

## RESEARCH

# Structural ambiguity and optionality of agreement patterns in Bosnian/Croatian/Serbian conjunct agreement

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The paper deals with conjunct agreement and addresses the question whether the choice of agreement patterns with conjoined subjects is determined by the underlying syntactic structure. We focus on so-called bare conjunction with a shared adnominal item (modifier or determiner) which agrees only with the first conjunct, in particular on the split interpretation of this construction. Since this type of conjunction allows the adnominal item only to agree with the first conjunct, even though it structurally dominates the entire conjunction, we hypothesize that it also yields first conjunct agreement on the verb. We report and discuss the results of a production experiment that tests this hypothesis and confirms its predictions.

**Keywords:** conjunct agreement; bare nominal conjunction; structural ambiguity; production experiment; Bosnian/Croatian/Serbian

## 1 Introduction

The broad question this paper aims to answer is whether in languages where conjoined subjects license several different agreement patterns on the verb, the choice of the agreement pattern is (partially) determined by the underlying syntactic structure. Another way to phrase this is whether the availability of various agreement patterns is a function of the structural ambiguity of the conjunction – between conjunction reduction (i.e. elided clausal conjunction), conjunction of two DPs, bare conjunction of two nouns or NPs, conjunction of two nouns or NPs embedded under a single DP<sup>1</sup> and other possible structures.

The narrow question is whether the available underlying structures, and hence also the algorithm that decides the surfacing agreement pattern, include a particular structure with two nouns or NPs embedded under a single DP.<sup>2</sup>

Based on its behavior regarding adnominal agreeing items, we assume that this structure yields first conjunct agreement. The reasoning is the following: when it is grammatical, bare conjunction with an agreeing adnominal item before the first conjunct always

<sup>1</sup> In light of a view promoted by some research that languages without articles like Bosnian/Croatian/Serbian (B/C/S) have no DP projection (Bošković 2008), we point out that it is not crucial for our paper that the relevant projection is the DP – it can be any other projection higher than NP, such as the projections of gender, grammatical number, numerals or others. For simplicity and compatibility with the literature about the configuration we are interested in, we refer to the relevant projection as the DP (but we are also for independent reasons convinced that B/C/S has a DP projection).

<sup>2</sup> Heycock & Zamparelli (2005) argue that NPs are conjoined in this type of structure, and Le Bruyn & de Swart (2014) that it is a conjunction of bare nouns, or of a DP and a bare noun. Since this issue does not make a difference regarding the arguments made in our paper, throughout the paper, we refer to the relevant items as nouns or NPs.

has the adnominal item in agreement with the first conjunct (Aljović & Begović 2016). Arguments have been provided in literature (Heycock & Zamparelli 2005; Le Bruyn & de Swart 2014) that this adnominal item with semantic scope over both conjuncts sits at the DP level, while the conjuncts are both bare nouns or possibly NPs in some languages. From the perspective of agreement, this structure has the features of the first conjunct at the surface level, and the conjoined nouns are embedded within it and hence in no local relation with the verb. The features of the first conjunct, copied by agreement onto the DP, are hence the most local features for the verb to agree with without competition – at least as far as the syntactic structure is concerned.

This derives a prediction that expressions with an available parse that matches this configuration will yield more first conjunct agreement and less last conjunct agreement (which is otherwise a structural competitor, see Willer-Gold et al. 2016) than those for which it is unavailable. This prediction was experimentally tested, and the results of the experiment are presented and discussed. The results confirm the prediction, thus supporting the view that the structure under discussion is one possible source of first conjunct agreement.

We look into Bosnian/Croatian/Serbian (B/C/S)<sup>3</sup> since it is a language which manifests a broad variety of four distinct agreement patterns with conjoined subjects, and which also has the bare nominal conjunction construction with a modifier or determiner which scopes over a whole conjunction, but agrees only with its first conjunct. Therefore, it presents a perfect playground for the type of investigation we are interested in.

We focus only on the feature of gender, which offers more possibilities because in B/C/S it shows three different values, which are all plausible results of agreement with conjoined subjects. Number, with two values, gives too few possibilities and imposes too many restrictions. In order to control for the effects of number agreement, we investigate gender in the context of a plural number on all the conjuncts. The reason is that the verb agreeing with a conjoined subject, irrespective of the number on the conjuncts, is strongly preferred to bear the value plural, and is otherwise ungrammatical in many cases. By keeping all the conjuncts plural, we minimize the interference of number agreement regarding the gender agreement which is the topic of the paper.

## 2 Single conjunct agreement: The patterns in B/C/S

(Single) conjunct agreement, the agreement of the verb with only one member of a coordinated subject – as illustrated in (1), has been subject of intensive discussion in recent syntactic research (van Koppen 2005; Marušić et al. 2007; 2015; Benmamoun et al. 2009; Bhatt & Walkow 2013; Polinsky 2014, to mention just a few).

- (1) *Bosnian/Croatian/Serbian (B/C/S)*<sup>4</sup>  
 Pištaljke i zvona su se čula / čule / čuli sve do reke.  
 whistle.F.PL and bell.N.PL AUX.PL REFL heard.N.PL / F.PL / M.PL all till river  
 ‘(The) whistles and the bells could be heard all the way to the river.’

Next to the questions about the algorithms for choosing the agreement pattern, and its sensitivity to different syntactic and semantic factors, a main reason for the prominent status of this phenomenon is that certain patterns of agreement, at least in some languages, offer grounds to argue for the presence of linear computations in the domain of grammar where

<sup>3</sup> The authors of this paper prefer the name Serbo-Croatian for the language under investigation, but we use the name Bosnian/Croatian/Serbian for reasons of uniformity with other papers that deal with it within the volume.

<sup>4</sup> All the examples in the paper, unless specified otherwise, come from B/C/S.

syntactic operations and syntactic structures are still present (Marušić et al. 2007; 2015). Yet, a number of syntacticians have attempted to provide a fully hierarchical account of such patterns (Aoun et al. 1994; 1999 for Arabic; Bošković 2009; Murphy & Puškar 2015; Despić 2016 for B/C/S).

B/C/S is one of the languages in which the full array of theoretically available options of gender agreement with coordinated subjects, as illustrated in (1), is verified empirically. It displays agreement with the first conjunct (first conjunct agreement, FCA: the feminine agreement in (1)), agreement with the last conjunct (last conjunct agreement, LCA: the neuter agreement in (1)), agreement with all the conjuncts (applicable only for conjuncts of the same gender, let us refer to it as resolved agreement, RES: the feminine agreement in (2) and default agreement (default gender agreement in B/C/S assigns the default masculine gender, typically when the conjuncts are mixed in gender, but not only then, see (2), abbreviated DEF: the masculine agreement in both sentences in (1) and (2)).

- (2) Breza i topola su se videle / %videli iz velike daljine.  
 birch.F.SG and poplar.F.SG AUX.PL REFL seen.F.PL/M.PL from large distance  
 ‘A/the birch and a/the poplar could be seen from far away.’

Examples involving singular conjuncts in (1), triggering plural on the verb, suggest that indeed what we see is agreement with the entire conjoined subject. If one of the singular conjuncts in this sentence were masculine or neuter, there is a consensus in the formal literature (e.g. Bošković 2009) that the verb would need to show the default masculine agreement because single conjunct agreement is not available with singular conjuncts (for a different view, see Franks & Willer-Gold 2014, the corpus report of Bojović 2003, as well the experimental data in Arsenijević & Mitić 2016a).

While in the given examples it is not clear that last conjunct agreement, neuter in (1), is not actually second conjunct agreement, this is easily discriminated by examples as in (3).

- (3) a. Daske, dleta i čekići su ležale / ??ležala / ležali unaokolo.  
 bar.F.PL chisel.N.PL and hammer.M.PL AUX.PL lay.F.PL/N.PL/M.PL around  
 ‘(The) bars, chisels and hammers lay all around.’  
 b. čekići, dleta i daske su ležale / ??ležala / ležali unaokolo.  
 hammer.M.PL chisel.N.PL and bar.F.PL AUX.PL lay.F.PL/N.PL/M.PL around  
 ‘(The) hammers, chisels and bars lay all around.’

Both examples in (3) involve three-membered conjoined subjects, and a neuter gender second conjunct. In both cases the agreement with the second conjunct is a sharply degraded option, compared to agreement with the first or last member.

A more debated source of controversy is the status of FCA in preverbal subjects, i.e. feminine in (1), (3a), which is reported as available by Puškar & Murphy (2014), Arsenijević (2017) and as ungrammatical by Bošković (2009) and Franks & Willer-Gold (2014). Arsenijević & Mitić (2016a; b) and Willer-Gold et al. (2016) show convincingly that this pattern is to be treated as grammatical, approximately as good as LCA in preverbal subjects, even if less preferred in certain environments. This paper tries to answer the question of the structural source of FCA, i.e. to test the hypothesis that it is partly, or even entirely, a result of the shared determiner/modifier configuration of the conjoined nominal expression.

### 3 Structural ambiguity as a source of variable agreement with conjoined subjects

One of the central questions of conjunct agreement is whether all patterns result from the same structural configuration(s) or whether each of them correspond to a different structure (with intermediate/mixed possibilities).

Aoun et al. (1994; 1999) argue that in Arabic, single conjunct agreement is an epiphenomenon of conjunction reduction. A conjunction of two clauses undergoes ellipsis of one of the conjuncts, and surfaces looking like phrasal conjunction. The verb shows agreement with a non-conjoined subject of the non-elided clause. We illustrate this analysis on a B/C/S example in (4).

- (4) a. U supi su se kuvale knedle i rezanca.  
 in soup AUX.PL REFL cooked.F.PL dumpling.F.PL and noodles.N.PL  
 ‘Dumplings and noodles simmered in the soup.’
- b. U supi su se kuvale knedle i ~~u supi su~~ se  
 in soup AUX.PL REFL cooked.F.PL dumpling.F.PL and in soup AUX.PL REFL  
~~kuvala~~ rezanca.  
 cooked.N.PL noodles.N.PL  
 ‘Dumplings simmered in the soup and noodles simmered in the soup.’

Bošković (2009) similarly argues that preverbal subjects involve a complex derivational process which results in LCA, while post-verbal subjects simply trigger the structurally local FCA. He considers FCA with preverbal subjects to be ungrammatical – a view experimentally rejected in, among others, Willer-Gold et al. (2016).

FCA with preverbal subjects thus presents a problem for at least two attempts to account for the agreement patterns available with conjoined subjects by purely syntactic means. Aoun et al.’s (1994) conjunction reduction analysis, applied to B/C/S, would only license LCA with preverbal subjects, because it has to be the material of the clause on the left that is elided.

- (5) Rezanca ~~su~~ se kuvala ~~u supi~~ i knedle su se  
 noodles.N.PL AUX.PL REFL cooked.N.PL in soup and dumpling.F.PL AUX.PL REFL  
 kuvale u supi.  
 cooked.F.PL in soup  
 ‘Dumplings simmered in the soup and noodles simmered in the soup.’

Similarly, Bošković’s (2008) structural account, which is too sophisticated to be briefly presented here, entirely excludes FCA with preverbal subjects.

A representative of a third type of structural analysis, Murphy & Puškar, (2015) neatly accounts for all the available agreement patterns, but ascribes them all to one and the same structural pattern, deriving the different options from a different ordering of the syntactic operations agree, move and merge.

Experimental work like Willer-Gold et al. (2016) and Arsenijević et al. (To appear) indicates that more than one structure is available, and their mapping to the surfacing agreement patterns does not seem to be one to one. This only gives additional weight to the question of what structures are available for conjoined subjects, and how they correlate with the available patterns of agreement. A number of different syntactic analyses have been proposed for conjoined nominal expressions, some of them as competing models for the same empirical phenomenon, and some as multiple available structures introducing structural ambiguity. Each of them may potentially have a different effect on agreement.

One option which prominently figures in the literature is the conjunction at the phrasal level: nominal expressions form a conjoined structure which is also nominal in nature, and as such may occur in the subject position. Even for this single option, several different models have been argued to be adequate: 1) a symmetrical flat structure in which all the conjuncts are at the same hierarchical level, as in (6a) (e.g. Camacho 1999); 2) an asymmetric hierarchical structure in which the last conjunct is a complement of a conjunction head, the second-to-last one is its specifier, and then additional conjuncts may

be recursively introduced as specifiers of newly added conjunction heads which select the already formed one as a complement, as illustrated in (6b) (see e.g. the discussion in Munn 1993); 3) a similar structure, but where whole new conjunction phrases can be recursively inserted in the specifier position of a previously generated one, represented in (6c) (see Franks & Willer-Gold 2014 for B/C/S). Moreover, as previously outlined, arguments have been put forth for a conjunction reduction structure, i.e. an underlying clausal conjunction reduced by ellipsis to a phrasal surface appearance – as in (6d) (most radically in Schein 2016; Hirsch 2017).

- (6) a. [<sub>&P</sub> NP & NP & NP...],  
 b. [<sub>&P</sub> [NP] & [<sub>&P</sub> [NP] & [<sub>&P</sub> ... & [NP]]]]  
 c. [<sub>&P</sub> [<sub>&P</sub> [<sub>&P</sub> ... & [NP]]] & [NP]] & [NP]]  
 d. [<sub>&P</sub> [<sub>CP</sub> clausal material [NP]]] & [<sub>CP</sub> clausal material [NP]]]

The phrasal conjunction (whatever its underlying structure) and the conjunction reduction structure may be competing parses for the same surface strings – a source of structural ambiguity. But are those the only available options?

#### 4 Bare conjunction with an adnominal item and conjunct agreement

The literature on conjunction offers at least a third potential underlying structure – next to phrasal conjunction and conjunction reduction. This configuration, often referred to as bare conjunction, has been argued in the literature to target the level of a nominal head, potentially also of an NP. The conjunction then embeds under a shared DP projection before embedding in the syntactic context – and in the cases relevant for our investigation, it can then occur as the subject of a clause. This configuration has two possible interpretations, one where the conjoined nominal expressions are co-referential, as in (7a), and another in which they have different referents, as in (7b). In this paper we focus only on the latter option, as it is the only one that may compete with other possible structures in structurally ambiguous cases.

- (7) a. [This [journalist and writer]] sells thousands of books every year.  
 b. [This [man and woman]] will only meet each other twenty years later.<sup>5</sup>

Bare nominal conjunction has been extensively investigated for several interesting properties, among which is the unexpected morphosyntax of the determiners/modifiers with scope over the entire conjunction (Heycock & Zamparelli 2005; Le Bruyn & de Swart 2014). Consider the examples in (8), where the demonstrative and the adjective respectively indicate the number or gender of the first conjunct (SG in the English example, F in the B/C/S one), while their interpretation clearly targets the entire conjunction (note the plural agreement on the verb, even in the example from English where singulars are conjoined).

- (8) a. **This** man and woman have already been here.  
 b. **Prljave** rešetke i sita su morale biti oprane.  
 dirty.F.PL grid.F.PL and sieve.N.PL AUX.PL must.F.PL be washed.F.PL  
 ‘The dirty spoon and the dirty knife must be washed.’

Due to the shared determiner or adjective, the term XN&N construction is used.

<sup>5</sup> Le Bruyn & de Swart (2014) have a somewhat different analysis, where in syntax the adnominal item forms a constituent with the first conjunct, but as the conjunct is part of an expression denoting a set of pairs – it gets an interpretation over the entire conjunction. This does not change anything in the construction of our arguments.

Two influential analyses have been proposed for this construction in Heycock & Zamparelli (2005) and in Le Bruyn & de Swart (2014), although they diverge on many important issues, they both analyze the shared determiners/modifiers as located in a DP which semantically scopes over the entire conjunction. Their analyses diverge regarding the semantic interpretation of the conjunction, and regarding its syntactic structure. Heycock & Zamparelli (2005) model it simply as one DP which projects over two conjoined NPs, which implies the structure in (9a) for the expressions under focus in this paper, and Le Bruyn & de Swart (2014) as a conjunction of a DP and an N, where the element X occurs within the first conjunct, as in (9b).

- (9) a.  $[_{DP}$  **prljave**  $[_{&NP}$  rešetke i sita]]  
 dirty.F.PL grid.F.PL and sieve.N.PL
- 
- b.  $[_{&P}$   $[_{DP}$  **prljave**  $[_{NP}$  rešetke]] i  $[_{NP}$  sita]]  
 dirty.F.PL grid.F.PL and sieve.F.PL
- 

In Heycock & Zamparelli's (2005) model, the restriction of agreement of the item X in the XN&N construction to the first conjunct needs to be independently accounted for, probably in terms of hierarchical and/or linear locality. In Le Bruyn & de Swart's (2014) model, it follows from the syntactic configuration, as the item X is within the first conjunct, analyzed as a DP. We adopt the analysis from Heycock & Zamparelli's (2005) because the alternative from Le Bruyn & de Swart's (2014) is syntactically non-standard as it conjoins two different categories. It is difficult to reconstruct its precise syntactic working, and therefore also to formulate its precise predictions. It is crucial for our experiment that the configuration XN&N yields FCA on the determiners and modifiers occurring in front of the first conjunct, and less relevant how exactly this agreement pattern emerges. For a detailed discussion of the empirical facts and a well-fitted analysis of the bare conjunction with an adnominal agreeing item in B/C/S, see also Aljović & Begović (2016).

It is important to stress that we are not concerned with how the FCA patterns within the DP emerge – we only deal with the empirical observation that all the DP level material in the XN&N configurations must carry the gender feature of the first conjunct. We do, however, consider that in XN&N configurations, adjectives, as well as determiners, sit in the DP – as presented in (9a).

B/C/S is a language without articles. This effectively makes a majority of conjoined nominal expressions potentially parsed into the XN&N configuration: all those surfacing as a conjunction of two bare nouns, and all those surfacing only with modifiers or

determiners in front of the first noun. A consequence for conjunct agreement on the verb is that whenever this configuration is available as a parse, an increase of FCA should occur. There are two reasons for this.

One is that in the XN&N configuration, FCA brings the features of the first conjunct onto the DP, and DP is a prominent controller of agreement.<sup>6</sup> It is more local to the verb than either of the conjoined nouns, which are embedded under a &P, which in turn occurs within the DP. Even when there is no overt determiner or an adjective, i.e. in true bare conjunction – it could be the case that a null determiner is mediating the transfer of the features of the first conjunct onto the verb (similar to the pronoun in den Dikken’s 2001 account of hybrid agreement).

- (10) [<sub>DP</sub> ∅ [<sub>&P</sub> rešetke i sita]] su morale...  
 ∅.F.PL grid.F.PL and sieve.N.SG AUX.PL must.F.PL

Furthermore, it is logical to assume that when FCA occurs as the agreement pattern for the DP-internal material of the subject, strengthening of the FCA pattern on the verb, a kind of priming, will occur as well. A stronger expectation would be possible if it were the case that the XN&N interpretation were entirely incompatible with LCA. Then, the hypothesis to test would be that the choice of the agreement pattern DP-internally determines also the choice of the agreement pattern on the verb. However, according to both the authors’ intuition and a questionnaire distributed to 25 speakers, LCA is more or less as compatible with this configuration as FCA is.

The aim of this paper is hence to examine the hypothesis that the XN&N configuration indeed acts as a strengthening factor for FCA on the verb.

## 5 Predictions

We focus on the XN&N configuration: a type of bare nominal conjunction where two conjoined bare nouns are jointly modified by an adjective or taken by a determiner, but where the modifier or determiner agrees only with the first noun. The reason is that it gives us a handle to overtly control for the features in the DP. As mentioned before, the XN&N construction is the only way in B/C/S to express a prenominal modifier or determiner which semantically scopes over the entire conjoined nominal expression. The alternative, with default agreement on this item is possible for very few speakers, and even then strongly degraded (see Aljović & Begović 2016 for a discussion). Post-nominally, default agreement is acceptable, but only heavy modifiers may occur post-nominally in B/C/S, as in (11c).

- (11) a. **prljava** [rešetka i sito]  
 dirty.F.SG grid.F.SG and sieve.N.SG  
 b. \*/??**prljavi** [rešetka i sito]  
 dirty.M.PL grid.F.SG and sieve.N.SG  
 c. [rešetka i sito] **prljavi** \*(od masti)  
 grid.F.SG and sieve.N.SG dirty.M.PL of fat

In examples in which the second conjunct is modified, the effect is that the XN&N configuration is eliminated as a possible parse, and only the configuration with two conjoined DPs remains prominently available.<sup>7</sup>

<sup>6</sup> While number features may also be semantically motivated, due to its absence of interpretive effect, gender can only be read off the lexical specification on the conjoined nouns.

<sup>7</sup> Heycock & Zamparelli (2005) show that in Italian even two modified nouns can enter the XN&N construction, but to the best of our knowledge expressions in which only the second conjunct is modified are not found in this configuration.

- (12) [rešetka i [prljava sito]]  
grid.F.SG and dirty.N.SG sieve.N.SG

Similarly when both conjuncts are modified by the same adjective, the XN&N configuration is not available because pragmatics clearly eliminates interpretations where either of the adjectives/demonstratives scopes over the entire conjunction, including that in which both do.

- (13) [[prljava rešetka] i [prljava sito]]  
dirty.F.SG grid.F.SG and dirty.N.SG sieve.N.SG

The following generalizations are thus central for our research:

1. the FCA-triggering XN&N configuration is the only option for the expression of nominal conjunctions occurring under the same modifier or determiner,
2. the XN&N configuration is a possible parse for conjoined bare nouns, as well as for conjoined nominal expressions with a modifier or determiner before the first conjunct (the other possible parse being a conjunction of two DPs),
3. in the remaining two possibilities (a conjunction of a bare noun and a modified noun and a conjunction of two modified nouns) the XN&N configuration is excluded,
4. when the XN&N configuration occurs in the subject position, (on both analyses offered in the literature) the subject is a DP which carries the gender feature of the first conjunct,
5. when the XN&N configuration occurs in the subject position, there is at least one instance of FCA taking place within the DP, which may plausibly prime the FCA pattern on the verb as well.

Since the aim of the paper is to test the hypothesis that XN&N is a possible structure for certain conjoined subjects (those involving bare nouns and those only involving a modifier in front of the first conjunct), we are interested in its predictions. In particular, the prediction we focus on is that expressions with a modifier in front of the first conjunct will be a more likely environment for FCA on the verb, due to the availability of a configuration in which there is only one DP in the subject, specified for the features of the first conjunct, and additionally due to a possible priming effect of the FCA that has taken place within this DP.<sup>8</sup>

The hypothesis of the availability of the XN&N configuration also makes two predictions regarding LCA, depending on how LCA is analyzed. If LCA results from the same grammar as FCA, it is expected that the availability of the XN&N configuration results in a decrease of LCA. If it is a result of a different grammar, then no such effect is expected, and FCA should be strengthened only at the account of DEF.

- (14) a. [<sub>DP</sub> prljave [<sub>&P</sub> rešetke i sita]] su moral-e...  
dirty.F.PL grid.F.PL and sieve.N.PL AUX.PL must.F.PL
- b. [<sub>&DP</sub> [<sub>DP</sub> prljave rešetke] i [<sub>DP</sub> prljava sita]] su morala?  
dirty.F.PL grid.F.PL and dirty.N.PL sieve.N.PL AUX.PL must.N.PL

<sup>8</sup> As performance opens a lot of room for distortion of the grammatically derived facts, and since there is also a possibility that the different agreement patterns are a matter of different grammars, we do not commit to the view that the XN&N configuration only yields FCA on the verb – it may still be possible that it results in LCA, and especially in DEF if it is some kind of a repair strategy. It suffices for our research that there is a stronger tendency for the XN&N configuration to yield FCA than in other configurations.



There were also multiple predictions about DEF depending on the analysis (last resort, resolution, attraction of gender by number, see Arsenijević & Mitić 2016a for a discussion). However, due to an interaction of a large number of options, it was impossible to formulate clear and testable predictions in its regard.

We designed an experiment to test the predictions as introduced above, which we summarize in (15), for the hypothesis that FCA and LCA compete within the same grammar:

- (15) The availability of the XN&N configuration as a potential parse for the subject will increase the chances for FCA agreement and decrease the chances for LCA agreement on the verb.

## 6 Experiment: Materials and method

We used the exact experimental design for production experiments that has been fruitfully implemented and reported in Willer-Gold et al. (2016; 2017), Arsenijević & Mitić (2016a; b) and several other experimental works. It was a production experiment in B/C/S, developed and administered using the portal Ixex Farm,<sup>9</sup> in which the participant first reads out loud a model sentence involving a masculine singular non-coordinated subject (the screen displays a sentence as in (16a)), and then needs to pronounce the sentence again, but with a substitute subject provided on the screen (the screen displays the substitute subject as in (16b)).

- (16) a. Ulaz je očišćen prošlog petka.  
entrance.M.SG is cleaned.M.SG last Friday  
'The entrance was cleaned last Friday.'
- b. Dotične kuhinje i kupatila.  
certain.F.PL kitchen.F.PL and bathroom.N.PL

The agreement pattern used by the participant in the pronounced sentence is coded as SG or PL for number and as FCA, LCA or DEF for gender.

All the sentences had preverbal subjects, were of approximately the same length in syllables and characters (mean length in syllables = 24), and involved adjectives and nouns of the same level of frequency and length (all within the third octile of the frequency list based on the Word Frequency Corpus, Arsenijević 2018). All the stimuli involved binary conjoined subjects with the first member headed by a F.PL noun and the second by a N.PL noun. All the predicates in the stimuli were passives from transitive verbs (Arsenijević & Mitić 2016b show that this variable affects the rate of FCA in B/C/S).

We only had one dependent variable: the agreement pattern produced, with three levels: FCA, LCA and DEF. Due to the mixed combination of genders, true RES from Willer-Gold et al. (2016), where the aggregate conjunction has the gender value shared by all the conjuncts, was not an option. There was only one independent variable: which conjunct was modified, with three levels: first (condition Mod1), second (Mod2) or both (ModB).<sup>10</sup> Condition Mod1 was tested for the effect on FCA and LCA, and Mod2 and ModB were included as baseline variables. Two baseline variables were needed in order to control for alternative explanations for a potentially attested contrast between Mod1 and either

<sup>9</sup> We express our gratitude to the administrators of Ixex Farm, in particular to its author Alex Drummond, for making our work considerably simpler.

<sup>10</sup> We did not include a condition without any modification because it would only add generally unwanted complexity to the experiment, while not significantly increasing its informativity. It is vacuously equivalent to the structural interpretations Mod1 allows: it allows both, but it does not have a modifier to strengthen the (X)N&N interpretation. Moreover, it would complicate the experiment by introducing the question whether XN&N and N&N are the same syntactic configuration or different ones (see Le Bruyn & de Swart 2014 for a discussion).

one of the two other conditions. With only Mod1 and Mod2, it would be possible that modification simply makes a conjunct more prominent, and that prominence (heaviness) makes a conjunct a more likely controller of agreement. In that case, Mod1 would promote FCA and Mod2 LCA, exactly the effect predicted by the tested hypothesis. With only Mod1 and ModB, it was possible that asymmetric modification (modification of only one conjunct) shows different behavior from symmetric modification (i.e. of both conjuncts). In the given setting, the strongest version of the prediction in (15) above was that Mod1 will yield more FCA than both base line conditions.

The experiment involved 18 critical sentences, six for each condition, 18 controls and 54 fillers. The conditions were thus represented by sentences of the following structure.

(17) Illustration examples for each condition

a. *Mod1*

*Model sentence:*

Izveštaj je ukraden iz fioke.  
report.M.SG AUX.SG stolen.M.SG from drawer.F.SG  
'The report was stolen from the drawer.'

*Substitute subject:*

izvesne sveske i pisma  
certain.F.PL notebooks.F.PL and letters.N.PL  
'certain notebooks and letters'

b. *Mod2*

*Model sentence:*

Izveštaj je ukraden iz fioke.  
report.M.SG AUX.SG stolen.M.SG from drawer.F.SG  
'The report was stolen from the drawer.'

*Substitute subject:*

sveske i izvesna pisma  
notebooks.F.PL and certain.N.PL letters.N.PL  
'notebooks and certain letters'

c. *ModB*

*Model sentence:*

Izveštaj je ukraden iz fioke.  
report.M.SG AUX.SG stolen.M.SG from drawer.F.SG  
'The report was stolen from the drawer.'

*Substitute subject:*

izvesne sveske i izvesna pisma  
certain.N.PL notebooks.F.PL and certain.N.PL letters.N.PL  
'certain notebooks and certain letters'

All the adjectives used were referential and discourse adjectives such as *izvesni* 'certain', *određeni* 'particular', *pomenuti* 'aforementioned' (see e.g. Stanković 2014 for a discussion of these adjectives). The intention was to strengthen the DP level interpretation of the adjective, which had two beneficial contributions. One is to more sharply eliminate the XN&N interpretation for the baseline conditions Mod2 and ModB (the XN&N structure coordinates nouns or NPs under one DP – it cannot coordinate DPs). The other is to make sure that the adjective sits in the DP (because DP is the locus of the referential interpretation) in the Mod1. This is in line with the arguments in the literature that in the XN&N

construction, the modifier/determiner sits in a shared DP. In all critical items the first conjunct was feminine and the second, and last, conjunct was neuter.

The controls were exactly the same as the critical examples except that they had the inverted order of genders in the conjunction: the first conjunct was N and the second was F. The purpose was to control for the effect of the order of gender values (attested as significant in Willer-Gold et al. 2016).

Critical items and controls were organized in 6 lists, so that each stimulus occurred exactly once in each condition and in each of its control counterparts. The purpose was to control for the possible effect of the particular lexical items, or various other properties of the different examples. These items were selected from reference dictionaries. The nouns were selected such that: a) they all were of a similar frequency, b) they constituted natural conjunctions in the sense of Le Bruyn & de Swart (2014), c) they could saliently be modified by the adjectives used.<sup>11</sup> The adjectives were selected such that they belonged to the relevant class (for the critical items: discourse-referential adjectives), and were of a similar degree of frequency.

Filler items were identical like critical examples, except that instead of conjoined nominal expressions, they all involved subject substitutes with a special behavior regarding number and gender. Each of the following six classes was represented with 6 examples: nouns derived by the suffix *-lo*, triggering N or M agreement (*piskaralo* ‘scribe’); paucal numbers with non-hybrid M nouns (*tri doktora* ‘three doctors’); paucal numbers with the *-lo* N-M hybrids above (*tri cerekala* ‘three laughers’); hybrid nouns in *-ica* triggering M or F agreement (*pijanica* ‘drunk’); an animate neuter noun with a relative clause (*čedo koje su čuvali* ‘sweetheart which they took care of’) and an animate neuter noun for animal offspring with a relative clause (*pile koje su kupili* ‘chicken that they bought’). This type of filler, which was designed to distract the participants from the structures with conjoined subjects, is illustrated in (18a). Additionally, there were three sets of 6 fillers, each fully mirroring each of the three conditions, except that the adjectives for color were used instead of the reference-oriented adjectives. Apart from distracting the participants from discourse adjectives, this type of filler facilitated the formation of lists which were designed to control for the effect of items. This type of filler is illustrated in (18b).

(18) a. *Model sentence:*

Vlasnik je došao u pekaru.  
owner AUX.SG come in bakery  
‘The owner came to the bakery.’

*Substitute subject:*

cerekalo  
laugher

b. *Model sentence:*

Konac je donet kod krojačice.  
thread AUX.SG brought at tailor  
‘The thread was brought to the tailor’s.’

*Substitute subject:*

ljubičaste igle i ljubičasta zrna.  
violet needles and violet beads  
‘violet needles and violet beads’

<sup>11</sup> The salience of the conjoined lexical items for natural conjunction was controlled in two ways. First, one author formulated the examples according to their intuitions, and the other evaluated them; where disagreement emerged, examples were replaced. Next, we conducted a questionnaire, as described below.

Thirty subjects participated in the experiment, five per list, mean age in the early twenties, and all were native speakers of B/C/S who have spent the past five years within the area of this language. The experiment was conducted at the University of Niš.

Before presenting the results, let us report on an additional controlling measure aimed to tighten the link between the results of the experiments and the hypothesis. One anonymous reviewer pointed out that our experiment only attempts to reject the hypothesis, while if we provided support for the assumption that the Mod1 condition has the XN&N interpretation (one in which the modifier scopes over the entire conjunction), it would additionally support the claim that a difference, if attested, is due to the availability of this reading.

We have conducted a questionnaire, in which we included one example from each set of six examples within the same condition for a single list in our experiment, each in two variants: Mod1 and Mod2, in a randomized order. We only used color adjectives because the discourse adjectives do not appear as predicates, which was required by the design of our questionnaire (see (19) below), and their semantics is generally difficult to describe to the participants for any other design of the questionnaire.<sup>12</sup> An example of a question is given in (19). Naturally, – it was given without the glosses, and with all the material in B/C/S. The third option was added because not all speakers produce FCA sentences (Willer-Gold et al. 2016), and while the first two options could be selected simultaneously, the third option (unacceptability) excluded the other two.

(19) What does this sentence mean?

Ljubičaste igle i zrna su donate kod krojačice.

violet needles and beads AUX.PL brought at tailor

‘Violet needles and beads have been brought to the tailor.’

- The needles are violet, the beads might be any color.
- Both the needles and the beads are violet.
- I find the sentence unacceptable.

Regarding the Mod1 sentences, results from 40 participants show an acceptance rate of the restriction of the first conjunct only in 93% of cases and the XN&N interpretation (both conjuncts are restricted) in 81% of cases, with around 7% of reported unacceptability, almost all for the FCA examples. Regarding the Mod2 condition, the acceptance of the reading where the last conjunct only is restricted is over 99%, and both other options remain below 2%. The high rate of the XN&N interpretation in the Mod1 condition, in combination with its low rate in the Mod2 condition, confirms our assumption that this condition does have one additional underlying structural configuration.

## 7 Results and discussion

The results of the experiment, in terms of the number of produced sentences for each of the patterns in the aggregate production per condition are given in a tabular and graphical representation in Figure 1.<sup>13</sup>

<sup>12</sup> That color adjectives give a good indication also of the behavior of discourse adjectives was guaranteed by the pilot experiment which we conducted, which had an identical design as the reported experiments, except that it had an additional variable: the type of adjectives. In addition to discourse adjectives, it included color adjectives, and they showed the same behavior as discourse adjectives along the relevant dimensions, only with weaker effects.

<sup>13</sup> The sums do not always reach the aggregate number of trials per condition (180) because the erroneously produced sentences in which any of the relevant parameters (the order between the verb and the subject, the verb, the subject etc.) were either changed, or omitted or incomprehensible were not included in the reported results.

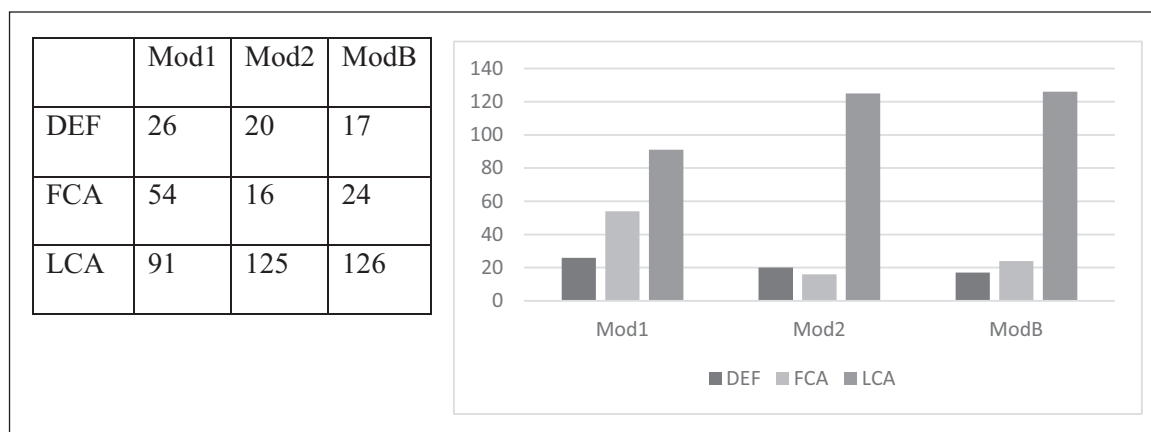
The rate of FCA when the first conjunct is modified is more than two times higher than when both are modified, and more than three times higher than when only the second conjunct is modified. The rate of LCA is not significantly higher when the second conjunct is modified than when both are, which eliminates the explanation based on prominence resulting from modification: if the heaviness of the conjunct played a role, we would expect some difference at least.

Considering the categorical nature of both the independent and the dependent variable, and the fact that the differences that we are interested in are between proportions, we applied the z-test to assess the significance of the differences. Since we were comparing differences in percentages (or absolute numbers) for each agreement pattern per condition, the best suited tests were the chi-square and the z-test – we chose the former as it was somewhat more reliable.<sup>14</sup> Table 1 displays the significant effects.

As predicted by the hypothesis about XN&N as a possible source of FCA, the rate of production of FCA is significantly higher in Mod1 than in both Mod2 and ModB, and the rate of production of LCA is lower in Mod1 than in both Mod2 and ModB. The prediction in the strongest form is hence confirmed.

Accounts which postulate linear locality based agreement as the source of LCA with preverbal conjoined subjects (Marušić et al. 2007; 2015) would need additional means to explain why the increase of FCA when the bare conjunction configuration is more prominently available is only at the expense of LCA, not of DEF. The reason is that in their model, FCA and LCA result from different stages in the derivation (even different modules).

A significant difference is also found between the rates of production of DEF between Mod1 and Mod2: it is produced significantly more in Mod1. This is orthogonal to the hypothesis tested, but in light of the proposal it favors the view where DEF is a strategy



**Figure 1:** Number of produced sentences of each agreement pattern per condition.

**Table 1:** Significance of effects.

	Mod1 vs. Mod2	Mod1 vs. ModB	Mod2 vs. ModB
FCA	Z = 4.827 P < 0.0001	Z = 3.511 P < 0.0001	
LCA	Z = -2.349 P = 0.02	Z = -2.414 P = 0.02	
DEF			

<sup>14</sup> A chi-square test gives exactly the same distribution of significant differences, with  $\chi^2 = 33.939$ ,  $df = 4$ ,  $p = 0.00000077$ .

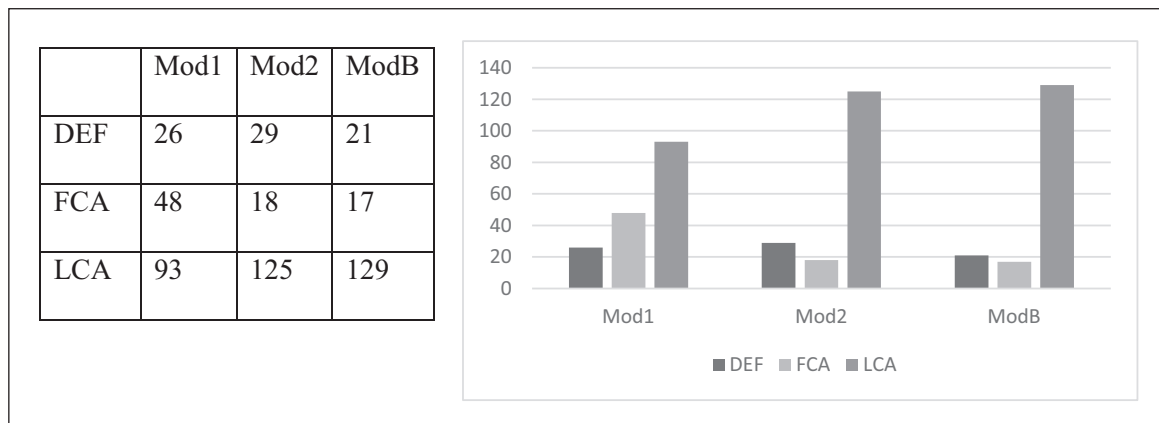
resorted to when pursuing the full syntactic agreement operation is demanding at the level of processing. The availability of XN&N as an additional possible parse increases processing demands, and a higher rate of the failure-repair DEF is produced. No significant differences have been attested between Mod2 and ModB.

Our results also bear on the analyses which derive single conjunct agreement from ellipsis (e.g. Aoun et al. 1994). It has been convincingly argued that the XN&N configuration does not involve ellipsis (Heycock & Zamparelli 2005; Le Bruyn & de Swart 2014), yet it strengthens a pattern of single conjunct agreement, supporting the view that ellipsis at least is not the only source of single conjunct agreement.

As presented in Figure 2 (for the significant difference, see Table 2), the control conditions, which only differed from the critical conditions in having the reversed order of gender values, showed the same pattern. A general strengthening of LCA relative to FCA – the same kind of effect of the order of gender values as reported in Arsenijević & Mitić (2016a; b) and in Willer-Gold et al. (2016) – was attested as well. As it goes beyond the aim of our paper, we do not discuss it here. However, this eliminates the possibility that the effects discussed are limited to the FN order of conjuncts.

### 8 Conclusion

The paper discusses conjunct agreement in B/C/S, in which four different agreement patterns can be attested with conjoined subjects: first conjunct agreement, last conjunct agreement, default agreement and resolved agreement. It addresses the question whether the choice of the agreement pattern is (partially) determined by the underlying syntactic structure, i.e. whether the availability of different agreement patterns is partially a function of the availability of different underlying syntactic structures for the conjunction. These different possible structures include conjunction reduction (i.e. elided clausal conjunction), conjunction of two DPs, bare conjunction of two NPs, conjunction of two Ns



**Figure 2:** Number of produced sentences for each agreement pattern per control condition.

**Table 2:** Significance of effects.

	Mod1 vs. Mod2	Mod1 vs. ModB	Mod2 vs. ModB
FCA	Z = 3.841 P < 0.0001	Z = 4.013 P < 0.0001	
LCA	Z = -2.196 P = 0.03	Z = -2.456 P = 0.014	
DEF			

or NPs embedded under a single DP. The last mentioned structural option, with a shared modifier or determiner, referred to throughout the paper as the XN&N configuration, if available, is expected to promote FCA, at the expense of the competing agreement patterns – since as mentioned above, it already manifests FCA on the NP-internal item X. This prediction was experimentally tested, and the results of the experiment were presented and discussed. The results confirm the prediction, thus supporting the view that the XN&N configuration is one of the sources of first conjunct agreement. Moreover, the experiment indicates that FCA primarily competes with LCA – suggesting that these two agreement patterns do not result from different grammars, or from different modules of grammar.

### Additional File

The additional file for this article can be found as follows:

- **Appendix.** The critical and the control stimuli. DOI: <https://doi.org/10.5334/gjgl.582.s1>

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### Competing Interests

The authors have no competing interests to declare.

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