) propose that thematic role reassignment is relatively cost-free, while Frazier (1990) assumes that thematic role assignment can sometimes be delayed. Absence of strong garden-path effects is predicted under both views. Bader (1994b) combines both approaches, proposing that case-assignment and theta-role assignment can either be delayed or redone without cost. Based on his study of scrambling ambiguities in German, Bader (1994b) notes that even in cases of derived word order, which is marked in the language, and in which both NPs are underspecified with respect to case, none of these factors alone is sufficient to produce garden-path effects. Thus the strength of garden-path effects resulting from theta-role reassignment cannot be predicted on the basis of word order variation only. Furthermore, the mode of disambiguation also plays an important role. The difference in garden-path strength between structures disambiguated by case and those disambiguated by agreement has been observed and discussed for German subject-object ambiguities in Meng and Bader (1996).¹⁹

All of the above arguments suggest that the results from the Serbo-Croatian experiment on the processing of word order variation are in no way conclusive. Much more work remains to be done before we can describe and analyze the exact nature of the parsing mechanism used in on-line thematic role assignment in a "free" word order language.

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Similar differences in the strength of disambiguation have been detected in processing word order variation in Serbo-Croatian (Urošević et al. 1988).

3. KOJI EXPERIMENT

3.1.i. The processing of filler-gap dependencies

Many studies have shown that subject relative clauses in English are easier to process than object relatives (Fodor, Bever & Garrett 1974; Wanner & Maratsos 1978; Holmes 1979; King & Just 1991; etc). Experimental results support the prediction that subject relatives, such as (28a), are easier to parse than object relatives, like (28b).

- (28) a. The teacher **who**_i **t**_i reported students witnessed several incidents.
 b. The teacher **whom**_i the students reported **t**_i witnessed several incidents.

(Wanner and Maratsos 1978)

Similar effects were observed with French relative clauses, which is not surprising given very similar structural representations of the subject/object asymmetry in these languages (Frauenfelder, Segui, and Mehler 1980; Holmes and O'Regan 1981). That is, in both English and French, the wh-word/complementizer configuration in relation to the overt subject/verb can determine gap assignment, as illustrated in (28a) and (28b) for English, (29a) and (29b) for French.

- (29) a. L'auteur **qui**_i **t**_i connaît l'éditeur a rencontré mon ami.
 b. L'auteur **que**_i l'éditeur connaît **t**_i a rencontré mon ami.

(Holmes and O'Regan 1981)

Moreover, Frazier (1987b) presents evidence that the parser prefers to interpret the wh-word in ambiguous Dutch relative clauses as linked to the subject position. Dutch and German provide stronger support for the use of AFS than English and French since the verb follows both arguments in both subject and object relatives and the relative pronouns used are

morphologically ambiguous between nominative and accusative case, as illustrated in (30) for Dutch.

(30) Ich schreef aan de vriend **die** mijn tante heeft bezocht. (D Frazier 1987b)

I wrote to the friend who my aunt has visited

a. I wrote to the friend who has visited my aunt.

b. I wrote to the friend who my aunt has visited.

In Frazier (1987b), Dutch speakers preferred the subject analysis for the completely ambiguous relative in (30), interpreting the head of the relative as the subject 74% of the time. In another set of sentences, illustrated by (31a) and (31b) below, Frazier (1987b) tested the processing of temporarily ambiguous relatives, in which the function of the head of the relative was disambiguated by the number agreement on the verb.

(31) a. Karl hielp de mijnwerkers die de boswachter **vonden**. (D Frazier 1987b)

Karl helped the mineworkers who the forester foundPL

("Karl helped the mineworkers who found the forester.")

b. Karl hielp de mijnwerkers die de boswachter **vond**.

Karl helped the mineworkers who the forester found-SG

("Karl helped the mineworkers who the forester found.")

In the self-paced reading task, subject relatives, such as (31a) were read faster than the object

relatives (31b) (Frazier 1987b). Kaan (1997), based on a series of experiments on Dutch, shows that there is a strong tendency to interpret an initial wh-word as subject in both main and embedded wh-clauses, which may be weakened by other factors such as definiteness features on the second NP, type of disambiguation, length of the ambiguous region, etc.

The filler-driven account of gap-finding has been shown to be at work in the processing of temporarily ambiguous relatives in German as well. Schriefers et al. (1995: self-paced reading) used a similar type of disambiguating information as Frazier (1987b), i.e. the number information on the auxiliary was compatible with either the subject interpretation of the head of the relative (32) or the object interpretation (33).

(32) Das ist die Managerin, **die_i** die Arbeiterinnen gesehen **hat**. (G Schriefers et al. 1995)

this is the manager who the workers seen has

("This is the manager who has seen the workers".)

(33) Das sind die Arbeiterinnen, **die_i** die Managerin **t_i** gesehen **hat**.

these are the workers who the manager seen has

("These are the workers who the manager has seen.")

Schriefers et al. (1995) found longer reading times at the disambiguating segment (the auxiliary) in the object relative (33) than in the subject relative (32). Furthermore, object relatives showed longer reading times despite the fact that in some conditions there was a plausibility bias for the object interpretation, indicating that the preference for subject interpretation, a part of the syntactic module of sentence parsing, may override pragmatic

information on the initial parse.

Similar preferences for subject interpretation have been observed in the processing of locally ambiguous wh-questions in German. Schlesewsky et al. (1996: various experimental tasks) report overall subject preference for the initial case-ambiguous wh-word, making subject questions like (34) easier to parse than object ones (35).

(34) Welche Frau sah **den** Mann am Freitag? (G Schlesewsky et al. 1996)

which woman_{AMB} saw the man_{ACC} on Friday

("Which woman saw the man on Friday?")

(35) Welche Frau sah **der** Mann am Freitag?

which woman_{AMB} saw the man_{NOM} on Friday

("Which woman did the man see on Friday?")

Meng and Bader (1997: speeded grammaticality judgement task) manipulated the mode of disambiguation in testing the strength of garden-path effects in object questions. As illustrated in (36) and (37) below, number information on the verb is used to disambiguate between the subject and object interpretation of the wh-word.

(36) Welche Studentin **hat** die Männer besucht? (G Meng and Bader 1997)

which student_{AMB} has the men visited

("Which student has visited the men?")

(37) Welche Studentin **haben** die Männer besucht?

which student_{AMB} have visited the men

("Which student have the men visited?")

Their results indicate that apart from the overall preference to interpret the initial wh-word as subject, there is a difference in the strength of garden-path effects caused by a difference in the salience of ungrammaticality. Number features on the verb (cf. (36) and (37)) produce stronger garden-path effects than case information on the second NP (cf. (34) and (35), and this contrast is theoretically accounted for by the Mismatch Effect (Meng and Bader 1997).

3.1.ii Summary

Experimental findings clearly indicate that there is a strong crosslinguistic preference to interpret a wh-word as linked to the subject position. This preference has been observed in different language types tested (cf. English vs. German), in both main and embedded wh-clauses (cf. verb-second vs. verb-final in German and Dutch) and in both types of structures derived by wh-movement (questions and relative clauses). Although some factors, such as manner of disambiguation, have been shown to weaken the subject preference, the predictions made by the processing theory about a general difficulty with object-linked wh-fillers have been confirmed by the data from numerous languages.

As for the Slavic languages, including Serbo-Croatian, there is, to the best of my knowledge, no previous work in the processing of filler-gap dependencies.

3.2 Koji relatives in Serbo-Croatian

Koji (wh-) relative clauses in Serbo-Croatian are generally analyzed as formed by wh-movement of the relative pronoun into the SpecCP position. The wh-filler is linked to the trace in the gap position via a syntactic chain, through which case and theta-role are transmitted. (38) and (39) illustrate subject and object koji relatives, in which the relative pronoun, coindexed with the head noun, is overtly marked for case.

(38) dečak_i **koji**_i t_i juri psa

boy who_{NOM} chases dog

(the boy who is chasing the dog)

(39) dečak_j **koga**_j pas juri t_j

boy who_{ACC} dog chases

(the boy whom the dog is chasing)

As already mentioned in the Section on the scrambling experiment, some nouns are morphologically ambiguous between nominative and accusative forms. When these nouns appear as heads of relative clauses, the structures are ambiguous as to the theta role they bear and the appropriate gap position to which the filler has to be bound. This contrast is illustrated in (40) and (41) below.

- (40) *dete_i koje_i juri kuće*
 child who_{NOM=ACC} chases puppy_{NOM=ACC}
 (the child who is chasing the puppy/ the child whom the puppy is chasing)
- (41) *dete_j koje_j kuće juri*
 child who_{NOM=ACC} puppy_{NOM=ACC} chases
 (the child whom the puppy is chasing/ the child who is chasing the puppy)

As these structures cannot be disambiguated by either word order or overt case morphology, only lexical semantics of the verb may be used to determine the functional role of the head noun. Examples (42) and (43) illustrate the temporarily ambiguous subject and object koji relative clause.

- (42) *dete_j koje_j kuće miluje*
 child who_{NOM=ACC} puppy_{NOM=ACC} pats
 (the child who is patting the puppy)
- (43) *dete_j koje_j kuće ujeda*
 child who_{NOM=ACC} puppy_{NOM=ACC} bites
 (the child whom the puppy is biting)

To create the temporary syntactic ambiguity needed for testing the processing of koji relatives in Serbo-Croatian, absence of overt case morphology was combined with verb-final word order, as illustrated in (42) and (43) above.

3.3 Materials

The same sentence frames were used as in the scrambling experiment (cf. Section 2.3.). Additionally, to rule out a preference for direct object interpretation, the head of relative was most of time in an oblique case. Test sentences used are illustrated in (44 a-d) below. Subscripted numbers indicate positions at which reading times (RTs) were measured.

(44) Rečima se nije moglo opisati

words could not describe

a. venčanje / koje je ₁ / izazvalo ₂ / divljenje ₃ / čak i kod gostiju ₄ / iz grada.

wedding / which aux / caused / admiration / even in guests / from city

(Words could not describe the wedding which has caused admiration even in the guests from the city.)

(SwhVO)

b. divljenje / koje je ₁ / izazvalo ₂ / venčanje ₃ / čak i kod gostiju ₄ / ... (OwhVS)

c. venčanje / koje je ₁ / divljenje ₂ / izazvalo ₃ / čak i kod gostiju ₄ / ... (SwhOV)

d. divljenje / koje je ₁ / venčanje ₂ / izazvalo ₃ / čak i kod gostiju ₄ / ... (OwhSV)

(44 a-d) above show that the overt case morphology on both NPs, as well as the one on the relative pronoun is ambiguous between nominative and accusative case. As already mentioned in Section 3.2., structures are ambiguous up to the verb, at which point the lexical semantics provides the parser with enough information to postulate either a subject or an object interpretation.

3.4. Predictions

The structural conditions used are repeated in schematic form as (45a-d) below.

- (45a) NP-S *koje_i* *aux* *t_i* V NP-O (SwhVO)
- (45b) NP-O *koje_j* *aux* *t_i* V *t_j* NP-S_i (OwhVS)
- (45c) NP-S *koje_i* *aux* *t_i* NP-O_j V *t_j* (SwhOV)
- (45d) NP-O *koje_j* *aux* NP-S V *t_j* (OwhSV)

(45a) illustrates that a subject gap, as predicted by the MCP, will be posited as soon as possible. As the initial interpretation is compatible with the correct analysis, this structure is predicted to be the least difficult for the parser.

(45d), on the other hand, will have to be reanalyzed as an object relative. If the parser postulates the gap for the wh-filler in the subject position, it has no way of knowing that this is an incorrect analysis before it reaches the verb which carries the disambiguating information. Not only will the initial interpretation assigned to the wh-filler have to be redone, but also an active search for an element to assign the now unassigned subject theta role has to be started. At the point at which the reanalysis is warranted (i.e. the verb) the subject theta role may be potentially assigned to two possible NP-elements in a preverbal position, either a pro or a trace linked to an overt NP right-adjoined to the IP. Since the parser has to revise the initial analysis, as well as keep the subject theta role in working memory until the second NP is encountered, processing structures like (45b) is predicted to be very costly. It will also have additional complications due to chain complexity, i.e. it consists of 2 two-member chains, one created by wh-movement and another by subject

postposition, which will make it the most difficult structure to process.

As for (45c) and (45d), assuming that in both structures the parser searches initially for a subject gap, upon encountering an overt NP in the first available argument position, i.e. the subject position, the parser will have to reanalyze the filler as the object filler, and to continue its search for an appropriate gap. After the verb disambiguates the structure, an object gap will be posited in (45d) without any further reanalysis. In (45c), however, multiple reanalysis is required: the parser has to reanalyze the relative as a subject relative, and second, the trace left by object movement has to be linked to its antecedent. Although the number of members of chains created by wh-movement in both (45c) and (45d) is equal, in (45c) the parser has to operate with two syntactically unrelated chains: one created by wh-movement, and another created by scrambling, which is predicted to increase the processing load.²⁰

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An alternative hypothesis would be to assume that the parser does not revise the initial analysis irrespective of the presence of an overt NP in a preverbal position. This hypothesis is based on the assumption that parsing proceeds in a parallel fashion, computing all the possible structural analyses, one of which involves object scrambling into a preverbal position. If this is the case, the question still remains whether it is more costly to operate with two chains (45c) rather than one (45d), given the fact that the computation of the first chain is completed before the head of the second chain is encountered in (45c) whereas the chain in (45d) has a much longer path, therefore its head has to be kept longer in the working memory.

3.5. Results

The mean RTs, computed for each position, are presented in TABLE 8.

TABLE 8:

Mean reading time (RT) for four conditions at four positions in koji experiment.

POSITION	1	2	3	4	TOTAL
Cond. 1 (SwhVOAdv)	1106	1022	1059	1287	4474
Cond. 2 (OwhVSAdv)	1059	1022	1260	1308	4649
Cond. 3 (SwhOVAdv)	1130	1202	1011	1282	4625
Cond. 4 (OwhSVAdv)	1024	1244	1092	1291	4651

The results of a priori planned comparisons, by analyses of variance (ANOVA), with both subject and item as random effects, are as follows:²¹

- (i) There was an effect of position 3 in a pairwise comparison between conditions 1 and 2 (SwhVO and OwhVS):

position 1 ($F_1(1,31)=0.25$, $p=.6207$; $F_2(1,31)=0.08$, $p=.7772$,

position 2 ($F_1(1,31)=1.25$, $p=.2726$; $F_2(1,31)=0.44$, $p=.5140$,

position 3 ($F_1(1,31)=12.39$, $p=.0014$; $F_2(1,31)=4.65$, $p=.039$,

position 4 ($F_1(1,31)=1.67$, $p=.2060$; $F_2(1,31)=0.59$, $p=.4485$).

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Additionally, no effects could be found of either types of nouns used (masculine inanimate vs neuter abstract), or complexity of noun phrases (with or without a modifier).

- (ii) No position was significant in a comparison between conditions 3 and 4 (SwhOV and OwhSV):
- position 1 ($F_1(1,31)=1.01$, $p=.3229$; $F_2(1,31)=0.36$, $p=.5513$,
position 2 ($F_1(1,31)=1.08$, $p=.3254$; $F_2(1,31)=0.25$, $p=.6217$,
position 3 ($F_1(1,31)=1.32$, $p=.2595$; $F_2(1,31)=0.56$, $p=.4599$,
position 4 ($F_1(1,31)=0.08$, $p=.7802$; $F_2(1,31)=0.04$, $p=.8512$).
- (iii) There was no difference between condition 1 (SwhVO) and condition 3 (SwhOV) ($F_1(1,31)=1.38$, $p=.2496$, $F_2(1,31)=0.81$, $p=.3742$).
- (iv) There was no difference between condition 2 (OwhVS) and condition 4 (OwhSV). ($F_1(1,31)=0.00$, $p=.9885$, $F_2(1,31)=0.00$, $p=.9927$).
- (v) Subject relatives (conditions 1 and 3) did not differ from object relatives (conditions 2 and 4). ($F_1(1,31)=1.90$, $p=.1784$, $F_2(1,31)=0.57$, $p=.4543$).
- (vi) Additional pairwise comparisons (condition 1 versus condition 2, condition 3 versus condition 4) were carried out on the subset of data, i.e. sentence frames with clear verbal disambiguation. The only notable difference between these analyses and the comparisons done on the whole data set is that the overall reading times for each structure follow the predicted order of difficulty (SwhVO (overall RTs=4235msec), OwhVS (overall RTs=4521msec), SwhOV (overall RTs=4485msec), OwhSV (overall RTs=4377msec). Namely, condition 2 was by far the most difficult structure to process, and object relatives with a preverbal subject (condition 4) took less time to read than subject relatives with a preverbal object (condition 3).

3.6. Discussion

Overall results confirmed the general predictions and findings from other languages that subject relatives are easier to process than object relatives. It seems that the MCP, at least its second clause which is derived from the AFS, is operative in Serbo-Croatian too. As indicated by the results for the subset of data, the most difficult structure to process is the one for which a number of additional computations are needed, i.e. object relatives with a postposed subject (OwhVS). The parser has to, first, redo the initial subject analysis assigned to the wh-filler, and second, compute two chains derived by two unrelated movement operations. Garden path effects at position 3 in condition 2 (a 201 msec statistically significant difference between conditions 1 and 2) indicate that the parser is reanalyzing the filler into an object relative, as predicted by the MCP. The longest overall reading times of the four structures tested also indicate additional parsing difficulty that can be attributed to the presence of two intersecting chains.

Similarly to the overall results the from scrambling experiment, parsing conditions 3 (SwhOV) and 4 (OwhSV), in which the disambiguation is introduced at a later point, i.e. after both arguments, did not differ significantly. In both conditions there is an increase in RTs at position 2, suggesting that, since the parser is following the MCP, false gap effects arise at the position at which it is considering positing a gap, but which is already filled by another overt argument.²² The non-significant difference between position 2 in both conditions (42

²²

Although ANOVA revealed no significance at this position, the difference in increased RTs from position 1 to 2 in both conditions (72 msec in condition 3 and 220 msec in condition 4) is surprising since the

msec) suggests that false gap effects may arise at this position in both types of structures. Additionally, the parser seems to be aware of multiple analyses these structures may receive, not choosing one over another, as indicated by almost no difference in RTs between the two conditions at the point of disambiguation. It may thus be argued that the MCP is replaced in these structures by another processing strategy which is used in on-line theta role assignment. An alternative view is to assume that absence of clear disambiguation in the whole data set obscured the predicted differences in processing. When, however, a subset of data is analyzed, the difference in the processing between SwhOV and OwSV structures becomes more apparent, and in accord with the predictions based on computing the cost of reanalysis, as well as the length of chains involved in the derivation.

disambiguation is introduced only at position 3 in both conditions. If lexical semantics of the head nouns used played a role in this case, one would expect a similar pattern for the same conditions in the scrambling experiment, as both experiments relied on the same set of sentence frames. As shown in TABLE 7 (Section 2.5.) there is only a 13msec difference between the first positions between the SOV and OSV structures, ruling out a possibility that subjects were matching lexical items and grammatical roles.

4. ŠTO EXPERIMENT

4.1.i The structure of što relatives in Serbo-Croatian

Apart from the standard relatives derived by wh-movement (koji relatives: cf. Section 3.2.) Serbo-Croatian uses another type of relative clause formation, i.e. relatives introduced by the indeclinable complementizer što.²³ Relativization is permitted into the subject, direct and indirect object, and object of preposition positions. A resumptive pronoun is obligatory in all gap positions except the subject position, in which it is disallowed, and the masculine inanimate direct object position, in which it is optional. For relativization out of direct and indirect object position a clitic form of the resumptive pronoun is used, which is homophonous with a non-resumptive clitic pronoun. For object of a preposition position only the full (strong) form of the pronoun is allowed. These facts are illustrated in (46 a-e) below.

- (46) a. žena što (*ona) mnogo priča
 woman comp (she) a lot talks
 (the woman that talks a lot)
- b. žena što smo *(je) sreli na ulici
 woman comp aux_{1PPL} (her_{ACC}) met in street
 (the woman that we have met in the street)

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Serbo-Croatian also uses a declinable relative pronoun što, which we will not discuss here. This pronoun is clearly distinguishable from the complementizer što, as it can only be coreferential with indefinite pronominal heads. Browne (1986) provides a detailed descriptive account of all the relativization strategies available in the language.

- c. računar što smo (ga) kupili
 computer comp aux_{IPPL} (it_{ACC}) bought
 (the computer that we have bought)
- d. žena što smo *(joj) pozajmili knjigu
 woman comp aux_{IPPL} (her_{DAT}) lent book
 (woman that we have lent the book to)
- e. žena što smo *(sa njom) putovali
 woman comp aux_{IPPL} with her_{INST} travelled
 (woman that we have travelled with)

The analysis adopted for što relatives is based on the analyses for English that relatives along the lines of Chomsky and Lasnik (1977). These relatives are derived by the movement of an empty operator to a specifier position headed by the complementizer što.²⁴ The trace left by the movement, in this case a resumptive pronoun coindexed with the trace, functions as

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Another school of thought treats English that as a relative pronoun, similar to other wh-pronouns (see Van der Auwera 1985 and references therein). Van der Auwera and Kučanda (1985) propose that the facts for Serbo-Croatian što are not so clear cut and that two conflicting analyses, što as a relative pronoun or što as a complementizer, are equally plausible. I have decided to adopt the complementizer (and empty operator movement) analysis widely accepted in the generative framework.

Note that both analyses make similar predictions for processing theory. In either case, a filler (a relative pronoun or an empty operator in the SpecCP headed by što) will signal the presence of a binder (resumptive pronoun) which it has to bind.

a variable.²⁵ Further support for the movement analysis for što relatives comes from the fact that they disallow subadjacency violations (cf. Goodluck and Stojanović 1996).²⁶

In summary, što relative clauses in Serbo-Croatian are analyzed as movement relatives. The fact that the resumptive pronoun functions as the spell-out of the trace in this type of relative clause may not be attributed to a different type of derivation. There is a clear distinction between a mechanism for relative clause formation (movement vs. non-movement), on one hand, and the principles guiding resumptive pronoun distribution, on the other. Some such principles may not be directly related to movement issues, and may apply equally to two languages which use different mechanisms for forming relative clauses. The distribution of resumptive pronouns in što relatives is discussed in more detail in Sections 4.1.iii.a-d.

Another property of što relatives is that they may never function as non-restrictive relative clauses. They obey a number of restrictions imposed on restrictive relative clauses,

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Note that in Serbo-Croatian all clitics must move to a clause-second position. This raising was analyzed as right-adjunction to Co (Ćavar and Wilder:1992; Progovac:1994) and movement to WP (Wackernagel C2 position) (Rivero:1994). Whatever the analysis to be adopted be, Cliticization is an obligatory process of clitic raising to C2 position in Serbo-Croatian. As the resumptive pronouns are in fact clitics (except for the object of a preposition) they all surface in the position following the complementizer što, either alone or as a part of a clitic cluster.

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A very similar type of relative clause in Czech and Swiss German does not obey subadjacency restrictions (see Toman 1998 for Czech and Van Riemsdijk 1989 for Swiss German). One has to keep in mind that Serbo-Croatian has another type of relative clauses, i.e. "za koga" relatives, which clearly allows relativization into syntactic islands, and has been analyzed as a non-movement strategy (cf. Goodluck and Stojanović 1996).

for example the ban on having either a proper name or a quantifier antecedent as the head of the relative. But most importantly, as discussed by Browne (1986), the restrictiveness of što relatives may be derived from the factivity inherent in the complementizer što. In Serbo-Croatian there are a number of complementizers used to introduce factive complement clauses, the most wide spread one being the complementizer što. As restrictive relative clauses are factive and as što serves to introduce factive complement clauses, it is not surprising that što relatives may not have a non-restrictive use.²⁷ Browne (1986) links this to the fact that što refers to an already established entity. Van der Auwera and Kučanda (1985) disagree with Browne about the factivity of što relatives, proposing that što relatives modify topics that are already given, which is not related to factivity of either the complementizer što or restrictive relative clauses.²⁸ No such restrictions hold for koji relatives, which may have a wide range of antecedents.

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One must be cautious in proposing an analysis under which the factivity of the restrictive relatives is derived directly from the factivity of the complementizer. As Browne (1986) himself points out, Slovenian uses a similar strategy for relative clause formation, in which the indeclinable ki (that) is used in relative clauses only, and the language has other means of introducing factive complement clauses, none of which employ ki.

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Van der Auwera and Kučanda (1985), based only on the use of commas in the written language, propose that što may appear in both restrictive and non-restrictive relative clauses. It seems that this proposal is unjustifiable based on the arguments given. Different syntactic restrictions, such as a ban on proper name heads of relative clauses, imposed on restrictive relatives, also hold for the Serbo-Croatian što relatives.

4.1.ii Što relatives in other languages²⁹

The strategy of forming a relative clause by operator movement and its coindexation to a resumptive pronoun is widely used in some other languages, as well. I will briefly present the data from a number of languages which seem to have a very similar type of relative clauses.³⁰ Most of these languages also have *wh*-relatives, and the što relativization strategy appears to belong to the colloquial style, unlike Modern Greek, Modern Irish and Hebrew, which have it as a standard strategy (cf. Toman 1998).

Slovenian is a language closely related to Serbo-Croatian. The indeclinable complementizer ki (that) is used to introduce relative clauses, and this strategy is much more widespread than in Serbo-Croatian (Browne 1986). Relativization is permitted out of all the positions relativizable by the *wh*-movement strategy. Resumptive pronouns are obligatory with all but the nominative masculine singular antecedents (Lencek 1982). The following examples illustrate a subject and object (with an animate and inanimate antecedent) ki relatives in Slovenian.

²⁹

The term što relatives will be used throughout this section to refer to relative clauses in Serbo-Croatian, Slovenian, Czech and Swiss German, which involve an indeclinable complementizer and a gap/resumptive pronoun in a relativized position.

³⁰

As for other Slavic languages and što relatives, the data are not really clear as to either their status in the language or a precise syntactic description. Browne (1986) notes that Polish and Russian use that relatives (co and što, respectively) without resumptive pronouns, and that Ukrainian ščo relatives are formed with the resumptive pronouns similarly to što, ki and co relatives in Serbo-Croatian, Slovenian and Czech, but native speaker's intuitions indicate that this strategy is not really available in the language (Budzhak-Jones, p.c.). For the above mentioned reasons I will not discuss Polish, Russian or Ukrainian relatives at this point.

- (47) a. gledam človeka, ki nima roke (SL Lencek 1982)
 watch_{1PSG} man_{ACC} that has-not hands
 (I am watching the man that does not have hands)
- b. človek, ki ga vidiš (SL Lencek 1982)
 man that him_{ACC} see_{2PSG}
 (the man that you see)
- c. avto, ki sem ga kupil (SL Sheppard p.c.)
 car that aux it bought_{1PSG}
 (the car that I have bought)

M. Zupančič and M. Sheppard, however, inform me that resumptive pronouns are banned from all the subject positions, irrespective of the gender or animacy features of the antecedent. The following examples illustrate subject ki relatives for masculine and feminine animate heads in Slovenian.

- (48) a. človek, ki je prišel (SL Zupančič p.c.)
 man that aux come_{3MascPast}
 (the man that has come)
- b. žena, ki je prišla (SL Zupančič p.c.)
 woman that aux come_{3FemPast}
 (the woman that has come)

I will thus assume that resumptive pronouns are banned from all the subject positions in Slovenian, irrespective of the animacy or gender features of the antecedent heads.

Czech also forms relative clauses with an indeclinable complementizer co and resumptive pronouns in all the positions, except for the subject and direct (inanimate) object position, in which the gap is obligatory (Toman 1998). The following examples illustrate relativization out of the subject, animate and inanimate direct object positions, respectively.

- (49) a. To je ten pes, co tu štěká celou noc. (CZ Toman 1998)
 this is the dog comp here barks whole night
 (This is the dog that barks here all night.)
- b. To je ten chlap, co ho viděli v tramvaji. (CZ Toman 1998)
 this is the guy that him saw_{3PPL} in streetcar
 (This is the guy that they saw in the streetcar.)

- c. To je ta kniha, co viděli na stole. (CZ Toman 1998)

this is the book comp saw_{3PPL} on table

(This is the book that they saw on the table.)

Another language that has a similar strategy for relative clause formation is Swiss German (Van Riemsdijk 1989). Those relatives are introduced by an invariant complementizer wo and a clitic-like resumptive pronoun in all but the subject and direct object positions. Although some other dialects of German, e.g. Bavarian, also use the wo marker, they combine it with a wh-pronoun (e.g. English "the man whom that the dog has bitten") and an obligatory gap (Van Riemsdijk 1989). Wo subject and direct object relatives are illustrated in the examples (50a) and (50b) respectively.

- (50) a. d vrauw wo (*si) immer z spaat chunt (SG Van Riemsdijk 1989)

the woman that (she) always too late comes

(the woman that always comes too late)

- b. es bild wo niemert (*s) cha zale (SG Van Riemsdijk 1989)

a picture that nobody (it) can pay

(a picture that nobody can afford)

As illustrated by the examples from a number of Slavic languages, including Serbo-Croatian, as well as Swiss German, the distribution of resumptive pronouns and gaps in što

relatives seems to follow some universal restrictions in all the languages that use this strategy for relative clause formation. I will turn now to precisely those environments that disallow resumptives and explore some of the proposals made in the literature that may account for such phenomena.

4.1.iii The distribution of resumptive pronouns and gaps in što relatives

The broad definition of resumptive pronouns adopted here is the one in which resumptives are pronouns interpreted as bound variables whose antecedent is an operator (Sells 1984). The question of whether resumptive pronouns represent the last resort representation, i.e. spell-out of the variable features of trace, has not been addressed in the literature on što relatives, although it is discussed at length for some other languages (Shlonsky 1992). Their dual nature, i.e. pronouns and variables, makes them obey both Principle B and Principle C of the Binding Theory (McCloskey 1990). The fact that in some languages, for example Hebrew, resumptive pronouns and gaps vary freely in a number of structural positions (e.g. direct object; embedded subject, and all direct object positions) has been accounted for by an obviation effect driven by the existence of two morphologically nondistinct complementizers in the language (Shlonsky 1992). Note that such an analysis may not account for the distribution of resumptives in što relatives, as there is no motivation to propose the existence of two types of complementizers in those structures.

Let us now examine more closely the distribution of resumptive pronouns in što relatives in each of the relativizable positions. TABLE 9 illustrates the distribution of resumptives in a number of languages in a range of positions in što relatives.

TABLE 9:
The distribution of resumptive pronouns in što relatives

SUBJECT	Serbo-Croatian		gap
	Slovenian		gap
	Czech		gap
	Swiss German		gap
DIRECT OBJECT	Serbo-Croatian	Masc.Inan.Sg.	gap/resumptive
		other	resumptive
	Slovenian		resumptive
	Czech	inanimate	gap/resumptive
		animate	resumptive
	Swiss German		gap
INDIRECT OBJECT	all four languages		resumptive
OBJECT OF A PREPOSITION	all four languages		resumptive (strong form of pronoun)

4.1.iii.a Relativization into a subject position

All languages discussed require an obligatory gap in the subject position. These facts also hold for Hebrew and Palestinian (Sells 1984; Shlonsky 1992). As correctly pointed out by Toman (1998) for the Czech data, the ban on the presence of a resumptive pronoun in što relatives may not be derived from the fact that a language allows pro-drop. A number of factors suggest that this assumption is correct. First, Swiss German is not a pro-drop language and it still disallows a resumptive in the subject position. Additionally, the register

of Czech in which što relatives are used strongly favours the use of overt subjects (Toman 1998). A more adequate explanation is provided by Van Riemsdijk (1989) (see also Goodluck and Stojanović 1996, footnote 4). The Avoid Pronoun Principle (Chomsky 1981) is a conversational principle, which prohibits the use of superfluous information for the sake of clarity. Moreover, it may be viewed as an obviation effect, which avoids using pronouns, for example, where an alternate locution is possible. Formulated as such, it may be translated into a principle of grammar by which information which is recoverable by means other than overt syntactic representation may be deleted. This proposal for the presence of gaps rather than resumptive pronouns in some positions in Swiss German relatives is advocated by Van Riemsdijk (1989), derived from the notion of recoverability based on considerations of locality facts, coindexing and government.³¹ The Avoid Pronoun Principle still seems to best account for the prohibition on the presence of resumptive pronouns in subject što relatives in Serbo-Croatian and other Slavic languages relevant for the discussion.

The recoverability of information carried by the subject resumptive pronoun has also been discussed in terms of, or may be indirectly related to, Keenan and Comrie's (1977)

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Van Riemsdijk (1989) proposes that same generalizations hold for both subject and object resumptive pronouns in Swiss German. I am unsure whether the same account is adequate to explain the Serbo-Croatian facts. Note that Serbo-Croatian does not have subject clitics, and the absence of such presupposes that no clitic raising out of the subject position takes place. In Swiss German, on the other hand, the facts suggest that both subject and object clitics raise to a presubject position (adjoined to Comp) which makes the coindexation between the operator and the resumptive pronoun possible, allowing for its subsequent deletion. Additionally, under the same analysis one would expect resumptives to be banned from all the direct object relatives in Serbo-Croatian, Slovenian and Czech, as they all cliticize into a clause-second position. TABLE 9 illustrates that this is clearly not the case.

accessibility hierarchy for relativization strategies (Browne 1986, Van der Auwera 1985, Van der Auwera and Kučanda 1985, Van Riemsdijk 1989, Toman 1998). Their hierarchy is as follows:

S > DO > IO > OBL > GEN > OCOMP,

where > indicates "more accessible". The subject position, being the most accessible for relativization, is occupied by the gap, and the further down the hierarchy the position is the more likely it will be to be occupied by a resumptive pronoun rather than a gap. Although it is to a certain extent debatable whether the fact that a gap, rather than a resumptive pronoun, must occupy the subject position is due to the recoverability of information carried by the resumptive pronoun based on the syntactic facts, which make the application of the Avoid Pronoun Principle necessary, or whether it is formulated in terms of a crosslinguistic preference principle, such as the accessibility hierarchy, I choose to follow Van Riemsdijk (1989), assuming that the distribution of gaps and resumptives is better accounted for under a syntactic analysis.

4.1.iii.b Relativization into a direct object position

The direct object position allows for more variation with respect to the use of resumptive pronouns than any other relativizable position in što relatives. A gap is optional with masculine inanimate objects in Serbo-Croatian, with all inanimate objects in Czech, and is obligatory with all types of objects in Swiss German. Otherwise, the use of a resumptive pronoun is obligatory in all the languages. Let us start with Swiss German, in which no free variation is allowed. Van Riemsdijk (1989) proposes the same analysis as for the obligatory

presence of a gap in the subject position, based on the Avoid Pronoun Principle. As both subject and object resumptive clitics (i.e. variables) cliticize into a position in which they would be bound by the operator, their deletion is necessary as the information carried by the resumptives is easily recoverable. Although this proposal works well for the Swiss data, it seems inadequate to account for, first, the variation between the resumptive and a gap in some Serbo-Croatian and Czech direct object relatives, and more importantly, for the obligatory presence of resumptives in all direct object positions in Slovenian.³²

Let us now examine some other proposals made in the literature. It seems that in both Serbo-Croatian and Czech animacy plays a role in allowing a resumptive pronoun to be dropped. Van der Auwera and Kučanda (1985) link this phenomenon to the accessibility hierarchy of Keenan and Comrie (1977). Under the proposed hierarchical ordering, inanimate direct objects are more accessible than the animate ones, which makes it possible to drop them under certain conditions.³³ Toman (1998) proposes that animacy plays only a

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Note that in all the languages discussed resumptive clitics surface in a position immediately following the complementizer. Thus the proposal about recoverability based on syntactic notions such as government, made for Swiss German, should work equally well for all the other languages.

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Note that this approach would predict that inanimate feminine objects in Serbo-Croatian would also drop. It is very difficult to determine the exact conditions under which feminine direct objects drop, for the following reason. Any direct object feminine resumptive pronoun (i.e. ju "her"), when in the same cluster with a past tense auxiliary (i.e. je "has") must drop, or rather merge with that auxiliary, so that only je remains. As this is a phonological rule applied to all feminine resumptives irrespective of animacy, it does not really address the question posed above. In the other tenses, i.e. present tense, in which no auxiliary is present, the feminine clitic is obligatory. We may thus conclude that feminine inanimate direct object

secondary role, and that a major factor that allows the direct object clitic drop is the morphological case of the pronoun.³⁴ The direct object masculine animate resumptive pronouns in Slavic languages have been analyzed by many traditional linguists as genitive rather than accusative marked (cf. Toman 1998, also Browne 1986). All other direct object resumptive pronouns are clearly accusative marked. Toman (1998) proposes for the Czech data that oblique cases, in this case genitive, need phonological support. In sum, inanimate masculine resumptives, as well as animate feminine, and plural resumptives may drop in Czech as they are overtly marked accusative. In the case of animate masculine, marked genitive, such drop is not allowed, and a resumptive pronoun is obligatory. Thus the proposal based on the morphological case of the resumptive may be translated into the Avoid Pronoun Principle, which requires avoiding superfluous information only under the condition that such information is fully recoverable, which would not be the case with genitive-marked resumptives under the assumption that they require phonological support. It seems then that the distribution of direct object resumptives and gaps in both Czech and Swiss German follows the same economy principle, formulated as the Avoid Pronoun Principle (Chomsky 1981).

The explanation for Serbo-Croatian and Slovenian is not so straightforward. The

resumptive clitics do not drop in Serbo-Croatian.

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Toman (1998) is right in pointing out that if the feature animacy were solely responsible for the possibility of clitic drop, one would expect to find a language in which there would be a distribution between a resumptive and a gap based on the animacy features of the subject antecedent. However, subject resumptives are banned in all languages irrespective of their animacy.

direct object feminine resumptive pronouns in Serbo-Croatian do not drop, although they are clearly marked accusative. In Slovenian, on the other hand, direct objects in general do not drop. Thus we may only conclude that although in some languages the direct object resumptive drop is governed by some economy principles, such as the Avoid Pronoun Principle, the distribution of resumptives and gaps in direct object što relatives in Serbo-Croatian has not yet received a non-stipulative account.

4.1.iii.c Relativization into an indirect object position

As seen from the TABLE 9, no gap is allowed in the indirect object position in any of the languages discussed. The resumptive pronoun is obligatorily present in the indirect object relatives.³⁵

4.1.iii.d. Relativization into an object of a preposition position

Although the position of the prepositional phrase may vary from language to language, the presence of a resumptive pronoun, usually a strong (full) form of the pronoun, is obligatory.

4.1.iv Summary

In summary, there are a number of languages in which relatives clauses have an invariant complementizer and a resumptive pronoun. The aim of the previous section was to provide

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I will not speculate at this point why the resumptive is obligatory in these cases. Note that both the accessibility hierarchy approach, as well as deletion under recoverability (all resumptives bear an oblique case, and as such may not be deleted) may offer some explanation.

descriptive accounts of the distribution between resumptives and gaps, and to examine some of analyses of these facts made in the literature. The main goal, however, was to provide the reader with some basic facts regarding the derivation and use of the Serbo-Croatian što relatives.

The third experiment in this study was designed to test processing strategies used in parsing što (that) relatives in Serbo-Croatian. As already discussed above, this type of relative is derived by operator movement to Comp and obligatory coindexing between it and a clitic resumptive pronoun in all structural positions, except the subject position. Subject and object što relatives are illustrated in (51) and (52), respectively.

- (51) $dete_i$ O_i što je t_i uplašilo ...
 child that aux scared_{3PPASTNEUTER}
 (the child that has scared...)

- (52) $dete_j$ O_j što ga_{jk} je pro_i uplašio t_k
 child that him aux scared_{3PPASTMASC}
 (the child that he has scared)

Since the binder for the object (resumptive clitic) in (52) precedes the one for the subject (t), object interpretation is predicted to be the preferred one. Additionally, absence of an overt NP in the subject position does not require the parser to postulate a gap in that position, given that Serbo-Croatian is a pro-drop language.

4.2 Studies on the processing of that relatives

The processing literature on filler-gap dependencies in English has not concentrated on the difference in the processing between wh- and that-relatives, as it does not appear to be important. Most of the studies have been carried out using materials with wh-relatives, and those results show an overwhelming preference for the subject interpretation. One of the studies in which only that relatives were used is that of King and Just (1991), which tested the role of working memory in sentence processing. Examples (53) and (54) below illustrate the test sentences used.

(53) The reporter that attacked the senator admitted the error.

(54) The reporter that the senator attacked admitted the error.

Subjects were divided into three memory span groups (high, mid, low) and tested on reading times and comprehension accuracy. Object relatives took longer to read for all three groups of subjects. Additionally, comprehension accuracy was lower for the low-span working memory group in object than in subject relatives in the presence of an extrinsic memory load. These results indicate that an initial subject preference is present in the processing of that relatives in English, as is the case with wh-relatives, which is theoretically accounted for by the parsing strategies, such as the AFS.

4.3 Materials

A set of 16 sentence frames, two conditions in each, was created for the sto experiment. There were no lexical restrictions regarding types of nouns that may serve as heads of sto relatives. Yet there were some other concerns that had to be incorporated into the design.

First, all the sentences had empty lexical subjects (*pro*) to ensure temporary ambiguity between subject and object interpretation for the head of the relative. Second, there was a question of the periphrastic tense to be used. Since the internal order inside the clitic cluster is different for the Perfect and Future Tense (e.g. Perfect : *što ga je* = that him aux vs. Future: *što će ga* = that aux him), the Future Tense would be more useful for reducing spillover effects because there is at least one constituent between što and the clitic. Furthermore, clitic drop is sometimes allowed for feminine *ju* in the Perfect Tense (e.g. *što ju je* = that her aux vs. ? *što je* = that aux, as it is allowed for masculine inanimate *ga* (him=it) in spoken language (cf. Section 4.1.i). Yet što relatives are almost on the verge on being ungrammatical in the Future Tense in Serbo-Croatian. Browne (1986) attributes this to the requirement that the identity of the head of relative be established earlier, i.e. što relatives are much more definite than koji relatives. Therefore all the sentence frames created for this experiment had the verb in the Perfect Tense. Moreover, the clitic order in the Perfect Tense, where the pronominal clitic immediately follows što, has an advantage, since in this configuration the adjacency between the clitic and *t/pro* was eliminated.

As for the problem of clitic drop, it could only be reduced, but never entirely eliminated from the design. Thus an equal number of both masculine and feminine animate and inanimate nouns (four for each type) serving as heads of relatives was used in order to filter out any effects of this phenomenon. Examples (55a) and (55b) illustrate test conditions used.

(55) Otac će još dugo spominjati službenika

"father will for a long time talk about clerk

- a. što ga je ₁ / satima ₂ / maltretirao ₃ / zbog jednog običnog formulara ₄ /.
 that him aux / for hours / harassed / because of one simple form"
 (The father will for a long time talk about the clerk that has harassed him
 for hours because of one simple form.)
- b. što ga je ₁ / satima ₂ / molio₃ / za jedan običan formular ₄ /.
 that him aux / for hours / begged / for one simple form"
 (The father will for a long time talk about the clerk that he has begged
 for hours for one simple form.)

Both (55a) and (55b) are ambiguous between a subject and object interpretation until the position 3, at which point the semantics of the verb is used to disambiguate between the two readings.³⁶

4.4 Predictions

Let us now consider structural representations for the two conditions tested.

- (56a) što_i ga_k je t_i satima maltretirao t_k ...
 (56b) što_j ga_{j_k} je pro_i satima molio t_k ...

³⁶

As in the scrambling and koji experiments, in some sentence frames the disambiguation had to be carried to the postverbal adverbial phrase (8 with verbal and 8 with postverbal disambiguation). These sentence frames will also be analyzed separately to examine any possible effects of this potential problem in the design.

If the parser follows the AFS and the MCP, object relative (56b) is predicted to be easier to process than its subject counterpart (56a). Binding the filler at an earlier position in (56b), as opposed to (56a), reduces the time an unassigned item has to be kept in the working memory, which is compatible with the predictions based on the AFS and the MCP about an active search for a binder. Increased RTs are expected at the position following the disambiguating segment (the verb) in (56a), since a reanalysis is required. In terms of chain complexity, both (56a) and (56b) consist of one two-member chain. These predictions are based on the assumption that clitic raising to the clause-second position is not computed for the analysis. If this were not the case, the length of the chain derived by cliticization would still be the same in both structures. The only difference relevant for our discussion here is that in subject relatives a crossing dependency between the two chains would arise, which would additionally, aside from the predictions based on the AFS, make them more difficult to process than the object ones (cf. Footnote 10). The MCP also predicts that computing two 2-member chains would be more difficult than computing one 3-member chain through which only one theta role is transmitted. Yet under the assumption that chains created by clitic raising are not computed for the analysis, the completion of a chain at the earliest argument position grammatically possible is predicted to play a major role in the processing of što relatives in Serbo-Croatian.

And finally, note that since in both structures transitive verbs are used, two verbal arguments are present, one which acts as a binder (subject "t" in (56a) and object "ga" in (56b), respectively), and another one (object "ga" in (56a) and subject "pro" in (56b),

respectively). As for the processing of the arguments unrelated to the filler-gap chains, the predictions are that they would be interpreted with a similar degree of difficulty. Both "pro" and clitics are pronominal elements seeking possible antecedents for reference outside the clausal domain, and the only difference between the two lies in their realization. Yet de Vincenzi (1991) has demonstrated that speakers of null subject languages do not have any additional difficulty with interpreting empty subjects, such as "pro", given that no movement chain has to be postulated.

In summary, both the MCP and the AFS predict, based on the structural differences affecting the position of possible binders, that the processing of object što relatives has a lower processing cost than the processing of subject što relatives in Serbo-Croatian.

4.5 Results

The mean RTs, computed for each position, are presented in TABLE 10.

TABLE 10:

Mean reading time (RT) for four different conditions at four positions in što experiment

POSITION	1 (što ga je)	2 (Adv)	3 (V)	4 (AdvP)	TOTAL
Cond. 1 (subject rel.)	1012	946	1037	1132	4127
Cond. 2 (object rel.)	981	900	948	1198	4027

The results of a priori planned comparisons, by analyses of variance (ANOVA), with both subject and item as random effects, are as follows:

- (i) A pairwise comparison showed a significant effect at position 2 in the subject analysis ($F_1(1,31)=4.59, p=.0401$), but it did not reach significance in the item analysis ($F_2(1,15)=2.26, p=.1533$).
- (ii) Position 3 was also significant in the subject analysis ($F_1(1,31)=6.31, p=.0174$), and this position was only marginally significant in the item analysis ($F_2(1,15)=3.78, p=.0709$).
- (iii) There was no effect at either the first or the last position in either analysis.
 (position 1 ($F_1(1,31)=3.17, p=.0847$; $F_2(1,31)=1.36, p=.2620$)
 (position 4 ($F_1(1,31)=0.13, p=.7211$; $F_2(1,31)=0.04, p=.8388$)

Additional analyses were carried out to test the degree of interaction between syntactic structure and a number of potential confounding factors. The results show that neither the point of disambiguation (verbal/postverbal) nor gender (masculine/feminine) nor animacy (animate/inanimate) features on the head noun played a significant role in the processing of što relatives. For masculine animate head nouns, however, position 3 was significant in both subject ($F_1(1,31)=6.31, p<.017$) and the item analysis ($F_2(1,3)=1361.94, p<.017$).

An additional analysis was carried out, taking gender and animacy features of the head noun as the dependent variable. TABLE 11 illustrates these results.

TABLE 11:
Mean reading times for each position for four types of head nouns used,
classified according to their gender and animacy features.

POSITION	1 što ga je	2 Adv	3 V	4 AdvP	Total RT
MASC. ANIMATE					
Condition 1 (subject rel.)	1093	986	1009	1244	4332
Condition 2 (object rel.)	1009	905	987	1171	4072
MASC. INANIMATE					
Condition 1 (subject rel.)	946	935	1028	1041	3950
Condition 2 (object rel.)	978	896	908	1120	3902
FEM. ANIMATE					
Condition 1 (subject rel.)	995	917	1026	1132	4070
Condition 2 (object rel.)	945	922	962	1240	4069
FEM. INANIMATE					
Condition 1 (subject rel.)	1014	945	1085	1111	4155
Condition 2 (object rel.)	994	889	936	1260	4079

Let us briefly examine overall RT differences between subject and object što relatives for each type of head noun used. The results indicate that a preference for object interpretation may be replaced by the animacy features on the head noun, i.e. an animate head noun favours subject over object interpretation, as illustrated by almost no difference between subject and object relatives in the feminine animate condition. A small difference in the feminine inanimate condition, on the other hand, indicates that inanimate heads may favour object

interpretation. An almost complete lack of difference in overall RTs in the masculine inanimate condition is attributed to the possibility of clitic drop with these types of head nouns, which in this case overrides both the animacy and the processing preferences.

Note, however, that with masculine animate head nouns, first, clitic drop is disallowed, and second, animacy features of the head noun would favour the subject interpretation. Yet this is the condition in which subject relatives took 260msec longer to read than the object ones, irrespective of the fact that the head of the relative was an animate noun. Furthermore, ANOVA showed that in this condition position 3 was significant on both the item and subject analysis, as predicted by the AFS.

The results from TABLE 11 may thus be interpreted in the following way: Confounding factors, such as animacy and clitic drop, may to a certain degree affect parsing decisions made. This accounts for the absence of significant results for any of the positions tested in the item analysis. These factors, however, do not completely override the use of the parsing strategies, like the AFS, as evidenced by the results in the masculine animate condition. It is only the AFS that makes the correct prediction for the type of difference exhibited in this condition.

4.6 Discussion

Following the AFS, the parser confirms an object analysis for condition 2 and carries out a reanalysis for condition 1, as evidenced by higher RTs at the point of disambiguation for the subject što relatives. Furthermore, the effect of position 2 arises from an object preference for što relatives which leads the parser into expecting an overt argument in the subject

position. The results from this experiment are strong regarding the use of MCP in the processing of relative clauses in Serbo-Croatian. As predicted by this parsing strategy, object što relatives are easier to process than subject relatives. The parser prefers to terminate the required chain as soon as possible, i.e. at the object clitic position, and the necessary reanalysis results in increased RTs in subject relatives. Moreover, adopting the object analysis speeds up on-line processing because the chain is completed before the verb is encountered. Since both subject and object relatives consist of a filler-gap dependency chain of an equal complexity, this, as predicted, was not a significant factor in the processing of što relatives.

On the other hand, a potentially problematic issue for the predictions based solely on the AFS is the fact that in the test sentences used subject relatives had crossing dependencies, which are predicted to be more difficult to process, as opposed to a single dependency within a multi-member chain. It is very difficult, based on the type of materials constructed for this experiment, to tease apart the predictions made by the AFS, on one hand, and the predictions derived from dependency differences, on the other. Yet there are some other data available which indicate that the AFS may be responsible for the processing difference between subject and object što relatives. In an act-out task testing children's knowledge of different types of relatives in Serbo-Croatian, Goodluck and Stojanović (1996) found that children, four to six years of age, performed worse on subject than on object što relatives. Some examples of subject and object relatives the child subjects were tested on are illustrated in (57) and (58), respectively.

- (57) Sanja vidi medveda što e jaše tigra.

Sanja_{Fem} sees bear_{Masc} that rides tiger_{MascAcc}

Sanja sees the bear that is riding the tiger.

- (58) Saša vidi kravu što je ovca gura.

Sasha_{Masc} sees cow_{Fem} that her_{Fem} sheep_{FemNom} pushes

Sasha sees the cow that the sheep pushes.

Putting aside all the differences between these test sentences and the ones used in the što experiment, on one side, as well as different populations tested and different experimental techniques used in the two experiments, one main point can still be made. Note that in the Goodluck and Stojanović (1996) experiment the test conditions did not differ at all with respect to the issue of chains/dependencies. The only difference relevant from the processing point of view is that in object relatives the binder is located at a structurally higher position than the one in the subject relatives. The AFS predicts that this structural difference will make subject relatives harder to process. This prediction was supported by the data, and the difference was statistically significant ($t=1.686$, $p<.05$).

In summary, indirect evidence seems to suggest that the predictions made by the AFS are in this case not reducible to some other part of the processing theory, such as crossed dependencies. Furthermore, if the chain derived by clitic raising was indeed computed for the analysis, one would expect object relatives, example (58) above, to be harder to process, due to an additional computational step, than subject relatives, example (57) above.

And finally, it has recently been suggested that the AFS, a purely syntactic module

of sentence parsing, is overridden by certain types of semantic information, such as animacy of the NPs (Mak et al. 1999). A corpus analysis of Dutch relative clauses shows that object relatives are much more frequent with inanimate antecedents. Additionally, Mak et al. (1999) carried out two experiments, an on-line reading experiment and an eye-tracking experiment, testing the interaction between the relative clause type (subject vs. object) and the animacy of the antecedent (animate vs. inanimate). Their test sentences are illustrated in examples (59) through (62) below.

(59-62) Vanwege het onderzoeken ... (D Mak et al. 1999)
 because of the investigation ...

subject relative clause, animate subject, inanimate object

(59) moesten de inbrekers, die de bewoner beroofd hebben (in her weekend),
 must the burglars, who the occupant robbed have (in the weekend)
 nog een tijdje op eht bureau blijven.
 some time at the police office stay
 (Because of the investigation, the burglars who have robbed the occupant during
 the weekend should for some time stay in the police office.)

object relative clause, animate subject, animate object

(60) moest de bewoner, die de inbrekers beroofd hebben ...
 (must the occupant who the burglars have robbed...)

subject relative clause, animate subject, inanimate object

(61) moesten de inbrekers, die de computer gestolen hebben ...

(must the burglars who have stolen the computer...)

object relative clause, animate subject, inanimate object

(62) moest de computer, die de inbrekers gestolen hebben ...

(must the computer that the burglars have stolen...)

As shown in the examples above, the animacy of the subject was held constant, while the animacy of the object and the clause type were varied. The results from both experiments are almost identical. Mak et al (1999) found a significant difference between subject and object relative clauses when the object was animate (examples (59) and (60)), but there was no difference when the object was inanimate. Mak et al. (1999) offer two possible explanations for the effects observed. First, the animacy of the antecedent influences the initial parsing decisions, so that subjects favour animate antecedents and objects favour inanimate heads. Or second, gap assignment is not done upon encountering the filler, but is delayed until the second NP, at which point the decisions about theta role assignment are made.

Let us consider both hypotheses in light of the Serbo-Croatian experiments. The first hypothesis is partially correct, as evidenced by the absence of a significant difference in processing between subject and object što relatives with animate and inanimate feminine heads. Yet this type of semantically motivated preference for interpretation does not override the use of syntactic parsing strategies, as indicated by the results for the masculine animate condition. Furthermore, if gap assignment is delayed until the second NP is encountered, the presence of a null subject in the što relatives would not provide immediate clues as to how theta roles are to be matched with lexical items, given that null subjects have to be interpreted

with respect to discourse information. It seems that the information provided by the second NP, in this case animacy, resembles the types of disambiguating information, namely the morphological case and verbal morphology, used in the experiments on German. This leads me to assume that the factors discussed above are more relevant for determining the strength of garden-path effects than for the actual gap assignment.

Furthermore, it seems that the strength of a particular disambiguation cue is subject to crosslinguistic variation. Kempe and MacWhinney (1999) examined the strength of a number of different morphological and semantic cues in the on-line processing of German and Russian declarative sentences. The predicted strength was calculated based on cue availability and cue reliability in a particular language. Kempe and MacWhinney (1999) predicted that animacy would be a stronger cue in German than in Russian, based on partially deficient morphological case paradigms in German. In Russian, on the other hand, case marking and subject-verb agreement are predicted to play a more important role than in German. Their results from on-line speeded sentence-picture matching experiments supported both predictions, with animacy showing larger effects in German than in Russian, and with strong effects of morphosyntactic cues, such as case marking, in Russian, but not in German. Based on a number of different linguistic criteria, it may be argued that Dutch is as close to German, as Serbo-Croatian is to Russian. The fact that animacy plays a stronger role in Germanic languages than in Slavic languages suggests that the effects of this cue may also be relatively strong if all other cues available to the parser are absent from the latter languages. If, however, the morphosyntactic cues are present, they are predicted to have an equally large effect in Slavic languages as animacy has in German and Dutch. The results from the

repetition experiments with children will show that these predictions are borne out in Serbo-Croatian (cf. Sections 6.2.iii, 6.3.iv, and 6.4.iv). It will be argued that none of these factors, however, is strong enough to override the use of the AFS.

In conclusion, although the data from Dutch indicate that semantic information, such as animacy, is factored in the processing of filler-gap dependencies, the evidence from the on-line reading time experiments on Serbo-Croatian provides strong support for the initial use of purely syntactic parsing strategies, such as the AFS.

5 GENERAL DISCUSSION

5.1 Introduction

The experiments presented in the thesis were designed to test a number of predictions about how different structural configurations are processed. These predictions are based on several universal parsing strategies which are built into the theory of human sentence processing, and as such should hold irrespective of language or structural differences. The language chosen for our study was Serbo-Croatian, a Slavic language that allows for word order variation and case syncretism with some lexical items, which has made it possible to test the processing of different word orders in the absence of any other cues available. Furthermore, the language has two different types of relative clauses, derived by the *wh*-movement and operator movement, respectively. The main goals of the Serbo-Croatian experiments were to test, first, whether the processing of empty categories, such as traces left by the *wh*-movement, would follow from the processing strategies operative in a number of other languages, and the second, even more important, goal was to address the issue of the processing of operator-variable chains in relative clauses.

The results from the on-line reading time experiments will be summarized in the following section. Next, those results will be discussed in terms of specific predictions about the processing of the relevant structures based on two parsing strategies, the Active Filler Strategy (Frazier 1987) and the Syntactic Prediction Locality Theory (Gibson 1998). The aim of this section is not to choose between the two somewhat competing theories, but to examine the Serbo-Croatian results in light of a more general theory of human sentence processing. Possible extensions of the work done with adults to other populations, such as

children, will be presented in the last section.

5.2 Summary of Results

As already mentioned, three different experiments with adult native speakers of Serbo-Croatian were carried out using an on-line reading task. The results are summarized below:

- scrambling experiment:
 - a. no position was statistically significant in pairwise comparisons between the conditions (SVO versus OVS, and SOV versus OSV).
 - b. SVO order was the least difficult to process.
 - c. verb-final orders (SOV and OSV) were more difficult than the verb-medial ones (SVO and OVS).
- koi experiment:
 - a. the subject relative (SwhVO) was the easiest to process.
 - b. there was a significant effect of position 3 in a pairwise comparison between subject relatives (SwhVO) and object relatives (OwhVS).
 - c. there was no significant difference in the processing of subject relatives with a scrambled object (SwhOV) and object relatives with an overt subject (OwhSV), both structures in which the second argument immediately follows the wh-filler.
 - d. there was a predicted contrast between the two sets of structures when a subset of data was examined: OwhVS had the longest overall reading times, and the position 3 was statistically significant in a comparison between the

SwhVO and OwhVS relatives; SwhOV structures took longer to read than OwhSV structures, although this difference was not statistically significant.

- što experiment:
 - a. there was a significant effect of positions 2 and 3 on the subject analysis in a pairwise comparison between subject and object relatives.
 - b. there was a significant effect of position on both the subject and item analysis for the masculine animate condition.

In summary, the results from the scrambling experiment indicate that there is a strong preference to interpret an initial ambiguous NP as the subject. Yet those results do not provide any conclusive evidence as to the processing of other word orders, especially those in which two preverbal NP arguments are adjacent to one another.

As for the processing of empty categories, the results from the koji experiment indicate that the parser prefers to postulate the gap in the first grammatically available position. This preference makes subject relatives easier to process than the object ones. When another overt NP argument immediately follows the wh-filler, this preference for subject interpretation is lost, and the difference in the processing between subject and object relatives is no longer present.

In što relatives, the binder for the object precedes the binder for the subject. This locality asymmetry, based on a structural difference, is reflected in processing: object što relatives are easier to process than subject relatives.

5.3. The Active Filler Strategy

The AFS was proposed to account for the processing difference between subject and object relative clauses in a number of languages, and empirical findings supported the assumptions that this strategy was based upon. The AFS is an ambiguity resolution strategy, which is employed only when some kind of structural ambiguity, either temporary or global, is present. Furthermore, it was designed primarily to account for the processing of empty categories, especially traces created by the *wh*-movement. In summary, the AFS is an ambiguity resolution strategy for the processing of filler-gap dependencies.

Formulated as such, the AFS is not capable of accounting for the processing of scrambled elements. Scrambling is a movement operation, in many respects similar to *wh*-movement, which leaves a trace in the base-generated position. The scrambled element is, in fact, a filler which has to be bound to the corresponding gap position. Unlike *wh*-fillers, which immediately signal the presence of an empty category, scrambling-fillers do not necessarily do so. Namely, upon encountering an NP, especially one without any overt case morphology, in the sentence-initial position, the parser is not provided with any overt cues to start a search for a potential binder. In the absence of any need to activate such a search, the parser prefers to analyze any case-ambiguous NP as generated in its base position. This preference cannot be captured by the AFS, as no overtly marked filler is present, thus no immediate search for the binder is activated.

The Minimal Chain Principle (de Vincenzi 1991) correctly predicts that the parser does not postulate a chain between a scrambled element and its trace as this computational operation is not initially warranted by the data. As the one-member chain is by definition the

minimal chain, the parser will prefer to analyze all case-ambiguous elements as being in their base-generated positions. Note, however, that the MCP was proposed to account for the processing of different types of empty categories. Incorporating the predictions based on the MCP into the study of the processing of scrambled elements represents a combination of the two parts that the MCP is composed of. Scrambled elements, like wh-fillers, have to enter into a required chain in order to be bound to the gap position, yet no evidence is provided to the parser to postulate a necessary chain. Thus the parser is provided with conflicting information: on one hand, the postulation of an empty category is required, and on the other, the information about such an operation is not immediately available. In the absence of such information, the parser postulates the minimal chain analysis for all arguments, and revises it later if necessary.

Note, however, that absence of significant effects for any of the scrambling structures tested, indicates that there are potential problems with trying to incorporate the MCP into the processing of different word orders. The preference for subject over object interpretation for the initial case-ambiguous NP may be similarly accounted for by a number of other different strategies. Thus the results from the Serbo-Croatian experiment on the processing of word order variation should be interpreted with caution, and viewed more as providing a baseline measure for the *koji* experiment, given that the same set of lexical items was used, rather than a conclusive study on how different word orders are processed.

Strategies proposed for the processing of temporarily ambiguous filler-gap dependencies, such as the AFS and the MCP, make correct predictions for the processing of *koji* relatives in Serbo-Croatian. In the test sentences, all nouns, and the corresponding

relative pronouns, were case-ambiguous, and word order was varied to reduce the availability of such clues as to which theta role is to be assigned to which argument. The evidence shows that in the absence of any other clues, when the parser is faced with a temporary syntactic ambiguity it chooses to postulate a gap in the first available position. This makes subject koji relatives easier to process than the object ones, and this result replicates the findings from many other languages. Note also that the presence of garden-path effects in object relatives with postposed subject (OwhVS) supports the predictions made by the AFS, indicating that parsing proceeds in a serial fashion, in which the parser sometimes makes correct, and sometimes incorrect choices, but never delays its decision. Given that for this structure the initial analysis turns out to be the incorrect one, a significant increase in the processing load is evident at the point at which a reanalysis is needed.

The AFS and the MCP make similar predictions for the processing of verb-final koji relative clauses, in which the second argument immediately follows the wh-filler. Both strategies predict that in this case object relatives will be easier to process than subject relatives. The AFS makes this prediction on the basis of a number of revisions required, and the MCP computes the number and length of chains present. Yet the results do not support these predictions, indicating that the AFS/MCP may be obscured or replaced in these structures by some other factors.³⁷ This in no way undermines the finding that subject wh-

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A potential confound may be the animacy of the nouns used. Note that both nouns in each test sentence were inanimate. Following Mak et al. (1999), the parser will have to choose between the two contradictory strategies, one which assumes postulating the gap in the first position, i.e. the subject position, and another which prefers to associate inanimate nouns with objects. This correctly predicts absence of a significant

relatives in Serbo-Croatian are generally easier to process than the object ones, which is correctly captured by the AFS, and its extension the MCP.

And finally, the AFS predicts that the preference for subject interpretation is derived primarily from the distance between the filler and its gap, and does not exclude the possibility that if locality facts were reversed, one could also find a preference for object interpretation. These parsing preferences are determined by locality, correlated with the amount of time an unassigned filler has to be kept in working memory. Because in the Serbo-Croatian što relatives binding into an object position will take less time, thus requiring fewer computational resources, as opposed to binding into a subject position, the AFS predicts that object što relatives should be less difficult to process than the subject ones. The empirical findings support this prediction. Furthermore, they indicate that the preference for subject interpretation found in all the other languages tested is not reducible to a general crosslinguistic subject preference, but is based on parsing predictions built into a general model of human sentence processing.

In conclusion, the primary goal of the Serbo-Croatian experiments was to test the use of the AFS in the processing of two types of filler-gap dependencies. The AFS predicts a subject preference for koji relatives, and an object preference for što relatives. Both of these predictions were confirmed by the results. In the next section the same findings will be examined in light of a more general model of sentence comprehension, formulated as the Syntactic Prediction Locality Theory (Gibson 1998).

difference between the two verb-final koji relatives, but is incapable of accounting for the difference observed between the two verb-medial relatives, which is predicted under the AFS.

5.4 The Syntactic Prediction Locality Theory

The SPLT is formulated as a general theory of sentence processing, taking both integration and memory costs into account. It uses a sophisticated metric to predict processing cost, and it is based primarily on predicting the number of categories, as well as tabulating the distance (time) items have to be kept in working memory. The SPLT is not dependent upon the presence of a local ambiguity, and does not make specific predictions about the processing of empty categories, as opposed to overt ones. It is a general, psychologically-motivated theory whose predictions are meant to apply across the board, in a wide range of different structures.

Unlike the AFS and the MCP, which are not directly involved in the processing of categories other than the empty ones, the SPLT is formulated to account for the processing of overt scrambled elements. It is a syntactic complexity metric that predicts only categories, and not so much dependencies. Under the assumption that the processing cost involved increases as a direct result of an increase in the number of predicted categories, the least effort will be required to process a structure with a minimum number of categories. Processing a structure like S-V should induce less memory load than processing a two-argument structure, such as S-V-O. This prediction is independent of either the presence of ambiguity or the order in which the arguments are encountered. Gibson's assumption about the number of predicted categories directly influencing the cost of processing is supported by the experimental findings from German. Even in the absence of ambiguity, sentence initial accusative-marked NPs took longer to read than initial nominative-marked NPs (Hemforth 1993). Gibson attributes this result to the SPLT, under which the number of predicted

categories for the initial accusative-marked NP is three (verb, an empty category for the fronted NP, and a subject), whereas in initial nominative-marked NPs this number is two. This prediction is not based on the presence of local ambiguity, as both nouns are unambiguously marked for case. Note that similar ease in the processing of unambiguously subject-initial, as opposed to object-initial structures was also found in Serbo-Croatian. Urošević et al. (1986) found that unambiguously marked subject initial utterances (SVO, SOV, VSO) took less time to be semantically evaluated and named than object-initial ones (VOS, OVS, OSV). The fact that a similar asymmetry is observed in the processing of ambiguously marked initial nouns in Serbo-Croatian suggests that ambiguity does not play a significant role in the processing of word order variation. The SPLT makes correct predictions regarding the preference for subject interpretation observed in a number of languages, including Serbo-Croatian.

As for the processing of filler-gap dependencies in *wh*-relative clauses, the predictions derived from the SPLT are very similar to those based on the AFS. As positing a gap in subject position reduces the working memory load, a subject preference is expected under both approaches. Whereas the AFS is applied in temporarily ambiguous relatives only, the SPLT predicts less difficulty with subject than object relatives irrespective of the presence of ambiguity. Both the AFS and the SPLT can thus successfully account for the Serbo-Croatian data.

The SPLT makes contradictory predictions for the processing of *što* relatives in Serbo-Croatian. On one hand, locality considerations make object relatives less difficult to

process than the subject ones.³⁸ On the other, predicting an object gap, as opposed to the subject gap, requires more computational resources given that the number of predicted categories is bigger for the former.³⁹ The only way to resolve the two conflicting predictions is to assume that the parser predicts the subject gap, based on the number of predicted categories as well as a locality preference derived from a crosslinguistic frequency of subject gaps preceding object gaps. This compromise strategy would lead the parser into misanalyzing the relative as a subject relative, and would result in garden-path effects at the point at which a reanalysis is required. Even under ranked parallel approach, a significant difficulty with object relatives is expected. The results, however, clearly indicate that this is not the case, as the garden-path effects are observed with subject relatives, correctly predicted by the AFS. As only locality facts are factored into the predictions of the processing costs, the AFS does not run into the problems discussed above. Because the SPLT is designed to account for the processing of a wide range of structures, it is precisely for this reason that it will prove inadequate in an attempt to unify different phenomena.

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Gibson (1998) proposes, based on the study of the processing of intersecting and nested dependencies in German and Dutch (Bach et al. 1986), that intersecting dependencies do not increase the processing cost involved. Under this approach, even if the clitic trace is computed, subject relatives would not be more difficult to process than object ones, as the parser would easily handle a crossing dependency in the former. Thus the difference between the subject and object relatives, in Gibson's analysis, would boil down to locality and the number of predicted categories.

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Note that in theory the parser has no way of knowing that the verb in the subject relative is a transitive one at the point at which the filler is encountered and has thus to make predictions not taking transitivity into account.

Although its contributions to the general theory of sentence processing are unquestionable, certain processing phenomena seem to be better accounted for by specific parsing strategies which are designed to apply in a limited range of environments.

5.5 Conclusion

The results from the scrambling experiment indicate that the parser prefers to analyze an initial case-ambiguous NP as the subject. Yet they do not provide any support for the use of the MCP in the processing of optional chains, i.e. scrambled overt NP arguments, in Serbo-Croatian. This parsing principle, proposed and tested for the processing of different types of empty categories, cannot, at this point, be extended to the processing of overt categories too. On the other hand, the SPLT, formulated in terms of a number of predicted categories, seems to provide an explanation for the subject preference in both ambiguous structures in Serbo-Croatian, as well as in non-ambiguous declarative structures in other languages

As for the processing of required filler-gap dependencies, there is evidence that the parser follows some of the parsing strategies discussed. Postulating the chain derived by movement in koji relatives is done at the first available argument position, i.e. subject position. Thus the strategy initially proposed for English (the AFS), and later tested on Dutch, German and Italian (the MCP) can be said to be actively used for the processing of required chains in a language typologically different from the languages in which it has been previously tested.

Finally, the object preference observed in the processing of što relatives in Serbo-Croatian is attributable to the AFS only. The fact that object binders precede subject ones

accounts for this crosslinguistically rare preference, which follows from the AFS.

In conclusion, there is evidence that the parser follows some of the filler-driven strategies proposed. Postulating the chain derived by movement in both koji and što relatives is done at the first available argument position, i.e. subject and object positions respectively. The results support the prediction that the parser follows the AFS in an active search for the binder for the wh-element. Furthermore, the evidence in favour of this account is very strong given the similarity of results from two experiments which tested processing two different types of filler-gap dependencies within the same language. Since the AFS makes different predictions for processing koji and što relatives, the fact that the parser follows it in both constructions provides independent evidence for its active use in Serbo-Croatian. Furthermore, these results show that subject interpretation for ambiguous relatives in languages like English, German, Dutch, etc. is an effect of a parsing strategy rather than global preference for subject interpretation.

6 PROCESSING STRATEGIES IN CHILD GRAMMAR

6.1.i Introduction

The primary goal of these experiments is to extend the processing work done with adults to children, namely to test whether adult parsing strategies are operative in child language. Very few studies have concentrated on sentence processing in child language, and most of the research potentially related to the issues discussed here is classified as either sentence processing or language acquisition research. The experiments discussed here will primarily examine the role of the parsing mechanism in children's competence grammar.

Goodluck and Tavakolian (1982) looked at children's interpretation of relative, temporal, and infinitival clauses in English, and found (contrary to previous research) a qualitative similarity between children and adults in their grammar of relative clauses. The child competence grammar may be, as they propose, overridden by the pressure of the sentence processing mechanism in cases of increased processing load that the child is incapable of handling. Still, it can be argued that children show that both their competence grammar as well as their processing mechanisms are guided by the same universal principles that are at work in the adult grammar. Goodluck et al. (1995) used a self-paced reading task in testing how children (mean age 10) process direct object gaps in purpose clauses and wh-object gaps in embedded questions in English. Overall results indicate that children use parsing strategies similar to those of adults in processing filler-gap dependencies in questions, and the absence of such similarity for purpose clauses is accounted for by late acquisition of these constructions in child grammar and/or by the need to integrate lexical and syntactic information.

Additional support for the existence of some adult parsing strategies in child language comes from Slobin and Bever's (1982) study of the strategies used by children in interpreting word order and inflections in a number of language, Serbo-Croatian being one of them. In brief, they found that children pay attention not only to structural position but also to other cues, such as inflection, in their theta role assignment during sentence comprehension (c.f. Section 2.2.ii).

And finally, as observed in Stojanović (1997), there is some evidence which supports the use of the AFS by children in što relatives in Serbo-Croatian. In an act-out task testing children's knowledge of different types of relatives in Serbo-Croatian, Goodluck and Stojanović (1996) observe that children performed worse on subject than on object što relatives (cf. Section 4.6). In summary, all of the above observations suggest that there are similarities in the ways children and adults interpret temporarily ambiguous structures.

The implications of these results, particularly those related to the use of the AFS and the MCP in filler-gap processing, for the theory of adult sentence processing, will be examined in the following two experiments. Thus the main goal of the experiments will be to test the ease/difficulty children have with comprehending structures with temporary syntactic ambiguities of the types used in the scrambling, koji and što experiments with adults. Qualitative replication of the results with adults will provide strong empirical support for the existence of some parsing strategies, the AFS in particular, in child language. Furthermore, this study will contribute to our understanding of how parsing strategies operate in both adult and child sentence processing, given a crosslinguistically rare preference for object interpretation of što relatives.

6.1.ii Procedure

These experiments used an elicited imitation task (repetition) as the main experimental technique. The reasons for choosing this task were the following: first, young children are unable to take part in on-line reading tasks, second, there are data already available on children's performance in act-out and elicited production tasks, third, repetition permits greater lexical freedom than other tasks, and finally, repetition has been found to be an effective way of measuring structure retention (Aaronson & Ferres 1984). Subjects were also asked to perform an additional task (act-out) on a subset of conditions, which will be reported separately in Section 6.5. Since the major contribution of the Serbo-Croatian experiments lies in the unique behaviour of što relatives (object preference), different types of što relatives involving three types of ambiguity, i.e. temporarily and completely ambiguous subject and object relatives, as well as the unambiguous ones, were elicited and acted-out, to provide a wide range of different structural conditions under which certain parsing strategies operate.

Before each testing session, subjects received a couple of practice trials to ensure familiarity with the task. They were asked to repeat the sentence they had just heard. If the child asked the experimenter to repeat the sentence, this was done only once per sentence, and noted down on the response sheet. If no sentence was elicited after the second presentation, the experimenter would move onto the next test sentence. All responses were written down in response sheets and taped on a tape recorder.

6.1.iii Order of presentation

A within subject design was used for all the experiments. Eight questionnaires were created for the repetition task, each consisting of 26 test sentences presented in a random order. Each subject received 26 test sentences, two tokens of each sentence type in the scrambling/koji experiments (2 SVO, 2 OVS, 2 SOV, 2 OSV; 2 SwhVO, 2 OwhVS, 2 SwhOV, 2 OwhSV) and 2 subject and 2 object što relatives in the temporarily ambiguous and unambiguous condition, plus 2 completely ambiguous što relatives. It was anticipated that the low number of tokens per each type would lead to problems in statistical analyses later, but a number of factors, primarily lexical limitations, made it very difficult to create additional test sentences. The act-out procedure consisted of a couple of practice sentences, plus nine test sentences, three for each type of ambiguity. Half of the subjects received the repetition test first, followed by the act-out, and the other half did the act-out first, followed by the repetition. Child subjects were tested in one session, which lasted about 25-30 minutes, and all but one subject were able to complete the whole test battery.

6.1.iv Subjects

Thirty-three Serbo-Croatian speaking children were tested, 19 four year olds (mean age 4;3) and 14 five year olds (mean age 5;6). Four four year old subjects were excluded from tabulation because of their inability to complete the task, or because they produced more than 50% incorrect responses. Responses from 29 subjects (mean age 5;7) were tabulated for the analysis. The testing was done in two daycare centres in two cities, Banja Luka (Bosnia) and Belgrade (Yugoslavia). The fact that two different dialects of Serbo-Croatian are spoken in

those two cities did not affect either the procedure or the results as the experimenter is a fluent speaker of both dialects, and no significant difference in the pattern of responses between the two groups of children was found on the later analyses.⁴⁰

Eight adult subjects, native speakers of Serbo-Croatian living in the Ottawa area, were tested as controls.⁴¹

6.1.v General Coding Decisions

A coding system was designed and adopted for analyzing the repetition data. Elicited repetitions were analyzed as correct if they corresponded exactly to target stimulus sentences. Responses were coded as adaptations if up to four changes to the original sentences were made. If, however, the responses were either ungrammatical, or not congruent at all with the information in the stimuli, they were coded as incorrect. And finally, instances in which subjects failed to produce any utterance at all were scored as such. Additional coding decisions were made, and will be discussed separately for each experiment.

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Words can not express how much I enjoyed testing these children. They were extremely friendly, fun to talk and listen to, curious, yet at the same time very obedient, patient and attentive to the task. Additionally, the daycare centre in Banja Luka in which a part of the testing was done is the one that I used to go to when I was a child, and this has brought back nice childhood memories. Irrespective of the recent war that affected both the teachers and the parents of the children in a very emotional way, I have never seen so much enthusiasm and hope as I did that summer in the children born in the midst of horror. I thank them from the bottom of my heart.

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I am very much indebted to all my friends who agreed to take part in these experiments, and much more to a very good friend and colleague Nada Vasić who volunteered to test all the adult control subjects.

6.2 SCRAMBLING REPETITION EXPERIMENT

6.2.i Materials

For this experiment two sets of materials were combined, one based on semantic disambiguation similar to the one used in the on-line experiment, and another one, for which a new set of conditions was created. (63 a-d) illustrate conditions in which the lexical semantics of the verb plays the disambiguating role. (64 a-d) illustrate the conditions in which inflectional morphology on the verb, a morphosyntactic cue based on subject-verb agreement, is used to disambiguate between different interpretations.⁴²

Semantic disambiguation

(63) Deda ne čuje da ...

grandpa not hears that

a. vetar otvara prozor. (SVO)

wind opens window

(Grandpa does not hear that the wind is opening the window.)

b. prozor otvara vetar. (OSV)

c. vetar prozor otvara. (SOV)

d. prozor vetar otvara. (OSV)

⁴²

Both nouns used are ambiguous between the nominative and accusative case marking. As one noun bears singular, and the other one has plural features, it is the agreement features on the verb that will determine the assignment of the subject role.

Morphological disambiguation

(64) Deca se smeju kada ...

children refl laugh when

a. kuce jure mače. (SVO)

puppies_{PL} chase_{PL} kitten_{SG}

(Children are laughing when the puppies are chasing the kitten.)

b. mače jure kuce. (OVS)

c. kuce mače jure. (SOV)

d. mače kuce jure. (OSV)

The latter set replicated the mode of disambiguation used in experiments on German and Dutch , i.e. number marking on the verb was used to disambiguate temporarily ambiguous structures (for Dutch see Frazier 1987, Kaan 1997; for German see Schriefers et al. 1995, Meng and Bader 1996, Schlesewsky et al. 1996, among others, and for German and Russian see Kempe and MacWhinney 1999). Stronger garden-path effects are expected to arise when number information on the verb rather than its lexical semantics plays the disambiguating role.

16 sentence frames were created, eight conditions in each frame, four for the scrambling experiment and four for the koji experiment. The number of sentence frames was not equal for two types of disambiguation used, 10 for semantic and 6 for morphological disambiguation, given the very limited number of lexical items that would satisfy both the morphological and pragmatic criteria, and that would also be easily accessible to children. In the conditions with morphological disambiguation, half the sentences had the verb in the

singular form, and in the other half the verb was marked for plural.

6.2.ii Predictions

Exactly the same predictions as made for the on-line scrambling experiment with adults hold for the repetition experiment with children. Keeping in mind that adult responses to different types of structures differed in overall reading times, but did not come out as significant on the statistical analysis, the scrambling repetition experiment was included in the child test battery primarily as a check against any lexical preferences, and also to investigate the different strengths of the two types of disambiguation used, given that the same set of test sentences is used in the koi repetition experiment. In short, SVO structures are predicted to be easiest to repeat, followed by the SOV and OSV, with the OVS structures having the highest percentage of incorrect repetitions. This effect is predicted to be stronger for the morphological than the semantic disambiguation.

6.2.iii Results

Analyses of variance were done for all three experiments on the mean percentage correct responses for each condition using the items analysis (i.e. per each sentence frame). The analysis was done in this way because not all subjects responded to at least one token of each condition (cf. Footnote 43). A priori planned pairwise comparisons analogous to the ones in the adult on-line experiments were carried out for each experiment.

Let us now turn to the results for the scrambling repetition experiment. TABLE 12 illustrates the overall responses by children in this experiment.⁴³

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The number of tokens per condition was supposed to be equal in all the questionnaires created. Yet some of the questionnaires were flawed due to the procedural mistakes. Namely, even after an initial double checking and running the whole experiment, I was not able to spot that some of the sentences in the questionnaires did not have the structural form corresponding to the code assigned to them. For example, (a) would be used for an SVO structure, (b) for an OVS structure, etc. In some cases the sentence would have the right code but incorrect structure, i.e. sentence 2b (OVS) was presented as an OSV (2d) structure instead. Interestingly enough, in the scrambling repetition experiment this mistake was made for one type of structure only: an OVS structure was presented as an OSV structure in three sentence frames (2b, 4b, 7b). This has resulted in an unbalanced number of tokens per condition, and has made any statistical analysis very difficult. Moreover, the same type of mistake arose in the conditions with kōji relatives, as they use the same sentence frames. In this case, the most common mistake was that OwVVS relatives were presented as OwVSV relatives instead. Out of eight questionnaires, three were not affected by this problem at all. As for the coding decisions, if a sentence was presented as an OSV sentence it was coded as such and included in the OSV condition. This decision to include all the sentences in the tabulation was based on the assumption that responses, if made, should not be wasted. And finally, no such problems were encountered in the conditions with što relatives. Intuitively speaking, this pattern of mistakes reflects the general processing predictions discussed throughout the thesis. Što relatives are the easiest to comprehend, as compared to the other two types of structures tested. Second, object initial structures with a postposed subject (OVS and OwVVS) are by far the most difficult, and subjects tend to convert them into 'less complicated sentences', as indicated by their pattern of responses on both the scrambling and kōji experiments.

TABLE 12:

Responses by children in four conditions in the scrambling repetition experiment

	(SVO)		(OVS)		(SOV)		(OSV)	
	N	%	N	%	N	%	N	%
Correct	15	25	9	19	11	20	14	20
Adaptations	35	58	28	58	34	62	39	57
Incorrect	7	12	4	8	7	13	12	17
No repetition	3	5	7	15	3	5	4	6
TOTAL	60		48		55		69	

The results of a priori planned comparisons, by analyses of variance (ANOVA) on the mean percentage of correct responses for each condition with item as random effect, are as follows:

- (i) The difference between SVO and OVS was not significant ($F(1,15)=0.98$, $p=.3375$).
- (ii) The difference between SOV and OSV was not significant ($F(1,15)=0.00$, $p=.9965$).
- (iii) The difference between SVO and OVS in the condition with semantic disambiguation was not significant ($F(1,9)=0.01$, $p=.5472$).
- (iv) The difference between SOV and OSV in the condition with semantic disambiguation was not significant ($F(1,9)=1.07$, $p=.3274$).
- (v) The difference between SVO and OVS in the condition with morphological disambiguation was not significant ($F(1,5)=0.56$, $p=.4896$).
- (vi) The difference between SOV and OSV in the condition with morphological disambiguation was significant ($F(1,5)=10.00$, $p=.025$).

As shown in TABLE 12, percentage correct responses is very similar for all the four conditions tested. Although the SVO structures had the highest percentage of correct repetitions, there was almost no difference between the other three types of structures tested. Overall results indicate that no predicted difference in responses in the four conditions was elicited. The only predicted difference obtained was for the SOV/OSV contrast in the condition with morphological disambiguation.

Additionally, an examination of the types of adaptations made revealed that children tended, first, to convert OVS into SVO very frequently (43% changes for the OVS condition were of this type, as opposed to only 6% SVO->OVS conversions for the SVO condition). Second, children deleted both arguments equally often for SOV (20% of both the subject and object deletion, respectively), while the object was deleted more than the subject in the OSV condition (38% object deletion, 8% subject deletion). As for other modifications not directly related to the issues addressed here, the most frequent one was the a change of number features on the verb. Plural was converted into singular in 13 out of 16 instances of number change, and the same pattern was observed in the conditions with koji relatives. No other interesting pattern of modifications was observed in the scrambling repetition data.

Another type of analysis suggests that there is a trend in the predicted direction. TABLE 13 illustrates types of structures produced by children, collapsing across the stimulus sentences the subjects were presented with.

TABLE 13:
Types of structures produced by children in the scrambling repetition experiment

	N	%
SVO	41	18
OVS	14	6
SOV	27	12
OSV	24	10
SV	25	11
OV	10	4
VO	7	3
VS	6	2
NVN	4	2
NNV	1	1
Other	4	2
Unscorable	47	20
Ungrammatical	22	9
TOTAL	232	

As shown in TABLE 13 above, SVO structures were the easiest, whereas OVS were the most difficult structures to elicit in imitation, as evidenced by the highest and lowest percentage for the SVO and OVS, respectively. As for the SOV and OSV structures, almost no difference between them was observed. These findings replicate those from the on-line reading experiments with adults, in which there was a difference in RTs between conditions SVO and OVS, which was not present in the SOV/OVS contrast.

TABLE 14 illustrates the same type of analysis based on the type of disambiguation used.

TABLE 14:
Types of scorable structures produced by children
in the scrambling repetition experiment,
classified according to the type of disambiguation

	<i>Semantic</i>		Nchildren /Ntokens	<i>Morphological</i>		Nchildren /Ntokens
	N	%		N	%	
SVO	15	15	11/15	26	40	19/26
OVS	8	8	7/8	6	9	6/6
SOV	19	19	14/19	8	12	8/8
OSV	15	15	12/15	8	12	8/8
SV	23	23	15/23	2	3	2/2
OV	5	5	4/5	5	8	5/5
VS	5	5	5/5	1	1.5	1/1
VO	6	6	5/6	1	1.5	1/1
Other	1	1	1/1	8	12	6/8
TOTAL	97			65		

As shown in TABLE 14, semantic disambiguation did not produce any consistent pattern of responses, e.g. children seem to have the same amount of difficulty/ease with the SVO and OSV structures, which is counterintuitive and goes against most of the processing predictions. Morphological disambiguation, on the other hand, confirmed at least one of the predictions initially made: SVO structures are by far the least difficult to imitate and produce. A small difference in percentages between the other three types of structures makes it impossible to draw any conclusions about child processing mechanism based on these data only. Looking

back at TABLE 12, this is exactly what the percentage correct responses for each of type of structure shows, i.e. the best performance on SVO, and almost no difference between the other three conditions tested.

6.2.iv Discussion

The results from the scrambling repetition experiment suggest that the SVO word order is the least difficult to comprehend by children. This replicates, first, the findings from a number of child studies, based on both experimental and naturalistic data, and second, the results from the on-line reading time experiment with adults, who also showed significant ease in the processing of SVO word order. As two object-initial orders, as well as SOV order, did not differ to any marked degree, no arguments can be made at this point about specific parsing strategies used by children in the processing of the different word orders. The trends noted indicate that children have a similar amount of difficulty when processing structures in which one of the arguments, be it subject or object, is moved out of its base-generated position. A plausible explanation would be to examine the observed difficulty in terms of potential problems children have with scrambling chains, as opposed to singleton chains, on one hand, and the required chains of the wh-filler dependency type, on the other.

A second point worth noting is related to the type of disambiguating information used. As predicted, children seem to have more difficulty in the processing of sentences with semantic as opposed to sentences with morphological disambiguation. Inflectional morphology on the verb represents a much stronger disambiguating cue than lexical semantics of the verb. Ignoring the morphosyntactic information would violate the subject-verb

agreement requirement and make the sentence ungrammatical at the level of syntax. Ignoring semantic cues, on the other hand, makes the sentence pragmatically implausible, yet perfectly grammatical. Assuming that the SVO word order is the most neutral one, and could thus be used to provide baseline measures for overall performance success, a higher percentage of this type of structure produced in the morphological condition indicates that performance errors present in the semantic condition could be to a certain degree attributed to another level of processing at which this type of semantic information is factored in (cf. discussion in Section 6.7.iii). Additionally, the fact that the difference between the SOV and OSV structures was statistically significant only in the morphological condition suggest that children do pay attention to morphosyntactic information much more than they do to lexical/pragmatic information.

To conclude, the results from the scrambling repetition experiment suggest that the trends observed in the children's performance may be accounted for by a number of processing assumptions made about the adult sentence parsing mechanism, but do not provide us with conclusive evidence as to how the child processing mechanism operates. And finally, as they qualitatively replicate the results from the experiment with adults, this indicates that a similar parsing mechanism is operative in both adult and child language.

6.3 KOJI REPETITION EXPERIMENT

6.3.i Studies on the comprehension of wh-relatives by children

It has been observed, based on various kinds of comprehension data, that children generally have fewer problems with subject than object relatives. The debate has evolved around the issue of the relation between the type of embedding, on one hand, and the functional role of the head of relative, on the other (Brown 1971; de Villiers et al. 1979; Sheldon 1974, 1977; Smith 1974, among others). Most of the child studies in English show clear-cut results as to the subject/object asymmetries discussed throughout this thesis: subject relatives are mentally easier to compute and interpret than their object counterparts.

Although the child data on languages other than English is sparse, the same pattern of comprehension difficulty is observed. In French, object relatives were harder to imitate than subject relatives by children (Kail 1975), and similarly, the former were more difficult to understand than the latter (Segui and Leveille 1977). Rothweiler (1993) summarizes the main findings from studies on children's comprehension of relative clauses in German. Relative clauses in which the relative pronoun is extracted from the subject position are easier to understand than the reverse, irrespective of the position of the relative clause (Park 1976, Mills 1997).

In summary, the comprehension data from studies on English, French and German indicate that children have more problems with object than subject relatives. As most of these studies were carried out before the AFS was formulated, only indirect links between their results, on one hand, and the processing predictions based on the AFS, on the other, can be made. The difficulty children (as well as adults) have with interpreting relative clauses in

which the relative pronoun is extracted from the object, as opposed to the subject position, may be attributed to the use of the AFS in both adult and child grammar. The main goal of the experiments reported below was to examine the use of adult parsing strategies, such as the AFS, in children's comprehension of different types of wh-filler-gap dependencies in Serbo-Croatian.

6.3.ii Materials

The same set of sentence frames was used as in the scrambling experiment. Examples (65 a-d) and (66 a-d) illustrate the conditions with semantic and morphological disambiguation, respectively. With both types of disambiguation, the relative pronouns koi/koje, based on the inherent ambiguity of the potential head nouns used, are morphologically ambiguous between nominative and accusative case marking.

Semantic disambiguation

(65) Macu je uplašio ...

kitten aux scared

a. vetar koji otvara prozor. (SwhVO)

wind which opens window

(The kitten was scared by the wind which was opening the window.)

b. prozor koji otvara vetar. (OwhVS)

window which opens wind

(The kitten was scared by the window which the wind was opening.)

c. vetar koji prozor otvara. (SwhOV)

d. prozor koji vetar otvara. (OwhSV)

Morphological disambiguation

(66) Gledali smo crtani

watched aux cartoon

a. o kucama koje jure maće. (SwhVO)

about puppies_{PL} which chase_{PL} kitten_{SG}

(We have watched a cartoon about the puppies which chase the kitten.)

b. o mačetu koje jure kuce. (OwhVS)

about kitten_{SG} which chase_{PL} puppies_{PL}

(We have watched a cartoon about the kitten which the puppies chase.)

c. o kucama koje maće jure. (SwhOV)

d. o mačetu koje kuce jure. (OwhSV)

6.3.iii Predictions

Predictions made for the koi on-line reading experiment with adults apply also to the repetition experiment with children. The SwhVO structures will be easiest to imitate, and the OwhVS relatives will be the most difficult, producing the smallest number of correct repetitions. As for the SwhOV and OwhSV structures, the former are predicted to be slightly more difficult, as they involve an additional chain, created by object scrambling into a preverbal position. Additionally, the effect is predicted to be stronger in the morphological than in the semantic disambiguation.

6.3.iv Results

TABLE 15 illustrates the overall responses by children in the koi repetition experiment.

TABLE 15:

Responses by children in four conditions in the koi repetition experiment

	(SwhVO)		(OwhVS)		(SwhOV)		(OwhSV)	
	N	%	N	%	N	%	N	%
Correct	10	18	7	15	10	16	9	14
Adaptations	29	54	24	51	35	56	36	55
Incorrect	12	22	12	26	13	21	15	23
No repetition	3	6	4	9	4	7	5	8
TOTAL	54		47		62		65	

The results of a priori planned comparisons, by analyses of variance (ANOVA) on the mean percentage of correct responses for each condition with item as random effect, are as follows:

- (i) The difference between SwhVO and OwhVS was not significant ($F(1,15)=0.69$, $p=.4180$).
- (ii) The difference between SwhOV and OwhSV was not significant ($F(1,15)=0.14$, $p=.7153$).
- (iii) The difference between SwhVO and OwhVS in the condition with semantic disambiguation was not significant ($F(1,9)=0.01$, $p=.9361$).
- (iv) The difference between SwhOV and OwhSV in the condition with semantic disambiguation was not significant ($F(1,9)=0.32$, $p=.5873$).

- (v) The difference between SwhVO and OwHVS in the condition with morphological disambiguation was significant ($F(1,5)=10.00$, $p=.025$).
- (vi) The difference between SwhOV and OwHVS in the condition with morphological disambiguation was not significant ($F(1,5)=0.10$, $p=.7650$).

As shown in TABLE 15, percentage correct responses is very similar for all the four conditions tested. Overall results indicate that no predicted difference in responses in the four conditions was elicited. The predicted difference was obtained only for the SwhVO/OwHVS contrast in the condition with morphological disambiguation.

Another type of analysis also failed to show the predicted pattern. TABLE 16 illustrates types of structures produced by children, collapsing across the stimulus sentences the subjects were presented with.

TABLE 16:
Types of structures produced by children in the kōji repetition experiment

	N	%
SwhVO	27	24
OwHVS	15	13
SwhOV	24	22
OwHVS	27	25
SwhV	12	11
OwHVS	4	4
Other	2	1
TOTAL	111	

The percentages of different types of relative clauses produced by children do not differ

appreciably (TABLE 16). Although, as predicted, children seem to have most difficulty with subject-postposed object relatives (OwhVS), there is no difference between canonical subject and object relatives (SwhVO and OwhSV structures), on one hand, and subject and object relatives in verb-final structures (SwhOV and OwhSV), on the other.

TABLE 17 illustrates the same type of analysis based on the type of disambiguation used.

TABLE 17:

Types of scorable structures produced by children in the *koji* repetition experiment, classified according to the type of disambiguation

	<i>Semantic</i>		Nchildren /Ntokens	<i>Morphological</i>		Nchildren /Ntokens
	N	%		N	%	
SwhVO (1)	13	18	12/13	14	36	13/14
OwhVS (4)	13	18	11/13	2	5	2/2
SwhOV (3)	17	24	14/17	8	21	8/8
OwhSV (2)	15	20	12/15	11	28	9/11
SwhV	10	14	7/10	2	5	2/2
OwhV	4	6	4/4	0	0	
Other	0	0		2	5	2/2
TOTAL	72			39		

As shown in TABLE 17, absence of a difference between different types of structures in the conditions with semantic disambiguation replicates the overall pattern of responses, illustrated in TABLES 15 and 16 above. As for the structures with morphological disambiguation, the percentage of structures produced follows exactly the predicted order of difficulty the parser will have when processing *koji* relatives in Serbo-Croatian (cf. number in parentheses at the

left in TABLE 17 illustrate the predicted order of difficulty). Subject relatives with canonical word order (SwhVO) present the least difficulty for children, followed by object relatives with canonical word order (OwhVS), followed by subject relatives with an object in the preverbal position (SwhOV), and finally, the most difficult structure to process was an object relative with a postverbal subject (OwhVS).

An additional analysis was carried out on the basis of correct responses per sentence frame.⁴⁴ TABLE 18 illustrates the item analysis for the conditions with morphological disambiguation.

TABLE 18:

Mean percentage correct responses on the item analysis in four conditions in the kiji repetition experiment, in sentence frames with morphological disambiguation

SwhVO	64	(1)
OwhVS	33	(4)
SwhOV	43	(3)
OwhSV	48	(2)

TABLE 18 shows that the same pattern of responses is present when an item analysis is performed on the conditions with the morphological disambiguation.

To sum up, although the overall numbers do not show any difference between different types of kiji relatives, a closer examination of the data reveals that the results

⁴⁴

The item analysis was performed on the mean percentage of correct responses out of the number of stimulus sentences given. The analysis was done in this way because of unavailability of subject analysis.

qualitatively replicate those from the on-line reading time experiment with adults.

6.3.v Discussion

Child comprehension data suggest that children are sensitive to some of the processing strategies used in the adult grammar. Note that in the adult experiment there was an effect of position in a comparison between the SwhVO and OwhVS relatives, and that SwhOV and OwhSV did not differ significantly. Those findings appear to be replicated in the child repetition experiment. Using the condition with morphological disambiguation as a measure of children's comprehension in the initial stage of processing (cf. Section 6.7.iii), both the percentages of structures produced, as well as mean percentages of correct responses for the SwhVO and OwhVS differ appreciably. For the SwhOV and OwhSV structures, on the other hand, the minimal difference observed is in the predicted direction.

Two points can be made about the observed differences. First, children's performance on different types of koji relatives in Serbo-Croatian parallels adults' performance on the same set of structures, indicating that similar processing strategies are employed both by children and adults. Second, as already discussed for the scrambling repetition experiment, the fact that no clear-cut results were obtained with semantic disambiguation can be explained if children adopt a syntax-first approach, analyzing all the structures as if they were in the canonical word order and not paying attention to semantic information. In short, children ignore semantic cues and adopt a strategy which relies on using syntactic information only. Children are prone to performance errors of this type, as shown in a study of French-speaking children's knowledge of subject and object relatives, in which they consistently misanalyzed

object relatives with postposed subjects as subject relatives, ignoring morphological cues on the relative pronoun (Sheldon 1977).⁴⁵ When another type of disambiguation is introduced, adopting such a strategy would produce a strong mismatch effect in the features on the head noun and the verb in object relatives, resulting in ungrammatical structures. As a ban on violating syntactic rules such as feature checking is a part of their competence grammar, children are forced to resort to adult strategies for sentence comprehension, such as the Active Filler Strategy.

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Note, however, that Sheldon (1977) found that children ignored the case marking on the relative pronoun, whereas the argument advocated here is based on ignoring lexical semantics of the verb. It seems that the effect Sheldon observed is attributable to the Mismatch Effect (Meng and Bader 1996), who observe that stronger garden-path effects arise with verbal information rather than case morphology.

6.4 ŠTO REPETITION EXPERIMENT

6.4.i Materials

Three types of ambiguity were created for this experiment. (67a) and (67b) illustrate a subject and an object relative in the temporarily ambiguous condition. (68a) and (68b) illustrate a subject and an object relative in the completely unambiguous condition. (69a) and (69b) are completely ambiguous between a subject and an object interpretation.

Temporarily Ambiguous

- (67) a. Dečak je sanjao slonče što ga je **uplašilo**.

boy_{Masc} aux dreamt-about elephant_{Neut} that him aux **scared**_{3PastNeut}

The boy had a dream about the elephant that had scared him.

- b. Dečak je sanjao slonče što ga je **video**.

boy_{Masc} aux dreamt-about elephant_{Neut} that him aux **saw**_{3PastMasc}

The boy had a dream about the elephant that he had seen.

Completely Unambiguous

- (68) a. Devojčica beži od dečaka što **ju** je uštinuo.

girl_{Fem} runs-away from boy_{Masc} that **her** aux pinched_{3PastMasc}

The girl is running away from the boy that has pinched her.

- b. Devojčica bež i od dečaka što **ga** je uštinula.

girl_{Fem} runs-away from boy_{Masc} that **him** aux pinched_{3PastFem}

The girl is running away from the boy that she has pinched.

Completely Ambiguous

- (69) a. Deka se rukuje sa dečakom što ga je sreo.

grandpa_{Masc} refl shakes-his-hand with boy_{Masc} that him aux met_{3PastMasc}

The grandpa is shaking hands with the boy that he has met/
that has met him.

- b. Dečak se rukuje sa dekom što ga je sreo.

boy_{Masc} shakes-hands with grandpa_{Masc} that him aux met_{3PastMasc}

The boy is shaking hands with the grandpa that he has met/
that has met him.

In all the conditions ambiguity was created by using nouns with different gender features, which are transmitted to a coreferential resumptive clitic, on one hand, and to the past tense morphology of the verb, on the other. The temporarily ambiguous condition (67 a-b) resembles the conditions used in the on-line experiment. The structure is ambiguous up to the verb, at which point both lexical semantics, as well as the inflectional morphology, disambiguate it. In the completely unambiguous condition (68 a-b), disambiguation is introduced at a very early point, immediately following što, in the form of gender features on the clitic, and is later enhanced by the inflectional morphology on the verb, not allowing for even a local ambiguity to arise. This condition is used to check for a genuine difference in processing complexity between subject and object što relatives. And finally, in the completely ambiguous condition (69 a-b), neither the clitic, nor the semantics nor the inflection of the verb may be used to disambiguate between the two readings. This condition provides a

baseline measure of preference for one structure over another.

6.4.ii Predictions

Based on the predictions and results from the on-line reading experiment with adults, object relatives are generally predicted to be easier than subject relatives irrespective of the type of ambiguity used. As the task used here is an off-line task, only global preferences for one interpretation over another should be observed. There is nonetheless predicted to be a difference in the effect of the processing preference between the completely unambiguous and temporarily ambiguous condition, with the former overruling a strong preference, due to the absence of an ambiguity.

6.4.iii Results

The same set of coding criteria used for analyzing responses in the scrambling and koji experiments was used for the što experiment. The only additional adaptations were that responses in which the clitic was dropped, as is allowed for feminine animate in the past tense in the spoken language, and/or in which the auxiliary was deleted, a tendency present in all the conditions, were coded as correct if no other major structural change was made. TABLE 19 illustrates the overall responses by children in the što repetition experiment.

TABLE 19:
Responses by children in three conditions in the što repetition experiment

	<i>Temporarily Ambiguous</i>				<i>Completely Unambiguous</i>				<i>Completely Ambiguous</i>	
	Subject		Object		Subject		Object			
	N	%	N	%	N	%	N	%	N	%
Correct	17	29	20	35	15	26	21	36	12	21
Clitic drop	0	0	0	0	14	24	4	7	11	19
Aux. deletion	9	16	8	14	5	7	10	17	2	4
Adaptations	25	43	16	28	24	41	22	39	21	36
Incorrect	6	10	11	19	0	0	0	0	9	15
No repetition	1	2	2	4	0	0	1	2	3	5
TOTAL	58		57		58		58		58	

A priori planned comparison, by analyses of variance (ANOVA) on the mean percentage of correct responses for each condition with item as random effect, showed that the difference between subject and object relatives was not significant ($F(1,7) = 0.41$, $p = .5412$).

As shown in TABLE 19, there is a trend towards better performance on object than on subject relatives in both the temporarily ambiguous and completely unambiguous structures. As for adult control subjects, they had 99% correct repetitions in all conditions.

As the presence of clitics plays an important role for the interpretation of što relatives in general, a separate analysis was carried out to examine a possible correlation between clitic drop in children's repetitions and the subject/object asymmetry, on one hand, and auxiliary deletions and the same type of asymmetry, on the other, in the interpretation of the što

relatives. Examples (70) and (71) illustrate clitic drop and auxiliary deletion, respectively.

- (70) *stimulus* Pas beži od devojčice što **ju** je ugrizao.
 dog_{Masc} runs-away from girl_{Fem} that her aux bitten_{3PastMasc}
 The dog is running away from the girl that it has bitten.
- response* pas bježi od devojčice što je ugriz(a)o (CS#6, 5;3)
 dog_{Masc} runs-away from girl_{Fem} that aux bitten_{3PastMasc}
- (71) *stimulus* Kuće reži na dečaka što ga **je** udario.
 puppy_{Neut} barks at boy_{Masc} that him aux hit_{3PastMasc}
 The puppy is barking at the boy that has hit it.
- response* kuće reži na dječaka što ga udario (CS#18, 4;3)
 puppy_{Neut} barks at boy_{Masc} that him hit_{3PastMasc}

As the numbers of clitic drops and auxiliary deletions are very similar for subject and object relatives across all conditions, clitic drop and related phenomena do not play a role in children's processing of što relatives.⁴⁶ A decision was thus made to include both types of

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In the temporarily ambiguous condition, in which both NPs are masculine/neuter animate, clitic drop is disallowed. As shown in TABLE 19, children are fully aware of this rule and did not violate it even once. The cases in which clitic drop (or rather merging with the auxiliary form) occurs are the ones with feminine animate in the past tense, i.e. *ju je* becomes *je*. The examination of sentence frames with this configuration shows that children seemed to apply this spoken language rule equally often to both subject and object relatives. And finally, in some of the sentence frames in the completely unambiguous condition, children preferred to substitute *ju je* (her aux) by *ga je* (him aux) irrespective of pragmatic plausibility, which indirectly suggests that they are trying to avoid using the former configuration as much as possible, as it is also reported

changes to the original structures under correct responses. TABLE 20 illustrates percentage scorable responses, with incorrect and no repetitions excluded from the tabulation.⁴⁷

TABLE 20:
Percentage correct scorable responses by children in three conditions
in the što repetition experiment

	<i>Temp. Ambiguous</i>		<i>Comp. Unambiguous</i>		<i>Completely Ambiguous</i>
	Subject	Object	Subject	Object	
Correct	39	48	41	51	43
Adaptations	61	52	59	49	57

As shown above, results from the repetition experiment with children confirm the predictions

to be avoided in adult speech.

As for auxiliary deletion, children dropped it equally often in both subject and object relatives. The numbers in TABLE 19 for the completely unambiguous condition should be interpreted with caution as they also involve sentence frames in which feminine clitic drop is allowed, and one type of omission automatically overrules another. A separate analysis revealed that auxiliary deletion did not play any role in relative clause interpretation. Furthermore, this preference for auxiliary deletion in the child grammar of Serbo-Croatian has not, to my knowledge, been discussed in the literature. As the main verb is already marked for number and gender features, the presence of the auxiliary is superfluous in these structures and does not enhance communication in any way, as evidenced by other Slavic languages, e.g. Russian, which have similar verbal morphology and no auxiliaries. What Serbo-Croatian children seem to be doing is pushing a language change which has already taken place in some other related languages. Although this in itself is a very interesting problem to look at, it will not receive any further attention in the thesis as it is not directly related to the processing issues.

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A subject analysis reveals that subject contribution to correct responses is evenly distributed across the subjects in both types of relatives tested (nSubjects/nCorrect responses: Temporarily ambiguous: subject relatives: 18/20, object relatives: 15/21; Completely unambiguous: subject relatives: 16/24, object relatives 19/29; Completely ambiguous: 15/19).

made by the AFS, showing that there is an important trend towards the preference for object interpretation of što relatives in Serbo-Croatian.

6.4.iv Descriptive accounts of the most frequent adaptations

As shown in the Tables 19 and 20 above, children generally had more difficulty with subject than object što relatives. The aim of this section is to examine some of the most frequent errors, and their possible correlation to the subject/object asymmetry discussed above.

1. što: relative complementizer --> zato što: causal complementizer

Children often substitute the relative complementizer što by the causal complementizer zato što, as illustrated in the example (72) below.

(72) <i>stimulus</i>	Pas beži od devojčice <u>što</u> ga je tukla.
	dog _{Masc} runs-away from girl _{Fem} that him aux beat _{3PastFem}
	The dog is running away from the girl that has beaten it.
<i>response</i>	pas bježi od djevojčice <u>zato što</u> ga je tukla (CS#16, 5;6)
	dog _{Masc} runs-away from girl _{FemFe} because him aux beat _{3PastFem}
	The dog is running away from the girl because she has beaten it.

Although children sometimes interpret relative clause as an adjunct clause, they do this equally often for both subject and object relatives in all conditions tested. Since the complementizer što in Serbo-Croatian is used for factive complements only, and as restrictive relatives are factive (cf. Section 4.1.i), conversion of the function of što into its original one

(causal/factive complementizer) in child grammar does not come as a surprise. The number of these types of responses is evenly distributed across subjects, as well as items/conditions tested.⁴⁸

2. što: relative complementizer --> koji: relative pronoun

Example (73) illustrates substitution of što by koji, bearing the appropriate case morphology.

(73) <i>stimulus</i>	Maca se igra sa dečakom <u>što</u> ga je liznula.
	cat _{Fem} refl plays with boy _{Masc} that him aux licked _{3PastFem}
	The cat is playing with the boy that it has licked.
<i>response</i>	maca se igra sa desakom <u>koga</u> je liznila (CS#23, 4;8)
	cat _{Fem} refl plays with boy _{Masc} whom aux licked _{3PastFem}
	The cat is playing with the boy whom it has licked.

Complementizer što is substituted by the relative pronoun koji 12 times in 289 utterances, 7 times in subject and 9 times in object relatives. Given that the number of these changes is very low and evenly distributed in both subject and object relatives, this type of change plays no role in subject/object asymmetry in što relatives and may be attributed to some children's preference for koji over što relatives.

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Subject relatives had 9 and 11 responses of this type, object relatives had 6 and 13 responses, in the temporarily ambiguous and completely unambiguous condition, respectively. For the completely ambiguous condition, 5 responses in each condition were of this type.

3. Grammatical function reversal

Another interesting question is whether a predicted processing difficulty in subject relatives is correlated with consistent conversion of subject into object relatives. Example (74) illustrates an object relative converted into a subject relative (despite pragmatic implausibility), and (75) is an example of a subject relative converted into an object relative.

- (74) *stimulus* Pas beži od devojčice što **ju** je ugrizao.
 dog_{Masc} runs-away from girl_{Fem} that **her** aux bitten_{3PastMasc}
 The dog is running away from the girl that it has bitten.
- response* pas beži od devojčice što **ga** je ugrizla (CS#27, 4;10)
 dog_{Masc} runs-away from girl_{Fem} that **him** aux bitten_{3PastFem}
 The dog is running away from the girl that has bitten it.
- (75) *stimulus* Kuće reži na dečaka što **ga** je udario.
 puppy_{Neut} barks at boy_{Masc} that **him** aux hit_{3PastMasc}
 The puppy is barking at the boy that has hit him.
- response* kuće reži na dečaka što **ga** je udarilo (CS#27, 4;10)
 puppy_{Neut} barks at boy_{Masc} that **him** aux hit_{3PastNeut}
 The puppy is barking at the boy that it has hit.

TABLE 21 illustrates total number of responses classified according to the grammatical function of the head noun, i.e. conversions of subject into object relatives, and vice versa for each type of ambiguity created.

TABLE 21:
Total number of responses classified
according to the grammatical function of the head noun

<i>Temporarily Ambiguous</i>		<i>Completely Unambiguous</i>		<i>Completely Ambiguous</i>	
Subject	Object	Subject	Object	Subject	Object
36	33	36	40	3	1

As illustrated in TABLE 21, the results show no consistent preference in interpretation when all responses are collapsed together.

4. The role of [+/-] human feature of the head noun

A post hoc analysis revealed that there was a confounding factor in the design, i.e. [+/-] human feature on the head noun.⁴⁹ TABLE 22 illustrates the responses when sentences are

⁴⁹

Out of 20 animate nouns used, 6 were [-human] and 14 were [+human]. To create the ambiguity in the temporarily ambiguous condition it was necessary to have two nouns distinct in the [+/-human] feature, and similarly it was crucial to have both nouns with the same [+/-human] feature in the completely ambiguous condition. Some freedom with respect to this factor was allowed in the completely unambiguous condition only.

classified according to the [+/-] human feature on the head noun.

TABLE 22:

Percentage correct responses by children in the sto repetition experiment,
classified according to the [+/-] human feature
on the main clause subject (NP1) and the head noun (NP2)

<i>Temporarily Ambiguous</i>	<i>Subject</i>	<i>Object</i>
NP1[+human] NP2[-human]	28	57
NP1[-human] NP2[+human]	41	17
<i>Completely Unambiguous</i>		
NP1[+human] NP2[+human]	38	57
NP1[-human] NP2[+human]	45	41

As shown in TABLE 22, parsing decisions are influenced by other preferences. Human subjects take precedence over nonhuman ones, which is illustrated by better performance on subject than on object relatives in both conditions when the head noun is human. When the [+/-] human feature is balanced, all other things being equal, better performance on object than on subject relatives (57% as compared to 38% in the completely unambiguous condition) can be explained under a processing account only.

5. Summary:

As most of the changes to the original sentences are evenly distributed in both subject and object relatives in all conditions tested, preference for object interpretation may not be attributed to non-processing factors.

6.4.v Discussion

The results from the child repetition experiment on što relatives qualitatively replicate those from a similar on-line reading time experiment with adults. Child subjects generally have more difficulty with subject than object što relatives irrespective of the presence/absence of an ambiguity. The observed trend towards a preference for object interpretation of što relatives is predicted by some parsing strategies operative in adult languages, specifically the AFS.

Additionally, an interesting question raised by this experiment is the role of ambiguity in establishing initial parsing preferences. Note that an object preference was observed in both the temporarily ambiguous and completely unambiguous conditions. This effect is not predicted by the AFS but is expected under any other non-ambiguity resolution strategy, such as the Cost of Wh-Movement and the SPLT. Given the reservations about the SPLT based on the contradictory predictions it makes about the processing of što relatives in general (cf. Section 5.4.) and the fact that this experiment was not designed to address the role of ambiguity per se, this issue will be left for future work.

Finally, the results from this experiment suggest that certain types of semantic information influence general parsing preferences. Note that in the adult on-line reading experiment on što relatives, animacy of the noun influenced to some extent the functional role assigned to that noun. Furthermore, Dutch experiments on wh-relatives also suggest that there is a correlation between the animacy of the noun and the theta role assigned to it (Mak et al. 1999). Animate nouns prefer subject roles, and inanimate nouns are more often interpreted as objects. Those semantic preferences have also been observed to play a role

in children's comprehension of relative clauses. Goodluck and Tavakolian (1982) note that error rates for children on the act-out experiments jump if the object nouns in the relative clauses are animate (subjects nouns were held animate throughout the design). One of their experiments was designed primarily to examine the role that the animacy of the direct object plays in children's comprehension of relative clauses. Their results indicated that performance on subject relatives improved with inanimate objects, as opposed to animate objects. Goodluck and Tavakolian (1982) attribute the higher rate of errors for relative clauses with animate objects to an increase in processing load imposed by this semantic confound. In summary, the Dutch, English and Serbo-Croatian data indicate that, first, animacy does to a certain degree affect syntactic processing, and second, that the effects observed are a part of both the adult and child processing mechanism.

The preference observed in the što repetition experiment with children is more subtle in nature. In each condition both nouns are animate, and they differ only in being human or non-human. Children's performance suggests that human nouns favour subjects, and non-human nouns favour object roles. Note, however, that this general preference for animate over inanimate subjects, on one hand, and human over non-human subjects, on the other, did not overrule the use of the parsing strategies, e.g. the AFS, in either the adult or the child experiment. When the animacy/human feature is balanced, Serbo-Croatian speakers prefer object over subject što relatives. For adults this preference is statistically significant. Absence of a stronger effect for children, as opposed to just a trend in the predicted direction, is accounted for by the presence of this semantic confound. Not only are both nouns animate, which in itself favours the subject interpretation, but half of them are also human, additionally

obscuring a preference for object interpretation observed in the adult experiment. Given all the facts discussed above, it may be argued that children do not differ qualitatively from adults in their comprehension of što relatives in Serbo-Croatian.

6.5 ŠTO ACT-OUT EXPERIMENT

6.5.i Procedure

Subjects were asked to act-out with toys the meaning of the sentences read out aloud.

6.5.ii **Subjects:** 33 children aged four and five.

6.5.iii **Materials:** Exactly the same as the conditions in the repetition experiment, with three types of conditions created: temporarily ambiguous (76 a-b), completely unambiguous (77 a-b) and completely ambiguous (78 a-b).

Temporarily ambiguous

(76) a. Mače se krije iza dečaka što ga je pomilovao.

kitten_{Neut} refl hides behind boy_{Masc} that him aux stroked_{3PastMasc}

The kitten is hiding behind the boy that has stroked it.

b. Mače se krije od dečaka što ga je ogreblo.

kitten_{Neut} refl hides from boy_{Masc} that him aux scratched_{3PastNeut}

The kitten is hiding from the boy that it has scratched.

Completely unambiguous

- (77) a. Devojčica se krije od kučeta što ju je uplašilo.

girl_{Fem} ref hides from puppy_{Neut} that her aux scared_{3PastNeut}

The girl is hiding from the puppy that has scared her.

- b. Devojčica se krije od kučeta što ga je uštinula.

girl_{Fem} refl hides from puppy_{Neut} that him aux pinched_{3PastFem}

The girl is hiding from the puppy that she has pinched.

Completely ambiguous

- (78) a. Kuće beži od mačeta što ga je uštinulo.

puppy_{Neut} runs away-from kitten_{Neut} that him aux pinched_{3PastNeut}

The puppy is running away from the kitten that it has pinched/
that has pinched it.

- b. Mače beži od kučeta što ga je uštinulo.

kitten_{Neut} runs away-from puppy_{Neut} that him aux pinched_{3PastNeut}

The kitten is running away from the puppy that it has pinched/
that has pinched it.

6.5.iv Results

An ANOVA was carried out based on the mean percentage of correct responses for each condition in each sentence frame. Subject and object relatives did not differ significantly in any of the ambiguity conditions.

TABLE 23 illustrates the overall results from the act-out experiment on children's

comprehension of subject and object što relatives in Serbo-Croatian.

TABLE 23:
Percentages responses on the act-out of što relatives

Type	<i>Tempor. Amb.</i>			<i>Completely Unamb.</i>			<i>Completely Amb.</i>		
	Subj.	Obj.	Other	Subj.	Obj.	Other	Subj.	Obj.	Other
Subject	82	20	8	74	22	4			
							48	48	4
Object	24	69	7	29	65	6			

An ANOVA with items as random effects revealed no significant difference between subject and object relatives ($F(1,5)=1.03$, $p=.3563$).

For adult subjects performance on subject and object što relatives did not differ substantially.

As illustrated in TABLE 23 above, on the act-out task child subjects did not show a predicted difference in performance between subject and object relatives in any of the conditions tested. Furthermore, children even seem to favour subject over object relatives, contrary to the predictions made and findings from previous studies.

6.5.v Discussion

The results from the act-out experiment are surprising when compared to both the results from the child repetition experiment as well as to the adult on-line reading time experiment. Furthermore, the discrepancy in findings between this particular act-out task and the Goodluck and Stojanović (1996) act-out task has to receive an account. Let us first compare

the conditions and the results from the two act-out tasks, and then examine the difference in performance on the što act-out and repetition tasks.

As already discussed in Section 4.5., Goodluck and Stojanović (1996) found that children, four to six years of age, performed worse on subject than on object što relatives across all age groups tested. Test sentences used are illustrated by (79) and (80) below.

- (79) Sanja vidi medveda što e jaše tigra.

Sanja_{Fem} sees bear_{Masc} that rides tiger_{MascAcc}

Sanja sees the bear that is riding the tiger.

- (80) Saša vidi kravu što je ovca gura.

Sasha_{Masc} sees cow_{Fem} that her_{Fem} sheep_{FemNom} pushes

Sasha sees the cow that the sheep pushes.

Note that the 1996 act-out task was designed primarily with acquisition rather than processing issues in mind, so these data may only be interpreted as a trend in the predicted direction. Still, a significant difference in performance on subject and object relatives ($t=1.686, p<.05$) suggests that this experiment has to a some degree tapped children's sensitivity to certain parsing strategies. A number of potential factors that may have caused a difference in performance on the two tasks are outlined below.

First, children prefer overt binders to gaps. Under the assumption that overt elements induce less of a processing cost than empty categories, the presence of a trace in the subject relative, as opposed to an overt binder in the object relative, makes the latter more

accessible to children. Several elicited production studies have shown that children tend to produce resumptive pronouns in relative clauses, a strategy disallowed in the adult grammar (Labelle 1991, Fragman 1998, Goodluck and Stojanović 1996). Because in the što act-out experiment in this study a resumptive clitic pronoun is present in both subject and object relatives, a simple strategy based on preference for overt over empty categories cannot be used, in the way it could be used in the Goodluck and Stojanović (1996) experiment.

Second, in the 1996 experiment all object relatives had overt subjects. If children are looking for an overt NP in the subject position in the object relative, and if none is present, they adopt the subject analysis, ignoring the other cues, such as inflectional morphology and lexical information on the verb. Such a strategy would account for consistently better performance on subject than object relatives in the što act-out experiment, as both structures had an empty element in the subject position, trace and pro, respectively.

Third, children prefer subject to object relatives across the board, as evidenced by their tendency to convert potential object relatives into subject relatives, and not vice versa (Fragman 1998, Goodluck and Stojanović 1996, Ling 1999). The possibility of subject interpretation for object relatives in the 1996 act-out study was ruled out by the nonmatching gender and human features of the possible antecedent and the head noun, so this option was excluded altogether.⁵⁰

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The subject preference observed in the što act-out task could be explained under a frequency/tuning account. Subject što relatives are much more frequent than the object ones. In the adult written language of Serbo-Croatian (newspaper articles), out of the 2145 relatives I found, only 9 were što relatives, 7 subject and 2 object. In the spontaneous speech of two girls aged 2;4-3;10 and 2;6-3;10, there was a predominant use of što

Fourth, generally speaking, in the 1996 test sentences filler-gap binding and interpretation represent one operation, while in the new sentences they are distinct: the parser has to, first, analyze the functional role of the binder (subject/object) and then interpret the clitic/pro in relation to the whole sentence, going back to the sentence initial NP as a possible referent. This did not exist in the old conditions since the initial NP was always distinct in gender to prevent possible coreference. Cognitively, then, new structures are much more complex for children than the old ones.

Moreover, the cognitive complexity of the structures was matched by additional procedural demands. In the 1996 act-out the main clause was a fixed frame, which did not have to be interpreted. In the new act-out the main clause differed from one sentence frame to another, and more importantly, subjects were required to act-out both the main clause and the relative clause. Cognitive complexity and additional procedural steps have affected children's ability to perform successfully on this task.

In conclusion, a trend towards the preference for subject interpretation of što observed on the act-out task does not, it may be argued, reflect a processing strategy used by the child parsing mechanism. A combination of factors, especially cognitive complexity of structures and additional procedural steps involved, forces child subjects to resort to an

relatives, 10 of which were subject relatives and 5 of which were the object ones. And finally, in the Goodluck and Stojanović (1996) elicited production experiment, subject što relatives were produced much more often than any other type across all age groups tested.

If the tuning analysis is adopted, one would have to account for the absence of comparable effects in both the child repetition experiment as well as the adult on-line reading experiment. It seems that children will resort to a strategy based on frequency only when faced with additional computational demands that their cognitive system is incapable of handling.

interpretative preference which ignores language specific properties of što relatives. The results from the act-out thus do not argue against the use of the AFS, but rather obscure its application due to the factors discussed above.

6.7 GENERAL DISCUSSION

6.7.i Summary of Results

The results from the repetition and the act-out task with children are summarized below.

Repetition experiment

- scrambling experiment
 - a. better performance on SVO than on any other structure (OVS, SOV, OSV).
 - b. almost no difference between the three other structures.
 - c. a significant difference in performance between SOV and OSV in the morphological condition.
- koji experiment
 - a. a significant difference in performance between SwhVO and OwHVS in the morphological condition.
 - b. similar performance on SwhOV and OwHVS in both conditions.
- što experiment
 - a. better performance on object than on subject relatives.
 - b. object preference somewhat obscured by the preference for [+animate/+human] subjects.

Act-out experiment

- better performance on subject than object što relatives.

Generally speaking, apart from the results from the act-out experiment, the data

from other three experiments replicate the findings from the on-line experiments with adults. Children seem to follow similar parsing strategies as adults, and the difference between the two groups of subjects is a quantitative, not a qualitative one.

6.7.ii Discussion

A comparison of the results from a number of experiments testing the processing of filler-gap dependencies in the adult and child grammar of Serbo-Croatian reveals that there are no substantial differences between the two groups of subjects. Children show sensitivity to the parsing strategies operative in adult grammar, particularly the AFS. Where children and adults differ, it will be argued, is in their capacity to handle an increase in demands upon working memory, and as well as an increase in cognitive complexity. Child performance on the experiments discussed above indicates that although child processing resources are depleted, child and adult processors are identical. Children and adults make similar parsing decisions in resolving potential problems that would slow down parsing. As they seem to resort to the same set of parsing principles, there is no motivation to suppose that their parsing mechanisms are substantially different in nature. The differences observed are attributable to a number of additional problems children are faced with. First, as their processing operates within a still developing grammar, acquisition principles are interacting with processing principles. Second, the child cognitive system has not fully developed yet, thus a reduction in ability to handle cognitive complexity is expected. Third, the working memory capacity of children is reduced in comparison to that of adults. And finally, as children are prone to making different types of performance errors caused by a number of

factors, e.g. a shorter attention span, their success rates are predicted to differ from those of adults. All of the factors outlined above suggest that children, since lacking some of the resources available to adults, sometimes resort to other strategies to handle additional demands placed upon their cognitive system, which somewhat obscures their performance. Yet they are both sensitive to and actively use some universal parsing strategies operative not only in their language, but also in other languages worldwide.

6.7.iii Disambiguation cues and levels of processing

The results from both the adult and child experiments on the processing of Serbo-Croatian, as well as a number of other languages, indicate that different disambiguation cues vary in strength from language to language, and also in the degree to which their presence influences syntactic processing. In brief, animacy has been shown to affect syntactic processing of declarative sentences in Dutch and German, as well as the processing of što relatives in Serbo-Croatian (Mak et al. 1999, Kempe and MacWhinney 1999). Different morphosyntactic cues, such as case-marking on the noun and inflectional morphology on the verb, have also been found to play a role in sentence processing (Kaan 1997, Meng and Bader 1996, among others). Several proposals have been made in the literature about the difference in strength between particular cues, formulated as the Mismatch Effect (Meng and Bader 1996), or based on the crosslinguistic variation in cue reliability and validity (The Competition Model: Kempe and MacWhinney 1999), or derived from the interaction of the position of the disambiguating segment and its relative strength (Kaan 1997, Mak et al. 1999, Schlesewsky et al. 1996). Although some of these proposals have addressed the issue of the interaction between

syntactic and another level processing, no attempt was made to, first, unify different non-syntactic factors, and more importantly, to account for the effects observed within a more general model of sentence processing. By adopting a processing model along the lines of Forster's (1979) approach to the levels of processing, some of these phenomena will receive a unified theoretically-motivated account.

The model is comprised of a number of linearly ordered and autonomous levels of processing, each of which accepts input from only one level, and feeds its output onto the next level. The model is divided into three main subcomponents: lexical, syntactic and message level processing. Let us assume that lexical processing is not only responsible for accessing lexical items, but also for accessing a set of features carried with those items from the lexicon. Not only would this account for immediate access to certain inherent semantic properties, such as animacy, but it would also enable the parser to compute the relevant phi-features and other morphosyntactic properties, as lexical items are derived fully-inflected from the lexicon (Chomsky 1995). Pure syntactic processing would involve syntactic chunking in the sense of locally bound syntactic operations, such as wh-movement. Both of these modules represent an initial stage of processing, which feeds into a sentence-level processing, in which syntactic units are integrated into a sentential representation and pragmatic plausibility of the sentence is verified.

Let us now examine possible extensions of the proposed model to the data discussed above. Animacy features, together with other properties that are related to the probability of agentivity, are specified in the semantic feature matrix for each lexical item, and are passed onto the syntactic processor. By the same definition, phi-features are accessed immediately

and computed in the syntactic derivation. Although the difference in strength between semantically-based and morphosyntactically-determined factors is derived from independent considerations, the role they play in the processing is the same. They may compete with one another, such as lexical versus morphological case in German, or one may override the other, such as case morphology overriding animacy in Russian, but they do not necessarily affect the syntactic processing to any marked degree. Note that the results from the Serbo-Croatian experiments indicate that syntactic parsing operates irrespective of the presence of potentially confounding factors, such as animacy. Furthermore, the presence of certain other factors, such as subject-verb agreement, speeds up processing, as indicated by a stronger effect of a syntactic contrast in the morphological condition in both the scrambling and the koi repetition experiments with children.

The absence of such effects for the semantic condition, on the other hand, is easily accounted for under the proposed model. Sentence level processing, which primarily involves checking the semantic and pragmatic plausibility and passing the message onto the more general output level, is not performed on the initial parse. As it belongs to a "deeper" level processing, syntactic contrasts created in the semantic condition could not have been successfully tapped for the child subjects. Note that adults did not have problems with this processing stage, as evidenced by garden-path effects on different structures in the on-line experiments, in which only semantic disambiguation cue was used.

In conclusion, as the model proposed above allows for a certain degree of interaction between the lexical and syntactic processors, it is capable of accounting for the effects of animacy on functional role assignment in on-line sentence comprehension.

Nonetheless, the data from the Serbo-Croatian experiments indicate that purely syntactic parsing strategies, such as the AFS, are necessary, and cannot be replaced by factors such as animacy. Furthermore, absence of strong effects for the semantic condition argues for the postulation of two levels of processing, syntactic and semantic, with the latter one not so easily accessible in the cases of an increased processing difficulty, as observed with child subjects.

6.7.iv Što act-out and repetition experiments

One question that may be raised is whether there is an ideal off-line task that would tap children's processing. The findings from the repetition experiment with children replicate the results from the on-line experiment with adults. The act-out task, on the other hand, showed a trend in the opposite direction. Thus the observed difference in results may be to a certain degree attributed to different methodologies used. Although both repetition and act-out are comprehension tasks, performance on the two tasks may be affected by other factors. Saddy (1982) reports that an aphasic patient did much worse on the act-out task than on the sentence picture matching task, both of which tested the comprehension of subject and object relatives. Putting aside the specifics of the sentence picture matching task and problems it is associated with, let us concentrate on additional demands involved in the act-out task, as opposed to other comprehension tasks. Saddy (1982) argues that because the act-out task requires the subject to keep the representation of the sentence in working memory longer than the sentence picture matching task, a short term memory deficit will influence subjects' performance on the act-out. More importantly, in the act-out subjects not only have to plan

the actions described in the sentence, but they also have to perform them, so this task involves additional procedural steps. It could thus be argued that the act-out task involves other abilities, apart from the comprehension of the sentence, whereas other tasks, such as repetition, access syntactic processing only.⁵¹

The difference in performance between repetition and act-out task can be captured by the model of processing discussed above. Repetition and act-out access both levels of processing, but repetition task is not so much affected by sentence-level processing in the way act-out is. As the act-out requires the subjects to perform the actions depicted in the sentence, syntactic units have to be integrated for the sentence to receive a full interpretation. This integration is relatively cost-free in the cases where no additional cognitive or procedural demands are placed upon the processor.⁵² If, however, those demands exceed

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Some anecdotal evidence seem to indicate that children occasionally have more problems with the act-out than other comprehension tasks. Smoczyńska (in Slobin 1985) reports that a three-year-old subject was able to repeat all relative clauses presented with but could not act them out. Similarly, in the study of the acquisition of relative clauses in Serbo-Croatian, a four-year-old subject performed 100% correct on a question response testing the knowledge of long-distance binding in *wh*-questions, but was unable to act-out any of the relative clauses (Kudra 1994, Goodluck and Stojanović 1996).

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Further support for the argument that performance errors on the act-out task are caused by additional demands imposed upon the subjects comes from the examination of potential priming effects between the two tasks. The analysis reveals that there indeed was a priming effect. Namely, performance on subject *što* relatives was not affected by the order of presentation of the two tasks (Subject relatives: Temporarily ambiguous condition: act-out first: 80% correct, act-out second: 82% correct; Completely unambiguous: act-out first: 73% correct, act-out second: 75% correct). As for object *što* relatives, subjects who received the act-out after the repetition showed a better performance on object relatives in all conditions than the subjects who received the act-out first. (Object relatives: Temporarily ambiguous condition: act-out first: 65% correct, act-out second: 72%

what that the processor is capable of handling, subjects resort to different strategies in an attempt to avoid processing break-down. It may thus be argued that the level tapped by different experimental tasks depends to a certain degree on the complexity of the material. The complex materials in the new act-out, compared to simpler materials in the 1996 experiment, may have prevented the processor from accessing sentence-level processing, resulting in a processing-break down at this level of representation. In conclusion, any future debate should move away from the questions about superiority of one task over another, and concentrate more on issues involved in tapping different levels of processing within a general model of sentence comprehension.

correct; Completely unambiguous: act-out first: 53% correct, act-out second: 69% correct) .

7 CONCLUDING REMARKS

This thesis has presented a number of on-line and off-line experiments testing adults' and children's comprehension of various types of dependencies in Serbo-Croatian. The experiments were primarily designed to test the use of the Active Filler Strategy in the language. The results from the on-line reading time experiments with adults indicate that the AFS is actively used in the processing of both the wh-filler-gap dependencies, as well as operator-variable chains in relative clauses. Moreover, the object preference observed in the processing of što relatives is attributed to syntactic parsing strategies, such as the AFS, and is not easily explainable under any other approach. The preference for subject interpretation found in all the other languages previously tested is thus not reducible to a crosslinguistic subject preference, but is based on the processing considerations built into a general model of sentence comprehension. The results from the adult experiments thus strongly support the view that the human sentence parsing mechanism operates within a set of universal parsing strategies, into which language-specific properties can be easily accommodated.

Child processing mechanism, as it has been argued, is not qualitatively different from that of adults. The findings from the experiments with children are not so clear-cut as those for adults, yet they suggest that children operate with a similar set of parsing strategies. Absence of stronger results for children is partially due to the methodological decisions made, in conjunction with a general reduction in the processing capacity, which sometimes prevents the child processor from accessing deeper levels of processing, at which a number of additional computations are performed. The child processing mechanism is nevertheless argued to be a part of the general human sentence parsing mechanism, only quantitatively

different from that of adults.

This thesis has also raised a number of interesting questions that it did not initially set out to address. First, the role of ambiguity, one of the central issues involved in the formulation of the AFS, as well as any other ambiguity resolution strategy, needs to receive much closer examination. Some of the results from the child experiments question whether ambiguity does indeed play such a role as predicted by the AFS. Preference for a certain interpretation irrespective of the presence of ambiguity is predictable under the SPLT. As already mentioned, the experiments in this thesis were designed and conducted before the SPLT was formulated, and thus may not be interpreted as evidence for or against the SPLT. Any future work that will aim to choose between the different theories of filler-gap dependency processing will have to incorporate a number of important issues, such as presence/absence of ambiguity, overt/empty categories, and crosslinguistic as well as language-specific properties, into an experimental design.

The second question that was raised throughout the thesis is related to semantic properties of certain theta roles, and the effect those semantic links have on both the initial parsing decisions as well as general parsing preferences. Although it has been observed that there is a certain degree of interaction of semantic pairing between animacy features and theta roles, on one hand, and parsing preferences, on the other, the evidence presented still argues for the syntax-first approach to sentence processing. Interpretative preferences for assigning theta roles based on semantic properties of noun phrases do not replace purely syntactic parsing strategies, such as the AFS. Careful manipulation of a number of factors, such as different theta roles as opposed to different functional roles, animacy and other semantic

features, predictions based on processing strategies as opposed to both crosslinguistic preferences and semantic preferences, among others, would reveal not only the degree to which semantic properties affect syntactic parsing, but also the level at which this type of semantic information is factored in. Likewise, different types of morphosyntactic cues have also been found to affect sentence processing. A systematic study of different disambiguation cues will reveal the degree of strength each of them has in on-line comprehension, but is not expected to significantly affect the way in which the human sentence parsing mechanism is organized. In summary, it has been argued throughout the thesis that although there is a certain degree of interaction, neither semantic properties, such as animacy, nor morphosyntactic features, such as morphological case, are capable of fully replacing syntactic parsing strategies.

And finally, future studies with children will have to be designed in such a way that potentially confounding factors observed in the previous work are eliminated, or at least controlled for. A follow-up study with 20 child subjects was carried out in which slightly modified, but not significantly different materials from the ones created for the repetition and act-out experiments were used. The only important difference was that the age of the subjects tested was lowered to four years (mean age 4;0). The results showed that subjects as young as four are incapable of performing on these tasks, with their performance at a chance level on both the repetition and the act-out. An important implication of these results is that for a task to successfully tap comprehension in children, additional complexity of the materials, including both the cognitive complexity as well as procedural demands, have first to be eliminated, and only then will it be possible to carefully examine the different stages through

which the child processor is transformed into a more general human sentence parsing mechanism.

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APPENDIX 1

Materials for the scrambling and koji on-line reading time experiments

(1)

declaratives

- a. Mnogim ljudima / već odavno u tuđini / čini se / da im je / novi dom */ zamenio */ stari zavičaj */ u potpunosti*. (SVO)
"to many people / living abroad for a long time / it seems / that to them has / new home / replaced / old homeland / completely"
(To many people living abroad for a long time it seems that new home has replaced their old homeland completely.)
- b. Mnogim ljudima / već odavno u tuđini / čini se / da im je / novi dom */ stari zavičaj */ zamenio */ u potpunosti*. (SOV)
- c. Mnogim ljudima / već odavno u tuđini / čini se / da im je / stari zavičaj */ novi dom */ zamenio */ u potpunosti*. (OSV)
- d. Mnogim ljudima / već odavno u tuđini / čini se / da im je / stari zavičaj */ zamenio */ novi dom */ u potpunosti*. (OVS)

relatives

- i. Porodica Pavlović / uživa / u novom domu / koji im je */ zamenio */ stari zavičaj */ u potpunosti*. (S wh V O)
"the Pavlović family / enjoys / in new home / which to them has / replaced / old homeland / completely"
(The Pavlović family enjoys the new home which has replaced their old homeland completely.)
- ii. Porodica Pavlović / uživa / u novom domu / koji im je */ stari zavičaj */ zamenio */ u potpunosti*. (S wh O V)
- iii. Porodica Pavlović / uživa / u starom zavičaju / koji im je */ novi dom */ zamenio */ u potpunosti*. (O wh S V)
- iv. Porodica Pavlović / uživa / u starom zavičaju / koji im je */ zamenio */ novi dom */ u potpunosti*. (O wh V S)

(2)

declaratives

- a. Njegov pragmatični otac / ne veruje u to / da će mu / lično obrazovanje */ doneti */ materijalno blagostanje */ bez obzira gde živi*. (SVO)
"his pragmatic father / does not believe in that / that will him / personal education / bring/ financial security / no matter where he lives"
(His pragmatic father does not believe that personal education will bring him financial security no matter where he lives.)
- b. Njegov pragmatični otac / ne veruje u to / da će mu / lično obrazovanje */ materijalno blagostanje */ doneti */ bez obzira gde živi*. (SOV)
- c. Njegov pragmatični otac / ne veruje u to / da će mu / materijalno blagostanje */ lično obrazovanje */ doneti */ bez obzira gde živi*. (OSV)
- d. Njegov pragmatični otac / ne veruje u to / da će mu / materijalno blagostanje */

doneti */ lično obrazovanje */ bez obzira gde živi*. (OVS)

relatives

- i. Uvek će moći računati / na lično obrazovanje / koje će mu */ doneti */ materijalno blagostanje */ bez obzira gde živi*. (S wh V O)
"always will be able to count / on personal education / which will him / bring / financial security / no matter where he lives"
(He will always be able to count on personal education which will bring him financial security no matter where he lives.)
- ii. Uvek će moći računati / na lično obrazovanje / koje će mu */ materijalno blagostanje */ doneti */ bez obzira gde živi*. (S wh O V)
- iii. Uvek će moći računati / na materijalno blagostanje / koje će mu */ lično obrazovanje */ doneti */ bez obzira gde živi*. (O wh S V)
- iv. Uvek će moći računati / na materijalno blagostanje / koje će mu */ doneti */ lično obrazovanje */ bez obzira gde živi*. (O wh V S)

(3)

declaratives

- a. Svi u sudnici / su ostali zapanjeni / shvativši / da je / neočekivan odgovor* / promenio */ optuženikov iskaz */ iz korena*. (SVO)
"everybody in courtroom / have remained shocked / having realized / that has / unexpected answer / changed / defendant's statement / radically"
(Everybody in the courtroom was shocked having realized that unexpected answer has changed defendant's statement radically.)
- b. Svi u sudnici / su ostali zapanjeni / shvativši / da je / neočekivan odgovor* / optuženikov iskaz */ promenio */ iz korena*. (SOV)
- c. Svi u sudnici / su ostali zapanjeni / shvativši / da je / optuženikov iskaz* / neočekivan odgovor* / promenio */ iz korena*. (OSV)
- d. Svi u sudnici / su ostali zapanjeni / shvativši / da je / optuženikov iskaz */ promenio */ neočekivan odgovor */ iz korena*. (OVS)

relatives

- i. Porota će se / još dugo sećati / neočekivanog odgovora / koji je* / promenio */ optuženikov iskaz */ iz korena*. (S wh V O)
"the jury will refl / long remember / unexpected answer / which has / changed / defendant's statement / radically"
(The jury will remember for a long time unexpected answer which has changed defendant's statement radically.)
- ii. Porota će se / još dugo sećati / neočekivanog odgovora / koji je */ optuženikov iskaz */ promenio */ iz korena*. (S wh O V)
- iii. Porota će se / još dugo sećati / optuženikovog iskaza / koji je */ neočekivan odgovor */ promenio */ iz korena*. (O wh S V)
- iv. Porota će se / još dugo sećati / optuženikovog iskaza / koji je* / neočekivan odgovor* / promenio */ iz korena*. (O wh V S)

(4)

declaratives

- a. Upravo je objavljena / najnovija studija o tome / kako je / malo pleme */ sačuvalo */ staroslovensko ime */ sve do današnjeg dana*. (SVO)
"just was published / latest study about / how has / small tribe / kept / oldslavonic name / all until present day"
(A latest study was just published about how small tribe has kept oldslavonic name all until the present day.)
- b. Upravo je objavljena / najnovija studija o tome / kako je / malo pleme */ staroslovensko ime */ sačuvalo */ sve do današnjeg dana*. (SOV)
- c. Upravo je objavljena / najnovija studija o tome / kako je / staroslovensko ime */ malo pleme */ sačuvalo */ sve do današnjeg dana*. (OSV)
- d. Upravo je objavljena / najnovija studija o tome / kako je / staroslovensko ime */ sačuvalo */ malo pleme */ sve do današnjeg dana*. (OVS)

relatives

- i. S kolena na koleno / se prenosi priča / o malom plemenu / koje je */ sačuvalo */ staroslovensko ime */ sačuvalo */ sve do današnjeg dana*. (S wh V O)
"from one generation to another / refl told story / about small tribe / which has / kept / oldslavonic name / all until present day"
(A story is told from one generation to another about small tribe which has kept oldslavonic name all until the present day.)
- ii. S kolena na koleno / se prenosi priča / o malom plemenu / koje je */ staroslovensko ime */ sačuvalo */ sve do današnjeg dana*. (S wh O V)
- iii. S kolena na koleno / se prenosi priča / o staroslovenskom imenu / koje je */ malo pleme */ sačuvalo */ sve do današnjeg dana*. (O wh S V)
- iv. S kolena na koleno / se prenosi priča / o staroslovenskom imenu / koje je */ sačuvalo */ malo pleme */ sve do današnjeg dana*. (O wh V S)

(5)

declaratives

- a. Sindikat je ogorčen / što će / novi porez */ umanjiti */ ukupan prihod */ u drastičnoj meri*. (SVO)
"union is angry / because will / new tax / reduce / total income / drastically"
(The union is angry because new tax will reduce total income drastically.)
- b. Sindikat je ogorčen / što će / novi porez */ ukupan prihod */ umanjiti */ u drastičnoj meri*. (SOV)
- c. Sindikat je ogorčen / što će / ukupan prihod */ novi porez */ umanjiti */ u drastičnoj meri*. (OSV)
- d. Sindikat je ogorčen / što će / ukupan prihod */ umanjiti */ novi porez */ u drastičnoj meri*. (OSV)

relatives

- i. Sindikat je veoma zabrinut / zbog novog poreza / koji će */ umanjiti */ ukupan prihod */ u drastičnoj meri*. (S wh V O)
"union is very worried / because of new tax / which will / reduce / total income /

drastically"

(The union is very worried because of new tax which will reduce total income drastically.)

- ii. Sindikat je veoma zabrinut / zbog novog poreza / koji će / ukupan prihod / umanjiti / u drastičnoj meri. (S wh O V)
- iii. Sindikat je veoma zabrinut / zbog ukupnog prihoda / koji će */ novi porez */ umanjiti */ u drastičnoj meri*. (O wh S V)
- iv. Sindikat je veoma zabrinut / zbog ukupnog prihoda / koji će */ umanjiti */ novi porez */ u drastičnoj meri*. (O wh V S)

(6)

declaratives

- a. Jedan deo stanovništva / je bio gotovo razočaran / što je / poslednji referendum */ odložio */ neizbežan obračun */ na par godina*. (SVO)
"one part of population / has been almost disappointed / that has / last referendum / postponed / unavoidable showdown / for a couple of years"
(A part of population was almost disappointed that the last referendum has postponed unavoidable showdown for a couple of years.)
- b. Jedan deo stanovništva / je bio gotovo razočaran / što je / poslednji referendum */ neizbežan obračun*/ odložio */ na par godina*. (SOV)
- c. Jedan deo stanovništva / je bio gotovo razočaran / što je / neizbežan obračun */ poslednji referendum */ odložio */ na par godina*. (OSV)
- d. Jedan deo stanovništva / je bio gotovo razočaran / što je / neizbežan obračun */ odložio */ poslednji referendum */ na par godina*. (OVS)

relatives

- i. Vođene su burne diskusije / oko poslednjeg referenduma / koji je */ odložio */ neizbežan obračun*/ na par godina*. (S wh V O)
"had been heated debates / about last referendum / which has / postponed / unavoidable showdown / for a couple of years"
(There were heated debates about the last referendum which has postponed unavoidable showdown for a couple of years.)
- ii. Vođene su burne diskusije / oko poslednjeg referenduma / koji je */ neizbežan obračun */ odložio */ na par godina*. (S wh O V)
- iii. Vođene su burne diskusije / oko neizbežnog obračuna / koji je */ poslednji referendum */ odložio */ na par godina*. (O wh S V)
- iv. Vođene su burne diskusije / oko neizbežnog obračuna / koji je */ odložio */ poslednji referendum */ na par godina*. (O wh V S)

(7)

declaratives

- a. Komanda korpusa / je bila prilično zabrinuta / kada je / privremeno povlačenje */ izazvalo */ strašno nezadovoljstvo */ uprkos velikim ljudskim žrtvama*. (SVO)
"corps headquarters / have been rather worried / when has / temporary retreat / caused / great dissatisfaction / in spite of great collateral damage"
(The corps headquarters were rather worried when temporary retreat great

disatisfaction caused in spite of great collateral damage.)

- b. Komanda korpusa / je bila prilično zabrinuta / kada je / privremeno povlačenje */ strašno nezadovoljstvo */ izazvalo */ uprkos velikim ljudskim žrtvama*. (SOV)
- c. Komanda korpusa / je bila prilično zabrinuta / kada je / strašno nezadovoljstvo*/ privremeno povlačenje */ izazvalo */ uprkos velikim ljudskim žrtvama*. (OSV)
- d. Komanda korpusa / je bila prilično zabrinuta / kada je / strašno nezadovoljstvo*/ izazvalo */ privremeno povlačenje */ uprkos velikim ljudskim žrtvama*. (OVS)

relatives

- i. Mnogi su oficiri / bili šokirani / privremenim povlačenjem / koje je */ izazvalo */ strašno nezadovoljstvo */ uprkos velikim ljudskim žrtvama*. (S wh V O)
"many have officers / been shocked / by temporary retreat / which has / caused / great disatisfaction / in spite of great collateral damage"
(Many officers were shocked by temporary retreat which has caused great disatisfaction in spite of great collateral damage.)
- ii. Mnogi su oficiri / bili šokirani / privremenim povlačenjem / koje je */ strašno nezadovoljstvo */ izazvalo */ uprkos velikim ljudskim žrtvama*. (S wh O V)
- iii. Mnogi su oficiri / bili šokirani / strašnim nezadovoljstvom / koje je */ privremeno povlačenje */ izazvalo */ uprkos velikim ljudskim žrtvama*. (O wh S V)
- iv. Mnogi su oficiri / bili šokirani / strašnim nezadovoljstvom / koje je */ izazvalo*/ privremeno povlačenje */ uprkos velikim ljudskim žrtvama*. (OwhVS)

(8)

declaratives

- a. U istorijskim čitankama / se često spominje / da je / puč */ izgladio */ nesporazum */ tokom deset godina diktature*. (SVO)
"in history textbooks / refl often mentioned / that has / coup / settled / disagreement / during ten years of dictatorship"
(In history textbooks it is often mentioned that coup had settled disagreement during the ten years of dictatorship.)
- b. U istorijskim čitankama / se često spominje / da je / puč */ nesporazum */ izgladio */ tokom deset godina diktature*. (SOV)
- c. U istorijskim čitankama / se često spominje / da je / nesporazum */ puč */ izgladio */ tokom deset godina diktature*. (OSV)
- d. U istorijskim čitankama / se često spominje / da je / nesporazum */ izgladio */ puč */ tokom deset godina diktature*. (OVS)

relatives

- i. Vojni i politički analitičari / se nisu mogli složiti / oko puča / koji je */ izgladio */ nesporazum*/ tokom deset godina diktature. (S wh V O)
"military and political analysts / refl could not agree / about coup / which has / settled / disagreement / during ten years of dictatorship"
(Military and political analysts could not agree on coup which has settled disagreement during the ten years of dictatorship.)
- ii. Vojni i politički analitičari / se nisu mogli složiti / oko puča / koji je */ nesporazum */ izgladio */ tokom deset godina diktature*. (S wh O V)

- iii. Vojni i politički analitičari / se nisu mogli složiti / oko nesporazuma */ koji je */ puč */ izgladio */ tokom deset godina diktature*. (O wh S V)
- iv. Vojni i politički analitičari / se nisu mogli složiti / oko nesporazuma / koji je */ izgladio */ puč */ tokom deset godina diktature*. (O wh V S)

(9)

declaratives

- a. Jelena je kasnije / mnogo puta zažalila / što je / neopravdano nepoverenje */ dokrajčilo */ njihovo prijateljstvo */ jednom za svagda*. (SVO)
"Jelena has later / many times regretted / that has / unjustifiable mistrust / finished / their friendship / once for good"
(Jelena later regretted quite a few times that unjustifiable mistrust their friendship has destroyed once for good.)
- b. Jelena je kasnije / mnogo puta zažalila / što je / neopravdano nepoverenje */ njihovo prijateljstvo */ dokrajčilo */ jednom za svagda*. (SOV)
- c. Jelena je kasnije / mnogo puta zažalila / što je / njihovo prijateljstvo */ neopravdano nepoverenje */ dokrajčilo */ jednom za svagda*. (OSV)
- d. Jelena je kasnije / mnogo puta zažalila / što je / njihovo prijateljstvo */ dokrajčilo */ neopravdano nepoverenje */ jednom za svagda*. (OVS)

relatives

- i. Jelena se kasnije / sa gorčinom sećala / neopravdanog nepoverenja / koje je */ dokrajčilo */ njihovo prijateljstvo */ jednom za svagda*. (S wh V O)
"Jelena has later / with bitterness remembered / unjustifiable mistrust / which has / finished / their friendship / once for good"
(Jelena would later remember with bitterness unjustifiable mistrust which has destroyed their friendship once for good.)
- ii. Jelena se kasnije / sa gorčinom sećala / neopravdanog nepoverenja / koje je */ njihovo prijateljstvo */ dokrajčilo */ jednom za svagda*. (S wh O V)
- iii. Jelena se kasnije / sa gorčinom sećala / njihovog prijateljstva / koje je */ neopravdano nepoverenje */ dokrajčilo */ jednom za svagda*. (O wh S V)
- iv. Jelena se kasnije / sa gorčinom sećala / njihovog prijateljstva / koje je */ dokrajčilo */ neopravdano nepoverenje */ jednom za svagda*. (O wh V S)

(10)

declaratives

- a. Jedino je / Markova majka / osećala / da je / nedoknativ gubitak */ izazivao */ strašan bol */ i nakon toliko godina*. (SVO)
"only has / Marko's mother / felt / that has / irreparable loss / caused / great pain / even after many years"
(Only Marko's mother felt that irreparable loss was causing great pain even after so many years.)
- b. Jedino je / Markova majka / osećala / da je / nedoknativ gubitak */ strašan bol* / izazivao */ i nakon toliko godina*. (SOV)
- c. Jedino je / Markova majka / osećala / da je / strašan bol */ nenadoknativ gubitak */ izazivao */ i nakon toliko godina*. (OSV)

- d. Jedino je / Markova majka / osećala / da je / strašan bol */ izazivao */ nenadoknativ gubitak */ i nakon toliko godina*. (OVS)

relatives

- i. Svi su / izbegavali priču / o nenadoknativom gubitku / koji je */ izazivao */ strašan bol */ i nakon toliko godina*. (S wh V O)
 "everybody has / avoided story / about irreparable loss / which has / caused/ great pain / even after many years"
 (Everybody was avoiding to talk about irreparable loss which was causing great pain even after so many years.)
- ii. Svi su / izbegavali priču / o nenadoknativom gubitku / koji je */ strašan bol */ izazivao */ i nakon toliko godina*. (S wh O V)
- iii. Svi su / izbegavali priču / o strašnom bolu / koji je */ nenadoknativ gubitak */ izazivao */ i nakon toliko godina*. (O wh S V)
- iv. Svi su / izbegavali priču / o strašnom bolu / koji je */ izazivao */ nenadoknativ gubitak */ i nakon toliko godina*. (O wh V S)

(11)

declaratives

- a. Svi bivši studenti se / sa gorčinom sećaju / da je / strah */ pratio */ ispit */ u stopu */ kod tog profesora. (SVO)
 "all former students refl / with resentment remember / that has / fear / followed / exam / step by step / with that professor"
 (All the former students remember with resentment that fear would follow exam step by step with that professor.)
- b. Svi bivši studenti se / sa gorčinom sećaju / da je / strah */ ispit */ pratio */ u stopu */ kod tog profesora. (SOV)
- c. Svi bivši studenti se / sa gorčinom sećaju / da je / ispit */ strah */ pratio */ u stopu */ kod tog profesora. (OSV)
- d. Svi bivši studenti se / sa gorčinom sećaju / da je / ispit */ strah */ pratio */ u stopu */ kod tog profesora. (OVS)

relatives

- i. Čak je i Jovan / imao noćne more / zbog straha / koji je */ ispit */ pratio */ u stopu */ kod tog profesora. (S wh V O)
 "even has Jovan / had nightmares / because of fear / which has / exam / followed / step by step / with that profesor"
 (Even Jovan had nightmares because of fear which would follow exam step by step with that professor.)
- ii. Čak je i Jovan / imao noćne more / zbog straha / koji je */ ispit */ pratio */ u stopu */ kod tog profesora. (S wh O V)
- iii. Čak je i Jovan / imao noćne more / zbog ispita / koji je */ strah */ pratio */ u stopu */ kod tog profesora. (O wh S V)
- iv. Čak je i Jovan / imao noćne more / zbog ispita / koji je */pratio */ strah */ u stopu */ kod tog profesora. (O wh V S)

(12)

declaratives

- a. Organizatori su bili / prijatno iznenađeni / nakon što je / neočekivano finale*/
okončalo */ državno prvenstvo */ u punom sjaju*. (SVO)
"organizers have been / pleasantly surprised / after that has / unexpected finale /
finished / state championship / with full glory"
(The organizers were pleasantly surprised after unexpected finale has finished state
championship with full glory.)
- b. Organizatori su bili / prijatno iznenađeni / nakon što je / neočekivano finale*/
državno prvenstvo */ okončalo */ u punom sjaju*. (S wh O V)
- c. Organizatori su bili / prijatno iznenađeni / nakon što je / državno prvenstvo */
neočekivano finale */ okončalo*/ u punom sjaju*. (O wh S V)
- d. Organizatori su bili / prijatno iznenađeni / nakon što je / državno prvenstvo */
okončalo */ neočekivano finale */ u punom sjaju*. (O wh V S)

relatives

- i. Godinama su / ljudi pričali / o neočekivanom finalu / koje je */ okončalo */
državno prvenstvo */ u punom sjaju*. (S wh V O)
"for years have / people talked / about unexpected finale / which has / finished /
state championship / with full glory"
(For years people kept talking about unexpected finale which has finished state
championship with full glory.)
- ii. Godinama su / ljudi pričali / o neočekivanom finalu / koje je*/ državno
prvenstvo */ okončalo */ u punom sjaju*. (S wh O V)
- iii. Godinama su / ljudi pričali / o državnom prvenstvu / koje je */ neočekivano
finale */ okončalo */ u punom sjaju*. (O wh S V)
- iv. Godinama su / ljudi pričali / o državnom prvenstvu / koje je */ okončalo */
neočekivano finale */ u punom sjaju*. (O wh V S)

(13)

declaratives

- a. Mnogi učenici / su se žalili / da je / jedan zadatak */ učinio */ završni test */ mnogo
težim */ nego što su očekivali. (SVO)
"many students / have refl complained / that has / one question / made / final test /
much harder / than that have expected"
(Many students complained that one question has made final test much harder than
expected.)
- b. Mnogi učenici / su se žalili / da je / jedan zadatak */ završni test */ učinio */ mnogo
težim */ nego što su očekivali. (SOV)
- c. Mnogi učenici / su se žalili / da je / završni test */ jedan zadatak */ učinio */ mnogo
težim */ nego što su očekivali. (OSV)
- d. Mnogi učenici / su se žalili / da je / završni test */ učinio */ jedan zadatak */
mnogo težim */ nego što su očekivali. (OVS)

relatives

- i. Skoro su svi učenici / bili zabrinuti / zbog jednog zadatka / koji je */ učinio */ završni test */ mnogo težim */ nego što su očekivali. (S wh V O)
"almost have all students / been worried / because of one question / which has / made / final test / much harder / than expected"
(Almost all the students were worried about one question which has made final test much harder than expected.)
- ii. Skoro su svi učenici / bili zabrinuti / zbog jednog zadatka / koji je */ završni test */ učinio */ mnogo težim */ nego što su očekivali. (S wh O V)
- iii. Skoro su svi učenici / bili zabrinuti / zbog završnog testa / koji je */ jedan zadatak */ učinio*/ mnogo težim */ nego što su očekivali. (O wh S V)
- iv. Skoro su svi učenici / bili zabrinuti / zbog završnog testa / koji je */ učinio */ jedan zadatak*/ mnogo težim */ nego što su očekivali. (O wh V S)

(14)

declaratives

- a. Dobri poznavaoči međuljudskih odnosa / se nisu mnogo iznenadili / kada je / preduzeće */ otpustilo */ osoblje */ posle samo deset dana*. (SVO)
"those aware of what the relations among people were like / were not much surprised / when has / firm / fired / personnel / after only ten days"
(Those aware of what the relations among people were were not much surprised when firm has fired personnel after only ten days.)
- b. Dobri poznavaoči međuljudskih odnosa / se nisu mnogo iznenadili / kada je / preduzeće */ osoblje */ otpustilo */ posle samo deset dana*. (SOV)
- c. Dobri poznavaoči međuljudskih odnosa / se nisu mnogo iznenadili / kada je / osoblje */ preduzeće */ otpustilo */ posle samo deset dana*. (OSV)
- d. Dobri poznavaoči međuljudskih odnosa / se nisu mnogo iznenadili / kada je / osoblje */ otpustilo */ preduzeće */ posle samo deset dana*. (OVS)

relatives

- i. U juceršnjim novinama / svi su pisali / o preduzeću / koje je*/ otpustilo */ osoblje */ posle samo deset dana*. (S wh V O)
"in yesterdays papers / everybody was writing / about firm / which has / fired / personnel / after only ten days"
(In yesterdays papers everybody was writing about firm which has fired personnel after only ten days.)
- ii. U juceršnjim novinama / svi su pisali / o preduzeću / koje je */ osoblje */ otpustilo */ posle samo deset dana*. (S wh O V)
- iii. U juceršnjim novinama / svi su pisali / o osoblju / koje je*/ preduzeće*/ otpustilo */ posle samo deset dana*. (O wh S V)
- iv. U juceršnjim novinama / svi su pisali / o osoblju / koje je*/ otpustilo */ preduzeće */ posle samo deset dana*. (O wh V S)

(15)

declaratives

- a. Književni kritičari / nisu bili upoznati / sa činjenicom / da je / poslednji rukopis */ izmenio */ najnoviji roman */ u velikoj meri*. (SVO)
"literary critics / haven't been informed / about fact / that has / latest manuscript / changed / last novel / to a great extent"
(Literary critics did not know the fact that latest manuscript has changed last novel to a great extent)
- b. Književni kritičari / nisu bili upoznati / sa činjenicom / da je / poslednji rukopis */ najnoviji roman */ izmenio */ u velikoj meri*. (SOV)
- c. Književni kritičari / nisu bili upoznati / sa činjenicom / da je / najnoviji roman */ poslednji rukopis */ izmenio */ u velikoj meri*. (OSV)
- d. Književni kritičari / nisu bili upoznati / sa činjenicom / da je / najnoviji roman */ izmenio */ poslednji rukopis */ u velikoj meri*. (OVS)

relatives

- i. Uređivački odbor / se gotovo posvađao / oko poslednjeg rukopisa / koji je */ izmenio */ najnoviji roman */ u velikoj meri*. (S wh V O)
"editorial board / refl almost quarrelled / about latest manuscript / which has / changed / last novel / to a great extent"
(The editorial board was almost having a quarrel about latest manuscript which has changed last novel to a great extent.)
- ii. Uređivački odbor / se gotovo posvađao / oko poslednjeg rukopisa / koji je */ najnoviji roman */ izmenio */ u velikoj meri*. (S wh O V)
- iii. Uređivački odbor / se gotovo posvađao / oko najnovijeg romana / koji je */ poslednji rukopis */ izmenio */ u velikoj meri*. (O wh S V)
- iv. Uređivački odbor / se gotovo posvađao / oko najnovijeg romana / koji je */ izmenio */ poslednji rukopis */ u velikoj meri*. (O wh V S)

(16)

declaratives

- a. Milanova majka odbija / da poveruje u to / da je / pijanstvo */ prouzrokovalo */ ludilo */ pre šest meseci*. (SVO)
"Milan's mother refuses / to believe in that / that has / drinking / caused / madness / six months ago"
(Milan's mother refuses to believe that drinking has caused madness six months ago.)
- b. Milanova majka odbija / da poveruje u to / da je / pijanstvo */ ludilo */ prouzrokovalo */ pre šest meseci*. (SOV)
- c. Milanova majka odbija / da poveruje u to / da je / ludilo */ pijanstvo */ prouzrokovalo */ pre šest meseci*. (OSV)
- d. Milanova majka odbija / da poveruje u to / da je / ludilo */ prouzrokovalo */ pijanstvo */ pre šest meseci*. (OVS)

relatives

- i. Milan se / već duže vremena / nalazi na lečenju / zbog pijanstva / koje je */ prouzrokovalo */ ludilo*/ pre šest meseci*. (S wh V O)
"Milan refl / for a long time / been hospitalized / because of drinking / which has / caused / madness / six months ago"
(Milan has been hospitalized for a long time because of drinking which had caused madness six months ago.)
- ii. Milan se / već duže vremena / nalazi na lečenju / zbog pijanstva / koje je */ ludilo */ prouzrokovalo */ pre šest meseci*. (S wh OV)
- iii. Milan se / već duže vremena / nalazi na lečenju / zbog ludila / koje je */ pijanstvo */ prouzrokovalo */ pre šest meseci*. (O wh S V)
- iv. Milan se / već duže vremena / nalazi na lečenju / zbog ludila / koje je */ prouzrokovalo */ pijanstvo */ pre šest meseci*. (O wh V S)

(17)

declaratives

- a. Čak je i publika / bila iznenađena / kada je / alternativni bioskop*/ postavio */ izvrstan repertoar */ pre par godina*. (SVO)
"even audience itself / was surprised / when has / alternative cinema / introduced / excellent repertoire / a couple of years ago"
(Even the audience itself was surprised when alternative cinema had introduced excellent repertoire a couple of years ago.)
- b. Čak je i publika / bila iznenađena / kada je / alternativni bioskop */ izvrstan repertoar */ postavio */ pre par godina*. (SOV)
- c. Čak je i publika / bila iznenađena / kada je / izvrstan repertoar */ alternativni bioskop */ postavio */ pre par godina*. (OSV)
- d. Čak je i publika / bila iznenađena / kada je / izvrstan repertoar */ postavio */ alternativni bioskop */ pre par godina*. (OVS)

relatives

- i. Sve više ljudi / počinje da uživa / u alternativnom bioskopu / koji je */ postavio */ izvrstan repertoar */ pre par godina*. (S wh V O)
"more and more people / start to enjoy / in alternative cinema / which has / introduced / excellent repertoire / a couple of years ago"
(More and more people enjoy alternative cinema which had introduced excellent repertoire a couple of years ago.)
- ii. Sve više ljudi / počinje da uživa / u alternativnom bioskopu / koji je */ izvrstan repertoar */ postavio */ pre par godina*. (S wh O V)
- iii. Sve više ljudi / počinje da uživa / u izvrsnom repertoaru / koji je */ alternativni bioskop */ postavio */ pre par godina*. (O wh S V)
- iv. Sve više ljudi / počinje da uživa / u izvrsnom repertoaru / koji je */ postavio */ alternativni bioskop */ pre par godina*. (O wh V S)

(18)

declaratives

- a. Celo selo je / bilo svesno toga / da je / venčanje */ izazvalo */ divljenje */ čak i

kod gostiju */ iz grada. (SVO)

"whole village has / been aware of that / that has / wedding / caused / admiration / even in / guests from city"

(The whole village was aware of the fact that wedding has caused admiration even in the guests from the city.)

- b. Celo selo je / bilo svesno toga / da je / venčanje */ divljenje */ izazvalo */ čak i kod gostiju */ iz grada. (SOV)
- c. Celo selo je / bilo svesno toga / da je / divljenje */ venčanje */ izazvalo */ čak i kod gostiju */ iz grada. (O S V)
- d. Celo selo je / bilo svesno toga / da je / divljenje*/ izazvalo */ venčanje */ čak i kod gostiju */ iz grada. (OVS)

relatives

- i. Rečima se / nije moglo opisati / venčanje / koje je */ izazvalo */ divljenje */ čak i kod gostiju */ iz grada. (S wh V O)
"words refl / could not describe / wedding / which has / caused / admiration / even in / guests from city"
(Words could not describe wedding which has caused admiration even in the guests from the city.)
- ii. Rečima se / nije moglo opisati / venčanje / koje je */ divljenje */ izazvalo */ čak i kod gostiju */ iz grada. (S wh O V)
- iii. Rečima se / nije moglo opisati / divljenje / koje je */ venčanje */ izazvalo */ čak i kod gostiju */ iz grada. (O wh S V)
- iv. Rečima se / nije moglo opisati / divljenje / koje je */ izazvalo */ venčanje */ čak i kod gostiju */ iz grada. (O wh V S)

(19)

declaratives

- a. Direktor je / izrazio zabrinutost / kada je / međusobni sukob */ ugrozio */ zajednički posao* / na samom kraju projekta*. (SVO)
"director / has expressed concern / when has / mutual conflict / endangered / joint business / at the very end of the project "
(The director has expressed his concern when mutual conflict has endangered joint business at the very end of the project.)
- b. Direktor je / izrazio zabrinutost / kada je / međusobni sukob */ zajednički posao */ ugrozio */ na samom kraju projekta*. (SOV)
- c. Direktor je / izrazio zabrinutost / kada je / zajednički posao */ međusobni sukob */ ugrozio */ na samom kraju projekta*. (OSV)
- d. Direktor je / izrazio zabrinutost / kada je / zajednički posao */ ugrozio */ međusobni sukob */ na samom kraju projekta*. (OVS)

relatives

- i. Moralo se / što pre raditi / na okončanju / međusobnog sukoba / koji je */ ugrozio */ zajednički posao */ na samom kraju projekta*. (S wh V O)
"it was needed / as soon as to work / on ending / mutual conflict / which has / endangered / joint business / at the very end of the project"

(It was necessary as soon as possible to try to end mutual conflict which has endangered joint business at the very end of the project.)

- ii. Moralo se / što pre raditi / na okončanju / međusobnog sukoba / koji je */ zajednički posao */ ugrozio */ na samom kraju projekta*. (S wh O V)
- iii. Moralo se / što pre raditi / na okončanju / zajedničkog posla / koji je */ međusobni sukob */ ugrozio */ na samom kraju projekta*. (O wh S V)
- iv. Moralo se / što pre raditi / na okončanju / zajedničkog posla / koji je */ ugrozio */ međusobni sukob */ na samom kraju projekta*. (O wh V S)

(20)

declaratives

- a. Napokon je / sam sebi priznao/ da mu je / piće */ uništilo */ zdravlje */ nakon godina besomučnog opijanja*. (SVO)
"finally has / himself admitted / that him has / drinking / destroyed / health / after years of wild drinking"
(He has finally admitted to himself that drinking has destroyed his health after years of wild drinking.)
- b. Napokon je / sam sebi priznao/ da mu je / piće */ zdravlje */ uništilo */ nakon godina besomučnog opijanja*. (SOV)
- c. Napokon je / sam sebi priznao/ da mu je/ zdravlje*/ piće */ uništilo */ nakon godina besomučnog opijanja*. (OSV)
- d. Napokon je / sam sebi priznao / da mu je/ zdravlje */ uništilo */ piće*/ nakon godina besomučnog opijanja*.(OVS)

relatives

- i. Petar će / napokon morati / da ozbiljno shvati / savet lekara / da se pozabavi / pićem /koje mu je */ uništilo */ zdravlje */ nakon godina besomučnog opijanja*. (S wh V O)
"Petar will / eventually have to / seriously consider / advice of the doctor / that refl deal with / drinking / which him has / destroyed / health / after years of wild drinking"
(Petar will have to eventually seriously consider doctor's advice to deal with drinking which has destroyed his health after years of wild drinking.)
- ii. Petar će / napokon morati / da ozbiljno shvati / savet lekara / da se pozabavi / pićem / koje mu je */ zdravlje */ uništilo */ nakon godina besomučnog opijanja*. (S wh O V)
- iii. Petar će / napokon morati / da ozbiljno shvati / savet lekara / da se / pozabavi / zdravljem / koje mu je */ piće */ uništilo*/ nakon godina besomučnog opijanja*. (O wh S V)
- iv. Petar će / napokon morati / da ozbiljno shvati / savet lekara / da se / pozabavi / zdravljem/ koje mu je */ uništilo */ piće */ nakon godina besomučnog opijanja*. (O wh V S)

(21)

declaratives

- a. Zemljoradnička zadruga / je konstatovala / da je / korov */ zagušio */ kukuruz */

na većini obradivih površina *. (SVO)

"farm cooperative / has stated / that has / weed / suffocated / corn / on majority of farming lands"

(The farm cooperative has stated that weed has suffocated corn on the majority of farming lands.)

- b. Zemljoradnička zadruga / je konstatovala / da je / korov */ kukuruz */ zagušio* / na većini obradivih površina *. (SOV)
- c. Zemljoradnička zadruga / je konstatovala / da je / kukuruz */ korov */ zagušio* / na većini obradivih površina *. (OSV)
- d. Zemljoradnička zadruga / je konstatovala / da je / kukuruz */ zagušio* / korov */ na većini obradivih površina *. (OVS)

relatives

- i. Zemljoradnici su / bili očajni / zbog korova / koji je */ zagušio */ kukuruz */ na većini obradivih površina *. (S wh V O)
"farmers have / been desperate / because of weed / which has / suffocated / corn / on majority of farming lands"
(The farmers were desperate because of weeds which corn have suffocated on the majority of farming lands.)
- ii. Zemljoradnici su / bili očajni / zbog korova / koji je */ kukuruz */ zagušio* / na većini obradivih površina*. (S wh O V)
- iii. Zemljoradnici su / bili očajni / zbog kukuruza / koji je */ korov */ zagušio* / na većini obradivih površina*. (O wh S V)
- iv. Zemljoradnici su / bili očajni / zbog kukuruza / koji je */ zagušio* / korov */ na većini obradivih površina *. (O wh V S)

(22)

declaratives

- a. Upravu kluba / je iznenadilo / to što je / neočekivan poraz */ probudio */ ogroman gnev */ na samom početku sezone*. (SVO)
"club management / was surprised / by the fact that has / unexpected defeat / awakened / enormous rage / at the very beginning of season"
(The club management was surprised by the fact that unexpected defeat has awakened enormous rage at the very beginning of the season.)
- b. Upravu kluba / je iznenadilo / to što je / neočekivan poraz */ ogroman gnev */ probudio */ na samom početku sezone*. (SOV)
- c. Upravu kluba / je iznenadilo / to što je / ogroman gnev */ neočekivan poraz */ probudio */ na samom početku sezone*. (OSV)
- d. Upravu kluba / je iznenadilo / to što je / ogroman gnev */ probudio */ neočekivan poraz */ na samom početku sezone*. (OVS)

relatives

- i. Uprava kluba je / bila zatečena / neočekivanim porazom / koji je */ probudio */ ogroman gnev */ na samom početku sezone*. (S wh V O)
"club management has / been surprised / by unexpected defeat / which has / awakened / enormous rage / at the very beginning of season"

(The club management was surprised by unexpected defeat which enormous rage has awakened at the very beginning of the season.)

- ii. Uprava kluba je / bila zatečena / neočekivanim porazom / koji je */ ogroman gnev */ probudio */ na samom početku sezone*. (S wh O V)
- iii. Uprava kluba je / bila zatečena / ogromnim gnevom / koji je */ neočekivan poraz */ probudio */ na samom početku sezone*. (O wh S V)
- iv. Uprava kluba je / bila zatečena / ogromnim gnevom / koji je */ probudio */ neočekivan poraz */ na samom početku sezone*. (O wh V S)

(23)

declaratives

- a. Lekari su / Nadinim roditeljima / saopštili / da će / nekontrolisano prejedanje */ usporiti */ dugotrajno lečenje */ zbog preopterećenja srca*. (SVO)
"doctors have / to Nada's parents / told / that will / uncontrolled eating / slow down / long-term treatment / because of too much pressure for the heart"
(The doctors have told Nada's parents that uncontrolled eating will slow down her long-term treatment because of too much pressure for the heart.)
- b. Lekari su / Nadinim roditeljima / saopštili / da će / nekontrolisano prejedanje */ dugotrajno lečenje */ usporiti */ zbog preopterećenja srca*. (SOV)
- c. Lekari su / Nadinim roditeljima / saopštili / da će / dugotrajno lečenje */ nekontrolisano prejedanje */ usporiti */ zbog preopterećenja srca*. (OSV)
- d. Lekari su / Nadinim roditeljima / saopštili / da će / dugotrajno lečenje */ usporiti */ nekontrolisano prejedanje */ zbog preopterećenja srca*. (OVS)

relatives

- i. Nada će morati / da prestane / sa nekontrolisanim prejedanjem / koje će */ usporiti */ dugotrajno lečenje */ zbog preopterećenja srca*. (S wh V O)
"Nada will have to / that stop / with uncontrolled eating / which will / slow down / long-term treatment / because of too much pressure for the heart"
(Nada will have to stop with uncontrolled eating which will slow down her long-term treatment because of too much pressure for the heart.)
- ii. Nada će morati / da prestane / sa nekontrolisanim prejedanjem / koje će */ dugotrajno lečenje */ usporiti */ zbog preopterećenja srca*. (S wh O V)
- iii. Nada će morati / da prestane / sa dugotrajnim lečenjem / koje će */ nekontrolisano prejedanje */ usporiti */ zbog preopterećenja srca*. (O wh S V)
- iv. Nada će morati / da prestane / sa dugotrajnim lečenjem / koje će */ usporiti */ nekontrolisano prejedanje */ zbog preopterećenja srca*. (O wh V S)

(24)

declaratives

- a. Mnogi su se / sa setom prisećali dana / kada je / barjak */ krasio */ jarbol */ tokom svih praznika*. (SVO)
"many have refl / with sadness remember days / when has / flag / adorned / mast / during all holidays"
(Many people remember with sadness the days when flag would adorn mast during all holidays.)

- b. Mnogi su se / sa setom prisećali dana / kada je */ barjak */ jarbol */ krasio */ tokom svih praznika*. (SOV)
- c. Mnogi su se / sa setom prisećali dana / kada je / jarbol */ barjak */ krasio */ tokom svih praznika*. (OSV)
- d. Mnogi su se / sa setom prisećali dana / kada je / jarbol */ krasio */ barjak */ tokom svih praznika*. (OVS)

relatives

- i. Strahovita oluja i vetar / su uništili barjak / koji je */ krasio */ jarbol */ tokom svih praznika*. (S wh V O)
"strong storm and wind / have destroyed flag / which has / adorned / mast / during all holidays"
(Strong storm and wind have destroyed flag which would adorn mast during all holidays.)
- ii. Strahovita oluja i vetar / su uništili barjak / koji je */ jarbol */ krasio */ tokom svih praznika*. (S wh O V)
- iii. Strahovita oluja i vetar / su uništili jarbol / koji je */ barjak */ krasio */ tokom svih praznika*. (O wh S V)
- iv. Strahovita oluja i vetar / su uništili jarbol / koji je */ krasio */ barjak */ tokom svih praznika*. (O wh V S)

(25)

declaratives

- a. Politička situacija je / postajala / sve nestabilnija / jer je */ sveštenstvo */ napadalo */ predsedništvo */ zbog ukidanja slobode veroispovesti*. (SVO)
"political situation was / becoming / more and more unstable / because has / clergy / attacked / presidency / because of banning of freedom of religious expression"
(Political situation was getting more unstable because the clergy was attacking the presidency because of banning the freedom of religious expression.)
- b. Politička situacija je / postajala / sve nestabilnija / jer je */ sveštenstvo */ predsedništvo */ napadalo */ zbog ukidanja slobode veroispovesti*. (SOV)
- c. Politička situacija je / postajala / sve nestabilnija / jer je */ predsedništvo */ sveštenstvo */ napadalo */ zbog ukidanja slobode veroispovesti*. (OSV)
- d. Politička situacija je / postajala / sve nestabilnija / jer je */ predsedništvo */ napadalo */ sveštenstvo */ zbog ukidanja slobode veroispovesti*. (OVS)

relatives

- i. Tih godina je / u političkom životu / sve kontroverzniju ulogu / igralo / sveštenstvo */ koje je */ napadalo */ predsedništvo */ zbog ukidanja slobode veroispovesti*. (S wh V O)
"those years has / in political life / more controversial role / played / clergy / which has / attacked / presidency / because of banning of freedom of religious expression"
(In those years in political life a more controversial role was played by the clergy which was attacking the presidency because of banning the freedom of religious expression)

- expression.)
- ii. Tih godina je / u političkom životu / sve kontroverzniju ulogu / igralo / sveštenstvo */ koje je */ predsedništvo */ napadalo */ zbog ukidanja slobode veroispovesti*. (S wh O V)
 - iii. Tih godina je / u političkom životu / sve kontroverzniju ulogu / igralo / predsedništvo */ koje je */ sveštenstvo */ napadalo */ zbog ukidanja slobode veroispovesti*. (O wh S V)
 - iv. Tih godina je / u političkom životu / sve kontroverzniju ulogu / igralo / predsedništvo */ koje je */ napadalo */ sveštenstvo */ zbog ukidanja slobode veroispovesti*. (O wh V S)

(26)

declaratives

- a. Čak je / i sama domaćica / priznala / da je / začin */ upropastio */ kolač */ u potpunosti. (SVO)
"even has / hostess herself / admitted / that has / spice / spoiled/ cake / completely"
(Even the hostess herself has admitted that spice has completely spoiled the cake.)
- b. Čak je / i sama domaćica / priznala / da je / začin */ kolač */ upropastio */ u potpunosti. (SOV)
- c. Čak je / i sama domaćica / priznala / da je / kolač */ začin */ upropastio */ u potpunosti. (OVS)
- d. Čak je / i sama domaćica / priznala / da je / kolač */ upropastio */ začin */ u potpunosti. (OVS)

relatives

- i. Nikome se od gostiju / nije dopao / začin / koji je */ upropastio */ kolač */ u potpunosti. (S wh V O)
"none of the guests / liked / spice / which has / spoiled / cake / completely "
(None of the guests liked spice which has spoiled cake completely.)
- ii. Nikome se od gostiju / nije dopao / začin / koji je */ kolač */ upropastio */ u potpunosti. (S wh O V)
- iii. Nikome se od gostiju / nije dopao / kolač / koji je */ začin */ upropastio */ u potpunosti. (O wh S V)
- iv. Nikome se od gostiju / nije dopao / kolač / koji je */ upropastio */ začin */ u potpunosti. (O wh V S)

(27)

declaratives

- a. Sve zaljubljenike umetnosti / je veoma obradovala vest / da je / lokalno pozorište */ dobilo */ državno priznanje */ zbog doprinosa kulturi*. (SVO)
"all art lovers / has very delighted news / that has / local theatre / received / state award / because of contribution to culture"
(All art lovers were very delighted with the news that local theatre has received state award for its contribution to culture.)
- b. Sve zaljubljenike umetnosti / je veoma obradovala vest / da je / lokalno

- c. pozorište */ državno priznanje */ dobilo */ zbog doprinosa kulturi* . (SOV)
Sve zaljubljenike umetnosti / je veoma obradovala vest / da je / državno
priznanje */ lokalno pozorište */ dobilo */ zbog doprinosa kulturi*. (OSV)
- d. Sve zaljubljenike umetnosti / je veoma obradovala vest / da je / državno
priznanje */ dobilo */ lokalno pozorište */ zbog doprinosa kulturi*. (OVS)

relatives

- i. Svi zaljubljenici umetnosti / su čuli / za lokalno pozorište / koje je */ dobilo */
državno priznanje */ zbog doprinosa kulturi*. (S wh V O)
"all art lovers / have heard / for local theatre / which has / received / state award /
because of contribution to culture"
(All art lovers have heard about local theatre which has received state award for
its contribution to culture.)
- ii. Svi zaljubljenici umetnosti / su čuli/ za lokalno pozorište / koje je */ državno
priznanje */ dobilo */ zbog doprinosa kulturi*. (S wh O V)
- iii. Svi zaljubljenici umetnosti / su čuli / za državno priznanje / koje je */ lokalno
pozorište */ dobilo */ zbog doprinosa kulturi*. (O wh S V)
- iv. Svi zaljubljenici umetnosti / su čuli / za državno priznanje / koje je */ dobilo */
lokalno pozorište */ zbog doprinosa kulturi*.

(28)

declaratives

- a. Ministar je / bio iznenađen / time što je / bezazleni trač */ izazvao */ ogroman
skandal */ u javnosti*. (SVO)
"minister has / been surprised / by that has / innocent gossip / caused / enormous
scandal/ in public"
(The minister was surprised by the fact that innocent gossip has caused enormous
scandal in public.)
- b. Ministar je / bio iznenađen / time što je / bezazleni trač */ ogroman skandal */
izazvao */ u javnosti*. (SOV)
- c. Ministar je / bio iznenađen / time što je / ogroman skandal */ bezazleni trač */
izazvao */ u javnosti*. (O wh S V)
- d. Ministar je / bio iznenađen / time što je / ogroman skandal */ izazvao */ bezazleni
trač */ u javnosti*. (O wh V S)

relatives

- i. Svi su bili / u tančine upoznati / sa detaljima / bezazlenog trača / koji je*/
izazvao */ ogroman skandal */ u javnosti*. (S wh V O)
"everybody has been / in all tiny details informed / about the details of / innocent
gossip / which has / caused / enormous scandal / in public"
(Everybody knew every tiny detail of innocent gossip which has caused enormous
scandal in public.)
- ii. Svi su bili / u tančine upoznati / sa detaljima / bezazlenog trača / koji je */
ogroman skandal */ izazvao */ u javnosti*. (S wh O V)
- iii. Svi su bili / u tančine upoznati / sa detaljima / ogromnog skandala / koji je*/
bezazleni trač */ izazvao */ u javnosti *. (O wh S V)

- iv. Svi su bili / u tančine upoznati / sa detaljima / ogromnog skandala / koji je */ izazvao */ bezazleni trač */ u javnosti*. (O wh V S)

(29)

declaratives

- a. Stojan nije / ni bio svestan toga / koliko je / unapređenje */ povećalo */ nepoverenje */ kod svih njegovih kolega*. (SVO)
 "Stojan hasn't / been aware of that / how much has / promotion / increased / mistrust / among all his colleagues"
 (Stojan was not aware of how much promotion has increased mistrust among all of his colleagues.)
- b. Stojan nije / ni bio svestan toga / koliko je / unapređenje */ nepoverenje */ povećalo */ kod svih njegovih kolega*. (SOV)
- c. Stojan nije / ni bio svestan toga / koliko je / nepoverenje */ unapređenje */ povećalo */ kod svih njegovih kolega*. (OSV)
- d. Stojan nije / ni bio svestan toga / koliko je / nepoverenje */ povećalo */ unapređenje */ kod svih njegovih kolega*. (OVS)

relatives

- i. Jedino je Stojan / hteo da otvoreno razgovara / o unapređenju / koje je */ povećalo */ nepoverenje */ kod svih njegovih kolega*. (S wh V O)
 "only has Stojan / wanted to openly talk / about promotion / which has / increased / mistrust / among all his colleagues"
 (Only Stojan wanted to openly talk about promotion which has increased mistrust among all of his colleagues.)
- ii. Jedino je Stojan / hteo da otvoreno razgovara / o unapređenju / koje je */ nepoverenje */ povećalo */ kod svih njegovih kolega*. (S wh O V)
- iii. Jedino je Stojan / hteo da otvoreno razgovara / o nepoverenju / koje je */ unapređenje */ povećalo */ kod svih njegovih kolega*. (O wh S V)
- iv. Jedino je Stojan / hteo da otvoreno razgovara / o nepoverenju / koje je */ povećalo */ unapređenje */ kod svih njegovih kolega*. (O wh V S)

(30)

declaratives

- a. Pre dva stoleća / prvi put je / objavljena / vest / da je / gusarski čamac */ napao */ trgovački brod */ bez upozorenja*. (SVO)
 "two centuries ago / for the first time was / published / news / that has / pirate boat / attacked / commercial ship / without warning"
 (Two centuries ago the news was published for the first time that pirate boat had attacked commercial ship without warning.)
- b. Pre dva stoleća / prvi put je / objavljena / vest / da je / gusarski čamac */ trgovački brod */ napao */ bez upozorenja*. (SOV)
- c. Pre dva stoleća / prvi put je / objavljena / vest / da je / trgovački brod */ gusarski čamac */ napao */ bez upozorenja*. (OSV)
- d. Pre dva stoleća / prvi put je / objavljena / vest / da je /trgovački brod */ napao */ gusarski čamac */ bez upozorenja*. (OVS)

relatives

- i. Svi vojni brodovi / su krenuli u potragu / za gusarskim čamcem / koji je */ napao */ trgovački brod */ bez upozorenja*. (S wh V O)
"all military ships / have started a search / for pirate boat / which has / attacked / commercial ship / without warning"
(All military ships have started a search for pirate boat which has attacked commercial ship without warning.)
- ii. Svi vojni brodovi / su krenuli u potragu / za gusarskim čamcem / koji je */ trgovački brod */ napao */ bez upozorenja*. (S wh O V)
- iii. Svi vojni brodovi / su krenuli u potragu / za trgovačkim brodom / koji je */ gusarski čamac */ napao */ bez upozorenja*. (O wh S V)
- iv. Svi vojni brodovi / su krenuli u potragu / za trgovačkim brodom / koji je */ napao */ gusarski čamac */ bez upozorenja*. (O wh V S)

(31)

declaratives

- a. Uvaženom profesoru Kostiću / se niko nije usuđivao / da kaže / da je / sinoćnje predavanje */ izazvalo */ ogromno negodovanje */ kod mnogobrojnih slušalaca*. (SVO)
"to respectable professor Kostić / refl nobody dared / to tell / that has / last night lecture / caused / great disapproval / in numerous listeners"
(Nobody dared to tell respectable professor Kostić that last night lecture has caused great disapproval in numerous listeners.)
- b. Uvaženom profesoru Kostiću / se niko nije usuđivao / da kaže / da je / sinoćnje predavanje */ ogromno negodovanje */ izazvalo */ kod mnogobrojnih slušalaca *. (SOV)
- c. Uvaženom profesoru Kostiću / se niko nije usuđivao / da kaže / da je /ogromno negodovanje */ sinoćnje predavanje */ izazvalo */ kod mnogobrojnih slušalaca *. (OSV)
- d. Uvaženom profesoru Kostiću / se niko nije usuđivao / da kaže / da je /ogromno negodovanje */ izazvalo */ sinoćnje predavanje */ kod mnogobrojnih slušalaca *. (OVS)

relatives

- i. Burna se diskusija vodila / povodom sinoćnjeg predavanja / koje je */ izazvalo */ ogromno negodovanje */ kod mnogobrojnih slušalaca *. (S wh V O)
"heated refl debate had / because of last night lecture / which has / caused / great disapproval / in numerous listeners"
(There was a heated debate because of last night lecture which has caused great disapproval in numerous listeners.)
- ii. Burna se diskusija vodila / povodom sinoćnjeg predavanja / koje je */ ogromno negodovanje */ izazvalo */ kod mnogobrojnih slušalaca *. (S wh O V)
- iii. Burna se diskusija vodila / povodom ogromnog negodovanja / koje je */ sinoćnje predavanje */ izazvalo */ kod mnogobrojnih slušalaca *. (O wh S V)
- iv. Burna se diskusija vodila / povodom ogromnog negodovanja / koje je */

izazvalo */ sinoćnje predavanje */ kod mnogobrojnih slušalaca *. (O wh V S)

(32)

declaratives

- a. Mnogobrojni posetioci / su bili oduševljeni / što je / zabranjeni film */ otvorio */ čuveni festival */ uprkos pretnji organizatorima*. (SVO)
 "numerous visitors / have been delighted / that has / forbidden film / opened / famous festival / in spite of threats to organizers"
 (Numerous visitors were delighted that forbidden movie had opened famous festival in spite of threats to organizers.)
- b. Mnogobrojni posetioci / su bili oduševljeni / što je / zabranjeni film */ čuveni festival */ otvorio */ uprkos pretnji organizatorima*. (SOV)
- c. Mnogobrojni posetioci / su bili oduševljeni / što je / čuveni festival */ zabranjeni film */ otvorio*/ uprkos pretnji organizatorima*. (OSV)
- d. Mnogobrojni posetioci / su bili oduševljeni / što je / čuveni festival */ otvorio */ zabranjeni film */ uprkos pretnji organizatorima*. (OVS)

relatives

- i. Svi su / sa oduševljenjem / komentarisali /zabranjeni film / koji je */ otvorio */ čuveni festival */ uprkos pretnji organizatorima*. (S wh V O)
 "everybody was / with delight / commented about / forbidden film / which has / opened / famous festival / in spite of threats to organizers"
 (Everybody was commenting with delight about forbidden film which has opened famous festival in spite of threats to organizers.)
- ii. Svi su / sa oduševljenjem / komentarisali /zabranjeni film / koji je */ čuveni festival */ otvorio */ uprkos pretnji organizatorima*. (S wh O V)
- iii. Svi su / sa oduševljenjem / komentarisali / čuveni festival / koji je */ zabranjeni film */ otvorio */ uprkos pretnji organizatorima*. (O wh S V)
- iv. Svi su / sa oduševljenjem / komentarisali / čuveni festival / koji je */ otvorio */ zabranjeni film */ uprkos pretnji organizatorima*. (O wh V S)

APPENDIX 2

Materials for the što on-line reading time experiment

(33) Masculine animate

- a. Ni Siniša nije odmah / prepoznao / policajca / što ga je */ greškom */ kaznio*/
zbog prekoračenja brzine*. (subject relative)
"Not even Siniša immediately / recognized / policeman / that him aux / by
mistake / punished / because of speeding"
(Not even Siniša has immediately recognized the policeman that had given him by
mistake a speeding ticket.)
- b. Ni Siniša nije odmah / prepoznao / policajca / što ga je */ greškom */ optužio */
za zloupotrebu vlasti*. (object relative)
"Not even Siniša immediately / recognized / policeman / that him aux / by
mistake/ accused / of abuse of power"
(Not even Siniša has immediately recognized the policeman that he has by mistake
accused of abuse of power.)

(34) Feminine inanimate

- a. Svetlani je bilo najteže / da se odrekne / bašte / što ju je */ godinama */
očaravala */ svojom lepotom*.
"Svetlana found it most difficult/ to give up / garden / that her aux / for years /
thrilled / with its beauty"
(Svetlana found it most difficult to give up the garden that has for years thrilled
her with its beauty.)
- b. Svetlani je bilo najteže / da se odrekne / bašte / što ju je */ godinama */
održavala */ s puno ljubavi*.
"Svetlana found it most difficult / to give up / garden / that it aux / for years /
kept / with so much love"
(Svetlana found it most difficult to give up the garden that she has for years kept
with so much love.)

(35) Masculine inanimate

- a. Profesor se / sa tugom / opraštao / od instituta / što ga je */ još davno */
osposobio */ za vrhunske poslove*.
"Professor has / with sadness / parting / from institute / that him aux / long time
ago / enabled / for top research"
(The professor was parting with sadness from the institute that had him enabled
for top research a long time ago.)
- b. Profesor se / sa tugom / opraštao / od instituta / što ga je */ još davno */
osnovao */ sa najboljim prijateljem*.
"Professor has / with sadness / parting / from institute / that it aux / long time ago /
founded / with his best friend"
(The professor was parting with sadness from the institute that he had founded
with his best friend a long time ago.)

(36) Feminine animate

- a. Danica je / na večeru pozvala i / gospođu / što ju je */ prošle godine */
 podučavala */ lepim manirima*.
 "Danica has / to dinner invited also / lady / that her aux / last year / taught / nice
 manners"
 (Danica has also invited for dinner the lady that taught her nice manners last year.)
- b. Danica je/ na večeru pozvala i / gospođu / što ju je */ prošle godine */ negovala*/
 u staračkom domu*.
 "Danica has / to dinner invited also / lady / that her aux / last year / took care of /
 in seniors' home"
 (Danica has also invited for dinner the lady that she took care of in seniors' home
 last year.)

(37) Masculine animate

- a. Otac će / još dugo spominjati /služ benika / što ga je */ satima */ maltretirao */
 zbog jednog običnog formulara*.
 "Father will / for a long time talk about / clerk / that him aux / for hours /
 harrassed / because of one form"
 (The father will for a long time talk about the clerk that has for hours harassed him
 because of one simple form.)
- b. Otac će / još dugo spominjati / služ benika / što ga je */ satima */ molio */
 za jedan običan formular*.
 "Father will / for a long time talk about / clerk / that him aux / for hours / begged /
 for one form"
 (The father will for a long time talk about the clerk that he has for hours begged
 for one simple form.)

(38) Feminine inanimate

- a. Dugo je vremena / Sanja provodila / u luci / što ju je */ oduvek */ mamila */
 na duga putovanja*.
 "Plenty of time has / Sanja spent / in harbour / that her aux / always / tempted /
 into long journeys"
 (Sanja used to spend hours in the harbour that has always temped her into long
 journeys.)
- b. Dugo je vremena / Sanja provodila / u luci / što ju je*/ oduvek */ zvala*/
 svojom drugom kućom*.
 "Plenty of time has / Sanja spent / in harbour / that it aux / always / called /
 her second home"
 (Sanja used to spend hours in the harbour that she has always considered her
 second home.)

(39) Masculine inanimate

- a. Direktor / ni sam nije mogao / da poveruje u / izveštaj / što ga je*/ sinoć */
 raskrinkao */ u punoj meri*.
 "The director / could not himself / believe / report / that him aux / last night /
 exposed / completely"

(The director could not himself believe the report that exposed him completely last night.)

- b. Direktor / ni sam nije mogao / da poveruje u / izveštaj / što ga je*/ sinoć */
sročio */ u jednom dahu*.

"The director / could not himself / believe / report / that it aux / last night /
written / in one go"

(The director could not himself believe the report that he wrote last night in one
go.)

(40) Feminine animate

- a. U prvom razredu / Vesna je imala / učiteljicu / što ju je */ stalno */ opominjala*/
za svaku sitnicu*.

"In the first grade / Vesna had / teacher / that her aux / always / scorned /
for every little thing"

(Vesna had in the first grade the teacher that would always scorn her for every
little thing.)

- b. U prvom razredu / Vesna je imala / učiteljicu / što ju je */ stalno */ tužakala */
kod svojih roditeljima*.

"In the first grade / Vesna had / teacher / that her aux / always / complained
about / to her parents"

(Vesna had in the first grade the teacher that she would always complain about to
her parents.)

(41) Masculine animate

- a. Nenad je kasnije / imao duboko poštovanje / prema profesoru / što ga je */
neočekivano */ oborio */ na ispitu*.

"Nenad has later / had deep respect / for professor / that him aux / unexpectedly /
failed / at the exam"

(Nenad has later had deep respect for the professor that had unexpectedly failed
him at the exam.)

- b. Nenad je kasnije/ imao duboko poštovanje / prema profesoru / što ga je */
neočekivano */ nasledio */ u nastavi*.

"Nenad has later / had deep respect / for professor / that him aux / unexpectedly /
succeeded / in teaching"

(Nenad has later had deep respect for the professor that he has later unexpectedly
succeeded in teaching.)

(42) Feminine inanimate

- a. Pesnikinja je izbegavala / da razgovara / o pesmi / što ju je */ neočekivano */
proslavila */ širom cele zemlje*.

"Poetess was avoiding / to talk / about poem / that her aux / unexpectedly /made
famous/ all over the country"

(The poetess was avoiding to talk about the poem that has unexpectedly made her
famous all over the country.)

- b. Pesnikinja je izbegavala / da razgovara / o pesmi / što ju je */ neočekivano */

napisala */ po narudžbini izdavača*.

"Poetess was avoiding / to talk / about poem / that it aux / unexpectedly / wrote / following the publisher's order"

(The poetess was avoiding to talk about the poem that she has unexpectedly written following the publisher's order.)

(43) Masculine inanimate

- a. Nakon sudara / ni Igor nije mogao / prepoznati / auto / što ga je */ jutros */ udario */ pri punoj brzini*.

"After the collision / not even Igor could recognize / car / that him aux / this morning / hit / at full speed"

(After the collision not even Igor could recognize the car that has hit him this morning at full speed.)

- b. Nakon sudara / ni Igor nije mogao / prepoznati / auto / što ga je */ jutros */ kupio */ na pijaci automobila*.

"After the collision / not even Igor could recognize / car / that it aux / this morning / bought / at the second-hand car market"

(After the collision not even Igor could recognize the car that he has bought this morning at the second-hand car market.)

(44) Feminine animate

- a. Vaspitačica je pridavala / mnogo više pažnje / devojčici / što ju je */ kasnije */ optužila */ za fizičko matretiranje*.

"The teacher (kindergarten) was devoting / much more attention / to girl / that her aux / later / accused / of physical harrasement"

(The teacher would pay much more attention to the girl that has later accused her of physical harrasement.)

- b. Vaspitačica je pridavala / mnogo više pažnje / devojčici / što ju je */ kasnije */ zavolela */ kao rođenu kćerku*.

"The teacher (kindergarten) was devoting / much more attention / to girl / that her aux / later / loved / as her own daughter"

(The teacher would pay much more attention to the girl that she has later loved as her own daughter.)

(45) Masculine animate

- a. Komšija je celo jutro / bezuspešno pokušavao / da pronađe / trgovca / što ga je */ juče */ prevario */ za silne novce*.

"Neighbour has the whole morning / unsuccessfully tried / to find shop-assistant / that him aux / yesterday / cheated / for a plenty of money"

(The neighbour has spend to whole morning unsuccessfully trying to find the shop-assistant that cheated him yesterday for a plenty of money.)

- b. Komšija je celo jutro / bezuspešno pokušavao / da pronađe / trgovca / što ga je */ juče */ zvao */ zbog reklamacije*.

"Neighbour has the whole morning / unsuccessfully tried / to findshop-assistant / that him aux / yesterday / called / because of complaint"

(The neighbour has spend to whole morning unsuccessfully trying to find the

shop-assistant that he yesterday called because of a complaint.)

(46) Feminine inanimate

- a. Sa advokatom je / Ana Marković razgovarala / o optužnici / što ju je */ ipak */ teretila */ i za proneveru.
 "With the lawyer was / Ana Marković talking / about indictment / that her aux / still / accused / even of embezzlement"
 (Ana Marković talked to the lawyer about the indictment that still accused her even of embezzlement.)
- b. Sa advokatom je / Ana Marković razgovarala / o optužnici / što ju je */ ipak */ iznela */ i pred porotom*.
 "With the lawyer was / Ana Marković talking / about indictment / that it aux / still / read / even to the jury"
 (Ana Marković talked to the lawyer about the indictment that she still read even to the jury.)

(47) Masculine inanimate

- a. Suetni slikar / se sam divio / portretu / što ga je */ besprekorno */ oslikao */ u punom sjaju*.
 "The vain painter / was himself admiring / portrait / that him aux / perfectly / showed / in full glory"
 (The vain painter was himself admiring the portrait that has perfectly presented him in full glory.)
- b. Suetni slikar / se sam divio/ portretu / što ga je */ besprekorno */ naslikao */ u naletu nadahnuća*.
 "The vain painter / was himself admiring / portrait / that it aux / perfectly / painted / when he was inspired"
 (The vain painter was himself admiring the portrait that he has perfectly painted when he was inspired.)

(48) Feminine animate

- a. Gospođa Lazić se na ulici / sasvim slučajno / sudarila / sa devojkom/ što ju je */ zimus */ pokrala */ iz čiste pakosti*.
 "Mrs. Lazić has in the street / quite incidentally / bumped / into girl / that her aux / last winter / stole (from)/ out of spite"
 (Mrs. Lazić has in the street quite incidentally bumped into the girl that robbed her last winter out of spite.)
- b. Gospođa Lazić se na ulici / sasvim slučajno / sudarila / sa devojkom/ što ju je */ zimus*/ uhvatila */ sa svojim mužem*.
 "Mrs. Lazić has in the street / quite incidentally / bumped / into girl / that her aux / last winter / caught / with her husband"
 (Mrs. Lazić has in the street quite incidentally bumped into the girl that she caught with her husband last winter.)

APPENDIX 3

Materials for the scrambling and koji repetition experiments

(1)

declaratives

- a. Majstor pokazuje deci kako motor okreće točak. (SVO)
mechanic shows children how engine spins wheel
(The mechanic is showing the children how the engine spins the wheel.)
- b. Majstor pokazuje deci kako točak okreće motor. (OVS)
- c. Majstor pokazuje deci kako motor točak okreće. (SOV)
- d. Majstor pokazuje deci kako točak motor okreće. (OSV)

relatives

- i. Majstor je opravio motor koji okreće točak. (SwhVO)
mechanic aux repaired engine which spins wheel
(The mechanic has repaired the engine which spins the wheel.)
- ii. Majstor je opravio točak koji okreće motor. (OwhVS)
- iii. Majstor je opravio točak koji motor okreće. (SwhOV)
- iv. Majstor je opravio motor koji točak okreće. (OwhSV)

(2)

- a. Deko nam je pokazao kako ključ otvara kovčeg.
grandpa us aux shown how key opens chest
(Grandpa has shown us how the key opens the chest.)
- i. Deko traži ključ koji otvara kovčeg.
grandpa looks-for key which opens chest
(Grandpa is looking for the key which opens the chest.)

(3)

- a. Dedo ne čuje da vetar otvara prozor.
grandpa not hears comp wind opens window
(Grandpa does not hear that the wind is opening the window.)
- i. Macu je uplašio vetar koji otvara prozor.
kitten aux scared wind which opens window
(The kitten was scared by the wind which is opening the window.)

(4)

- a. Deca gledaju kako brod nosi tovar.
children watch how ship carries freight
(Children are watching how the ship carries the freight.)
- i. Učitelj je nacrtao brod koji nosi tovar.
teacher aux drawn ship which carries freight
(The teacher has drawn the ship which carries the freight.)

(5)

- a. Putnici vrište kada talas udara čamac.
passengers scream when wave hits boat
(Passengers are screaming when the wave is hitting the boat.)

- i. Putnicima je muka od talasa koji udara čamac.
passengers aux sickness from wave which hits boat
(Passengers get sick from the wave which is hitting the boat.)
- (6)
 - a. Odrasli se brinu kada sneg zavejava put.
grown-ups refl worry when snow covers road
(Grown-ups worry when the snow covers the road.)
 - i. Deca gaze po snegu koji zavejava put.
children walk on snow which covers road
(Children are walking in the snow which is covering the road.)
- (7)
 - a. Mama crta kako kamion vozi ugalj.
mom draws how truck carries coal
(Mom is drawing how the truck carries the coal.)
 - i. Deca se igraju oko kamiona koji vozi ugalj.
children refl play around truck which carries coal
(Children are playing around the truck which carries coal.)
- (8)
 - a. Vitez tvrdi da bedem štiti dvorac.
knigh claims that wall protects castle
(The knight claims that the wall protects the castle.)
 - i. Princ je sazio bedem koji štiti dvorac.
prince aux built wall which protects castle
(The prince has built the wall which protects the castle.)
- (9)
 - a. Baka je pričala da zvono budi selo.
grandma aux said that bell wakes-up village
(Grandma said that the bell wakes up the village.)
 - i. Baka je uvek spominjala zvono koje budi selo.
grandma aux always mentioned bell which wakes-up village
(Grandma would always mention the bell which wakes up the village.)
- (10)
 - a. Učiteljica nam je pričala kako cveće krasi polje.
teacher us aux told how flowers adorn meadow
(The teacher used to tell us how flowers adorn the meadow.)
 - i. Deca trče kroz cveće koje krasi polje.
children run through flowers which adorn meadow
(The children are running through the flowers which adorn the meadow.)
- (11)
 - a. Nije dozvoljeno da učiteljice grde dete.
not-aux allowed that teachers scorn child
(Teachers are not allowed to scorn the child.)

- i. Direktor razgovara sa učiteljicama koje grde dete.
principal talks to teachers who scorn child
(The principal is talking to the teachers who scorn the child.)
- (12)
- a. Mama se ljuti kada bake maze unuče.
mom refl upset when grandmothers pamper grandchild
(Mom is upset when grandmothers pamper the grandchild.)
 - i. Svi zavide bakama koje maze unuče.
everybody envies grandmothers who pamper grandchild
(Everybody envies the grandmothers who pamper the grandchild.)
- (13)
- a. Deca se smeju kada kuce jure mače.
children refl laugh when puppies chase kitten
(Children laugh when puppies chase the kitten.)
 - i. Gledali smo crtani o kucama koje jure mače.
watched aux cartoon about puppies which chase kitten
(We have watched a cartoon about the puppies which are chasing the kitten.)
- (14)
- a. Baka se čudi da dete nervira komsinice.
grandma refl surprised that child annoys neighbours
(Grandma is surprised that the child annoys the neighbours.)
 - i. U svakoj zgradi živi dete koje nervira komšinice.
in every building lives child who annoys neighbours
(In every building lives a child who annoys the neighbours.)
- (15)
- a. Dete plače zato što prase juri mace.
child cries because pig chases kittens
(The child is crying because the pig is chasing the kittens.)
 - i. Mama čita priču o prasetu koje juri mace.
mom reads story about pig which chases kittens
(Mom is reading a story about the pig which is chasing the kittens.)
- (16)
- a. Normalno je da unuče obožava deke.
normal aux that grandchild adores grandfathers
(It is normal that the grandchild adores grandfathers.)
 - i. U svakoj priči postoji unuče koje obožava deke.
in every story exists grandchild who adores grandfathers
(In every story there is a grandchild who adores grandfathers.)

APPENDIX 4

Materials for the što repetition experiment

Temporarily Ambiguous

- (17) a. Dečak je sanjao slonče što ga je uplašilo.
 boy_{Masc} aux dreamt-about elephant_{Neut} that him aux scared_{3PastNeut}
 (The boy had a dream about the elephant that had scared him.)
- b. Dečak je sanjao slonče što ga je video.
 boy_{Masc} aux dreamt-about elephant_{Neut} that him aux saw_{3PastMasc}
 (The boy had a dream about the elephant that he had seen.)
- (18) a. Kuče reži na dečaka što ga je udario.
 puppy_{Neut} barks at boy_{Masc} that him aux hit_{3PastMasc}
 (The puppy is barking at the boy that has hit him.)
- b. Kuče reži na dečaka što ga je ugrizlo.
 puppy_{Neut} barks at boy_{Masc} that him aux bitten_{3PastNeut}
 (The puppy is barking at the boy that it has bitten.)
- (19) a. Dečak se uplašio magareta što ga je udarilo.
 boy_{Masc} refl scared donkey_{Neut} that him aux kicked_{3PastNeut}
 (The boy got scared of the donkey that had kicked him.)
- b. Dečak se uplašio magareta što ga je jahao.
 boy_{Masc} refl scared donkey_{Neut} that him aux ridden_{3PastMasc}
 (The boy got scared of the donkey that he had ridden.)
- (20) a. Majmunče se plazi na dečaka što ga je ogrebalo.
 monkey_{Neut} refl sticks-out-his-tongue at boy_{Masc} that him aux
 scratched_{3PastNeut}
 (The monkey is sticking out his tongue at the boy that he has scratched.)
- b. Majmunče se plazi na dečaka što ga je zadirkivao.
 monkey_{Neut} refl sticks-out-his-tongue at boy_{Masc} that him aux teased_{3PastMasc}
 (The monkey is sticking out his tongue at the boy that has teased him.)

Completely Unambiguous

- (21) a. Devojčica se krije od dečaka što ju je poljubio.
 girl_{Fem} refl hides from boy_{Masc} that her aux kissed_{3PastMasc}
 (The girl is hiding from the boy that has kissed her.)
- b. Devojčica se krije od dečaka što ga je poljubila.
 girl_{Fem} refl hides from boy_{Masc} that him aux kissed_{3PastFem}
 (The girl is hiding from the boy that she has kissed.)
- (22) a. Devojčica beži od dečaka što ju je uštinuo.
 girl_{Fem} runs-away from boy_{Masc} that her aux pinched_{3PastMasc}
 (The girl is running away from the boy that has pinched her.)
- b. Devojčica bež i od dečaka što ga je uštinula.
 girl_{Fem} runs-away from boy_{Masc} that him aux pinched_{3PastFem}
 (The girl is running away from the boy that she has pinched.)

- (23) a. Maca se igra sa dečakom što ju je pomazio.
 cat_{Fem} refl plays with boy_{Masc} that her aux petted_{3PastMasc}
 (The cat is playing with the boy that has petted it.)
- b. Maca se igra sa dečakom što ga je liznula.
 cat_{Fem} refl plays with boy_{Masc} that him aux licked_{3PastFem}
 (The cat is playing with the boy that it has licked.)
- (24) a. Pas beži od devojčice što ju je ugrizao.
 dog_{Masc} runs-away from girl_{Fem} that her aux bitten_{3PastMasc}
 (The dog is running away from the girl that it has bitten.)
- b. Pas beži od devojčice što ga je tukla.
 dog_{Masc} runs-away from girl_{Fem} that him aux beat_{3PastFem}
 (The dog is running away from the girl that has beaten him.)

Completely Ambiguous

- (25) a. Deku se rukuje sa dečakom što ga je sreo.
 grandpa_{Masc} refl shakes-his-hand with boy_{Masc} that him aux met_{3PastMasc}
 (The grandpa is shaking hands with the boy that he has met/that has met him.)
- b. Dečak se rukuje sa dekom što ga je sreo.
 boy_{Masc} shakes-hands with grandpa_{Masc} that him aux met_{3PastMasc}
 (The boy is shaking hands with the grandpa that he has met/that has met him.)
- (26) a. Komšinica priča sa frizerkom što ju je ogovarala.
 neighbor_{Fem} talks to hairdresser_{Fem} that her aux gossiped-about_{3PastFem}
 (The neighbor is talking to the hairdresser that she has gossiped about/that has gossiped about her.)
- b. Frizerka priča sa komšinicom što ju je ogovarala.
 hairdresser_{Fem} talks to neighbor_{Fem} that her aux gossiped-about_{3PastFem}
 (The hairdresser is talking to the neighbor that she has gossiped about/ that has gossiped about her.)

APPENDIX 5

Materials for the što act-out experiment

Temporarily Ambiguous

- (1) a. Dečak trči od kučeta što ga je ugrizlo.
 boy_{Masc} runs away-from puppy_{Neut} that him aux bitten_{3PastNeut}
 (The boy is running away from the puppy that has bitten him.)
- b. Dečak trči za kučetom što ga je pomazio.
 boy_{Masc} runs after puppy_{Neut} that him aux petted_{3PastMasc}
 (The boy is running after the puppy that he has petted.)
- (2) a. Mače se krije iza dečaka što ga je pomilovao.
 kitten_{Neut} refl hides behind boy_{Masc} that him aux stroked_{3PastMasc}
 (The kitten is hiding behind the boy that has stroked it.)
- b. Mače se krije od dečaka što ga je ogreblo.
 kitten_{Neut} refl hides from boy_{Masc} that him aux scratched_{3PastNeut}
 (The kitten is hiding from the boy that it has scratched.)
- (3) a. Dečak beži od ždrebeta što ga je šutnulo.
 boy_{Masc} runs away-from foal_{Neut} that him aux kicked_{3PastNeut}
 (The boy is running away from the foal that has kicked him.)
- b. Dečak beži od ždrebeta što ga je jahao.
 boy_{Masc} runs away-from foal_{Neut} that him aux ridden_{3PastMasc}
 (The boy is running away from the foal that he has ridden.)

Completely Unambiguous

- (4) a. Devojčica se krije od kučeta što ju je uplašilo.
 girl_{Fem} refl hides from puppy_{Neut} that her aux scared_{3PastNeut}
 (The girl is hiding from the puppy that has scared her.)
- b. Devojčica se krije od kučeta što ga je uštinula.
 girl_{Fem} refl hides from puppy_{Neut} that him aux pinched_{3PastFem}
 (The girl is hiding from the puppy that she has pinched.)
- (5) a. Mače skače oko devojčice što ga je golicala.
 kitten_{Neut} jumps around girl_{Fem} that him aux tickled_{3PastFem}
 (The kitten is jumping around the girl that has tickled it.)
- b. Mače skače oko devojčice što ju je liznulo.
 kitten_{Neut} jumps around girl_{Fem} that her aux licked_{3PastNeut}
 (The kitten is jumping around the girl that it has licked.)
- (6) a. Kuće se igra sa kravom što ga je poljubila.
 puppy_{Neut} refl plays with cow_{Fem} that him aux kissed_{3PastFem}
 (The puppy is playing with the cow that has kissed it.)
- b. Kuće se igra sa kravom što ju je poljubilo.
 puppy_{Neut} refl plays with cow_{Fem} that her aux kissed_{3PastNeut}
 (The puppy is playing with the cow that it has kissed.)

Completely Ambiguous

- (7) a. Jagnje trči za ždrebetom što ga je poljubilo.
 lamb_{Neut} runs after foal_{Neut} that him aux kissed_{3PastNeut}
 (The lamb is running after the foal that it has kissed/that has kissed it.)
- b. Ždrebe trči za jagnjetom što ga je poljubilo.
 foal_{Neut} runs after lamb_{Neut} that him aux kissed_{3PastNeut}
 (The foal is running after the lamb that it has kissed/that has kissed it.)
- (8) a. Kuće beži od mačeta što ga je uštinulo.
 puppy_{Neut} runs away-from kitten_{Neut} that him aux pinched_{3PastNeut}
 (The puppy is running away from the kitten that it has pinched/that has pinched it.)
- b. Mače beži od kučeta što ga je uštinulo.
 kitten_{Neut} runs away-from puppy_{Neut} that him aux pinched_{3PastNeut}
 (The kitten is running away from the puppy that it has pinched/that has pinched it.)
- (9) a. Krava skače oko devojčice što ju je udarila.
 cow_{Fem} jumps around girl_{Fem} that her aux hit_{3PastFem}
 (The cow is jumping around the girl that has hit her/that it has kicked.)
- b. Devojčica skače oko krave što ju je udarila.
 girl_{Fem} jumps around cow_{Fem} that her aux hit_{3PastFem}
 (The girl is jumping around the cow that has kicked her/that she has hit.)