SECOND POSITION AND THE PROSODY-SYNTAX INTERFACE

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Abstract

Bögel et al. (2009) outlined a new architecture for modeling the interaction between prosody and syntax: we proposed an arrangement of interacting components in which prosodic information is developed in a module that operates independently of the syntax while still allowing for syntactic rules and preferences to be conditioned on prosodic boundaries and other features. This architecture allows for misalignments between prosodic units and syntactic constituency, but it incorporates a Principle of Prosodic Preference that causes syntactic structures that do not coincide with prosodic boundaries to be dispreferred. In this paper, we extend the proposal to account for so-called second position clitics. These are clitics that are interpreted syntactically as if they are immediate constituents of a clause, but their appearance after the first prosodic word may embed them in lower constituents and thus insulate them from normal clausal interpretation. We meet this theoretical challenge by adding to the architecture a mathematically restricted "interface mapping" in the form of a regular relation that mediates between the divergent syntactic and prosodic requirements that clitics must jointly satisfy.

1   Introduction

In Bögel et al. (2009), we outlined a new architecture for modeling the interaction between prosody and syntax.[1] As an alternative to the co-description approach first suggested by Butt and King (1998), we proposed an arrangement of interacting components in which prosodic information is developed in a module that operates independently of the syntax while still allowing for syntactic rules and preferences to be conditioned on prosodic boundaries and other features. Under this architecture the terminal string of the syntactic tree (the LFG c-structure) is a sequence of lexical formatives intermixed with additional features that also satisfy the constraints of the prosodic component. This allows for misalignments between prosodic units and syntactic constituency because syntactic rules can ignore prosodic information that would otherwise disrupt syntactic patterns. However, the architecture also incorporates a Principle of Prosodic Preference that causes syntactic structures that do not coincide with prosodic boundaries to be dispreferred.

The present paper explores how this modular prosody-syntax architecture can be extended to apply to an additional class of syntax-prosody misalignments, the second position clitics that appear in many languages. Second position clitics have presented a challenge to many if not all theoretical frameworks — as a consequence, there is a substantial literature on the subject (i.a., Halpern and Zwicky (1996), Franks and King (2000), Anderson (2005) and references therein). The crucial aspects of the problem, from an architectural point of view, are demonstrated by the following example from Serbian/Croatian/Bosnian (SCB):

(1) [Taj *joj ga je* čovek]_{NP} poklonio.

 that her it AUX man presented

 'That man presented her with it.' (Halpern 1995, 26)

The clitic sequence *joj ga je* appears as an interruption between the demonstrative *taj* and the head noun *čovek* of what would otherwise be an ordinary initial NP, and those clitics contribute feature and argument information not to the interpretation of the NP that they are contained within but to the clause containing that NP.

Layered on top of these syntactic issues is the interaction with prosody: these clitics can appear in the second position of a prosodic unit without regard to syntactic alignments. This is illustrated by the prosodic bracketing in (2). In this paper, we adopt the usual convention of using square brackets to surround syntactic constituents and smooth parentheses to mark prosodic constituents. The clitics are shown in italics. As per assumptions in the literature, we show the clitics attaching to the prosodic word to their left and thus forming a new prosodic word (e.g., Selkirk (1995), Inkelas (1990)). That is, the clitics form one, larger prosodic word with their host.[2]

(2) $((($Taj$)_\omega$ *joj ga je*$)_\omega$ (čovek$)_\omega)_p$ (poklonio$)_p$

 that her it AUX man presented

 'That man presented her with it.'

On the traditional LFG view that the terminal string of the c-structure is a direct representation of the prosodically-ordered sequence of lexical formatives, the problem is first to account for the fact that the string underlying the initial NP (or any other phrasal category) contains otherwise unexpected clitics, and then to arrange for the functional contributions of those NP-internal clitics to affect the clausal f-structure even though that f-structure is not accessible through the usual ↑ metavariable. The prosody-syntax architecture as originally proposed deals only with misalignments of constituent boundaries and so does not offer an immediate solution to this problem.

The paper is organized as follows. In section 2 we provide an overview of the basic second position patterns that have been discussed in the literature, presenting data from Russian and SCB. In section 3 we recap the modular architecture proposed in Bögel et al. (2009). In the remaining sections we add to this architecture a mathematically restricted "interface mapping" that reconciles the positional requirements that the prosodic component imposes on these clitics with independent syntactic constraints on phrasal organization and functional interpretation.

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[2]For our purposes it is irrelevant whether the clitics are represented at the phonological/prosodic level as individual elements or as a clitic group (e.g., see Nespor and Vogel (1986) and Hayes (1989)).

2   Second Position Clitics: Data

In this section we consider data from Russian and SCB to illustrate possible patterns of second position clitic placement.[3] Russian is the simpler case, since the position of the relevant clitics is defined solely in prosodic terms. SCB clitics can appear in either prosodically defined second position (after the first prosodic word) or in positions that can be characterized in syntactic terms (after the first clause-level constituent). There is much controversy in the SCB theoretical linguistics literature as to whether SCB clitic placement is purely prosodic (Radanović-Kocić 1996), purely syntactic (Franks and Progovac 1994, Progovac 1996), or a combination of both (Halpern 1995); for discussion of this controversy and the major arguments for the different approaches, see chapter 10 of Franks and King (2000).[4] In this paper, we show how purely prosodic clitic placement and placement defined by a combination of prosodic and syntactic factors can both be captured within our extended LFG framework; purely syntactic clitic placement can be straightforwardly captured in traditional LFG theory. We leave the exact nature of the SCB data as a matter of continued research.

Prosodic conditioning bears most directly on the architecture for prosody/syntax interaction and is the main focus of this paper. We present a formal analysis of this in section 4 and, for the sake of completeness, we also provide an analysis of clitics that come after the first syntactic constituent in section 5.

2.1   Second Prosodic Word Languages: Russian

The Russian interrogative marker *li* is an example of a clitic that always appears after the first prosodic word in the clause over which it has semantic scope, i.e. the clause whose interrogativity is marked by *li*'s presence.[5] This is shown in (3) where the presence of *li* indicates that the subordinate clause is interrogative. The fact that *li* occurs after the main verb of the subordinate clause results in a neutral reading (King 1994).

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[3]Russian and SCB also have simple clitics (in the sense of Zwicky (1977)), e.g., many of the prepositions are simple clitics. Their surface realization poses no issues for LFG theory.

[4]More nuanced differences within SCB apparently exist between language and dialectal varieties. For example, Diesing et al. (2009) suggest that while Serbian allows for both syntactic and prosodic placement, Croatian only allows clitics after the first prosodic word. Damir Ćavar (p.c., September 2010) notes that differences in preference have been observed between Bosnian and Serbian and that differences may exist between standard Croatian and other Croatian dialects. We merely note that according to the current state-of-the-art in the literature, both syntactic and prosodic constraints seem to play a role. Diesing et al. (2009) further report differing preferences on clitic placement depending on whether the host is an argument or a predicate.

[5]The interrogative *li* can be used in matrix clauses as well as in subordinate clauses. However, in Contemporary Standard Russian and in spoken Russian, matrix uses of *li* are rare and often sound stilted. For this reason we use subordinate clauses in our examples. The pattern of clitic placement is identical in matrix and subordinate clauses for those speakers that still use *li* in matrix clauses.

(3) a. Oni ne znajut, rabotaet *li* Maša   na ètom zavode.
they not know   work   Q Masha at this   factory
'They don't know whether Masha works at this factory.'

b. Oni ne znajut $(((\text{rabotaet})_\omega\ li)_\omega$ Maša na ètom zavode).

Other items can be the host of *li*. In (4) the subject hosts *li* and the result is the focusing of the subject, as reflected by the clefting in the translation.

(4) a. Oni ne znajut, Maša   *li* rabotaet na ètom zavode.
they not know   Masha Q work   at this   factory
'They don't know whether it is Masha who works at this factory.'

b. Oni ne znajut, $(((\text{Maša})_\omega\ li)_\omega$ rabotaet na ètom zavode).

These examples tell us little about the exact positioning of *li* because the clitic appears after items that are both a single prosodic word and a single syntactic constituent. However, if a more complex syntactic constituent appears initially in the subordinate clause, it is the first prosodic word within that constituent that hosts *li*. This is shown in (5) in which the fronted phrase is a complex PP. The preposition and demonstrative form a single prosodic word[6] while the head noun of the NP within the PP forms a separate prosodic word.

(5) a. Oni ne znajut, na ètom *li* zavode rabotaet Maša.
they not know   at this   Q factory work   Masha
'They don't know whether it is at this factory that Masha works.'

b. Oni ne znajut, $(((\text{na ètom})_\omega\ li)_\omega$ zavode rabotaet Maša).

c. Oni ne znajut, [na ètom *li* zavode]$_{\text{PP}}$ rabotaet Maša.

In contrast, example (6) shows that *li* cannot appear after the entire PP.

(6) a. *Oni ne znajut, na ètom zavode *li* rabotaet Maša.
they not know   at this   factory Q work   Masha
'They don't know whether it is at this factory that Masha works.'

b. *Oni ne znajut, $((\text{na ètom})_\omega\ ((\text{zavode})_\omega\ li)_\omega$ rabotaet Maša).

c. *Oni ne znajut, [na ètom zavode]$_{\text{PP}}$ *li* rabotaet Maša.

Thus the examples in (5) and (6) form a minimal pair demonstrating that it is prosodic constituency and not syntactic constituency that is important for the placement of *li*. We also note that the interrogativity indicated by the presence of *li* in (5) applies to the entire subordinate clause, even though the linear order places the clitic within the PP.[7]

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[6]Most Russian prepositions are proclitics that form a prosodic word with the word to their right.

[7]There is an additional focus on the PP, or a subconstituent of it (King 1994), but the main interrogative scope is the entire clause.

A final constraint on the placement of *li* is that its prosodic host must lie within the subordinate clause. That is, the last word of the matrix clause cannot serve as its host, even though that word may satisfy the prosodic requirements of the enclitic. The different versions in (7) demonstrate that the order of the words in the subordinate clause other than *li* are immaterial for the ungrammaticality. Variations in the order of words in the matrix clause are also immaterial for the ungrammaticality. In (8a) the matrix verb cannot host *li*, while in (8b) the matrix subject cannot host *li*, even though both are full prosodic words.

(7) a. *Oni ne znajut, *li* rabotaet Maša   na ètom zavode.
         they not know   Q work   Masha at this   factory
         'They don't know whether Masha works at this factory.'

     b. *Oni ne znajut, *li* Maša rabotaet na ètom zavode.

     c. *Oni ne znajut, *li* na ètom zavode rabotaet Maša.

(8) a. *Deti   ne znajut, *li* rabotaet Maša   na ètom zavode.
         children not know   Q work   Masha at this   factory
         'The children don't know whether Masha works at this factory.'

     b. *Ne znajut deti, *li* rabotaet Maša na ètom zavode.

The ungrammaticality of (8) is explained if the subordinate clause forms a prosodic domain separate from that of the matrix clause, as generally assumed for the prosody-syntax interface (Selkirk 1986, 2001). That is, major syntactic categories such as IP, CP or VP are generally assumed to align with an intonational phrase and constitute an independent prosodic domain.

With respect to Russian, the observation is that *li* must be placed after a prosodic host within a larger prosodic domain such as the intonational phrase corresponding to the CP. This placement constraint is again exemplified in (9).

(9) a. Oni ne znajut, $(((rabotaet)_\omega \; li)_\omega$ Maša   na ètom zavode).
         they not know   work   Q Masha   at this   factory
         'They don't know whether Masha works at this factory.'

     b. *Oni ne znajut, (*li* rabotaet Maša na ètom zavode).

To summarize, the Russian interrogative clitic *li* must appear after the first prosodic word in its larger prosodic domain. This prosodic word may or may not correspond to a syntactic constituent. This is shown schematically in (10).

(10) a. $\sqrt{}$ [main clause] [$((xxx)_\omega \; li)_\omega \ldots$]

      b. * [main clause] [$(xxx)_\omega \; ((xxx)_\omega \; li)_\omega \ldots$]

      c. * [main clause] [*li* $(xxx)_\omega \ldots$]

2.2 Second Prosodic or Syntactic Constituent Languages: SCB

Serbian/Croatian/Bosnian (SCB) has been argued to allow clitic placement after either the first prosodic word or the first syntactic constituent in the clause (Halpern 1995).[8] Consider the minimal pair in (11) and (12). In (11) the clitic cluster occurs after the complex subject noun phrase, while in (12) the clitic cluster occurs after the first prosodic word in the subject noun phrase, namely the demonstrative modifier. The scopal interpretation of the clitics is identical in both sentences; that is, they are arguments and auxiliaries of the main verb.

(11) a. Taj čovek *joj ga je* poklonio.
   that man   her it AUX presented
   'That man presented her with it.'   (Halpern 1995, 26)

   b. [Taj čovek]$_{NP}$ *joj ga je* poklonio.

(12) a. Taj *joj ga je* čovek poklonio.
   That her it AUX man   presented
   'That man presented her with it.'   (Halpern 1995, 26)

   b. [Taj *joj ga je* čovek]$_{NP}$ poklonio.

   c. ((Taj)$_\omega$ *joj ga je*)$_\omega$ čovek poklonio.

The clitic host can also be the verb, as in (13). As verbs are both prosodic words and syntactic constituents ((13b,c)), these constructions do not provide much evidence for conditioning factors. The verb is always the clitic host when it is the only non-clitic in the clause as in (13d), the pro-dropped version of (13a).

(13) a. Poklonio *joj ga je* taj čovek.
   presented her it AUX that man
   'That man presented her with it.'

   b. [Poklonio]$_V$ *joj ga je* taj čovek.

   c. ((Poklonio)$_\omega$ *joj ga je*)$_\omega$ taj čovek.

   d. Poklonio *joj ga je*.
   presented her it AUX
   '(He) presented her with it.'

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[8]There are situations in which the clitics appear to be in third position (Ćavar and Wilder 1994a,b). These have largely been analyzed as sentences in which the first constituent is prosodically and syntactically separated from the remainder of the clause (e.g., via topicalization or contrastive focusing via left extraposition). We will not address these examples here, although we believe that our analysis can account for the data if the previous claims are correct about the unusual prosodic and syntactic structure of these sentences. That is, we would expect the topicalized or focused material to make up a prosodic domain that is independent from the main clause. Clitic placement would then proceed independently in each prosodic domain, which Radanović-Kocić (1988) has argued to be within an intonational phrase.

The clitics cannot appear sentence initially, as in (14a). That is, they are enclitics and must have a prosodic host to their left. (14b) provides a version of the sentence in which *joj* has been replaced with the full pronoun *njoj*. In this case there is a prosodic word that the clitics can attach to, and so the example is grammatical.

(14) a. **Joj ga je*   taj čovek poklonio.
       her it AUX that man   presented
       'That man presented her with it.'

     b. Njoj *ga je*   taj čovek poklonio.
       her it AUX that man   presented
       'That man presented her with it.'

The relevant domain for SCB clitic placement is the clause, not the sentence, as was also seen for the Russian interrogative marker *li*. This is shown in (15), where the clitics appear in the subordinate clause, prosodically hosted by the complementizer. Effectively, the complementizer occupies the first position of the clause and the clitics are in second position.

(15) a. Ona tvrdi [da *joj ga je*   taj čovek poklonio].
       she claims that her it AUX that man   presented
       'She claims that that man presented her with it.'

     b. Ona tvrdi $((da)_\omega$ *joj ga je*$)_\omega$ taj čovek poklonio.

As seen in (15), in a subordinate clause the complementizer must host the clitics. They cannot be hosted by another prosodic (16a) or syntactic (16b) constituent.

(16) a. *Ona tvrdi $[(da)_\omega$ $(taj)_\omega$ *joj ga je*   čovek poklonio].
       she claims that   that her it AUX man   presented
       'She claims that that man presented her with it.'

     b. *Ona tvrdi [da [taj čovek]$_{NP}$ *joj ga je* poklonio].

As also illustrated by (15), in embedded clauses the clitics are clause initial in that they immediately follow the complementizer which serves as the prosodic host. Thus the ungrammaticality in (14a) is the result of violating a prosodic, not a syntactic, requirement.

Although clitics may appear in third or even later position in examples involving topicalization or focusing (see fn. 8), clitics generally cannot appear after the second prosodic word in a clause. This is shown in (17).

(17) a. Marija *ga* neće   doneti.
       Maria it NEG.will bring
       Maria won't bring it.

b. *(Marija)$_\omega$ (neće)$_\omega$ *ga* doneti.
Maria   NEG.will it bring
Maria won't bring it.   (Halpern 1995, 67)

Finally, the SCB clitics generally form a cluster and cannot occur in different positions in the clause, even if those positions are otherwise possible second position sites. This is shown in (18) where some of the clitics are hosted by the first prosodic word while others are hosted by the first syntactic constituent. This generally results in ungrammaticality.[9]

(18) a. *Taj *joj ga* čovek *je*   poklonio.
that her it man   AUX presented
'That man presented her with it.'

b. *[(Taj)$_\omega$ *joj ga* čovek]$_{NP}$ *je* poklonio.

c. *[(Taj)$_\omega$ *joj* čovek]$_{NP}$ *ga je* poklonio.

In summary, SCB clitics can appear after either the first prosodic word or the first syntactic constituent in their clause, and they generally cluster together. These possibilities are outlined in (19).[10]

(19) a. $\sqrt{}$ XP *clitics* ...

b. $\sqrt{}$ ((xxx)$_\omega$ *clitics*)$_\omega$ ...

c. $\sqrt{}$ [main clause] [C *clitics* ...]

d. * *clitics* ...

e. * XP XP+ *clitics* ...

f. * [main clause] [C XP *clitics* ...]

g. * [main clause] [C ((xxx)$_\omega$ *clitics*)$_\omega$ ...]

h. * ... *clitics* ... *clitics* ...

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[9]However, Damir Ćavar (p.c. September 2010) notes that instances of split clitic clusters do exist. Again, these examples involve topicalization, in particular VP-topicalization in which a pronominal clitic remains in the topicalized VP and the auxiliary clitics appear in the main clause.

[10](19e) may be possible with topicalization or contrastive focus fronting; (19h) may be possible when the clitic clusters are in separate clauses or with instances of VP topicalization.

3 Architecture for Syntax-Prosody Interactions

Our analysis of prosodically-conditioned second position clitics is framed within the architecture proposed by Bögel et al. (2009). We review some of its key properties as context for the present discussion.

Bögel et al. (2009) proposed that prosodic information is represented in a component that operates independently of the syntax, thus allowing easy description of misalignment phenomena. We also proposed a simple way of making prosodic information accessible to syntax, so that syntactic rules and preferences can be conditioned on prosodic boundaries. We place the prosodic and syntactic components of the grammar in a configuration such that the terminal string of the syntactic tree is a sequence of lexical formatives intermixed with features determined by the prosodic component. Depending on how they are distributed with respect to syntactic groupings, those features may or may not have an impact on the syntax.

Bögel et al. (2009)'s proposed architecture assigns an extended interpretation to the ordinary rules of a conventional LFG grammar. The effect of this extended interpretation for particular rules is equivalent to including in the grammar some additional rules that are systematically related to the originals. We argued that this is generally the case: the behavior of every syntactic rule according to the proposed architecture can be modeled by a finite expansion to a set of rules that could have been written in standard, pre-existing notations. In other words, the architectural principles in (20) can be implemented as metagrammatical operations that systematically transform the rules of a conventional grammar.

(20) a. An independent prosodic component interprets various prosodic properties to determine the boundaries of prosodic phrases.

      b. Prosodic boundaries are visible to the syntax as distinct symbols in the terminal string of the syntactic constituent structure.

      c. Prosodic boundary symbols augment but do not disrupt syntactic patterns.

      d. The syntactic component obeys a Principle of Prosodic Preference: syntactic structures with constituent boundaries that do not coincide with prosodic boundaries are dispreferred.

As a consequence, this architecture implies no changes to the mathematical and computational properties of the syntactic component.

A conventional LFG grammar contains a set of c-structure rules of the form:

(21) CAT → RHS

where CAT is a nonterminal category and the right-hand side RHS denotes a regular language over categories annotated with functional (or other co-describing) constraints. To implement the architectural specifications, we replace each such rule with another rule of the form:

(22) CAT → (LB) RHS / [LB|RB] (RB)
Disprefer

The prosodic brackets (L(eft)B(racket) and R(ight)B(racket)) belong to the terminal and nonterminal vocabularies of the enlarged grammar, in accordance with (20b). The right-side of the original rule is replaced by a rule expansion which allows for the parsing of prosodic brackets. The categories of the original right-hand side can be optionally preceded by a left prosodic bracket (as indicated by the parentheses) and optionally followed by a right prosodic bracket. In addition, the expansion will match a daughter sequence that would match the RHS regular expression if all occurrences of either LB or RB in that sequence are ignored. The | indicates a disjunction and the / is a notation for the "Ignore" operator first introduced by Kaplan and Kay (1994).[11] The effect of this use of the Ignore operator is to implement property (20c) of the architecture: it ensures that occurrences of prosodic brackets cannot disrupt otherwise valid phrase-structure expansions.

The "Disprefer" annotation implements the Principle of Prosodic Preference (20d). Whenever a prosodic bracket is ignored in the middle of the RHS, the structure is assigned a dispreference optimality mark. The effect of this is to determine a ranking over possible syntactic analyses, as described by Frank et al. (1998). The only brackets that are not dispreferred are those that match the optional LB and RB categories, the ones that appear on the edges of constituents. Replacement rules produced in this way by metagrammatical expansion thus provide dispreferences only for misaligned prosodic brackets, as required.

Bögel et al. (2009) remark that this architectural conception does not depend on the internal details of the prosodic component, but they speculate that the mapping between its inputs and outputs may be regular in nature. If this is the case, then the combination of prosody with an LFG syntax has no more generative capacity than the syntactic module alone, and prosodic mappings can be characterized by well-known and convenient notations for specifying regular relations. Our account of second position clitics is consistent with this speculation but also not dependent on it: we introduce a separate regular relation to define with formal precision an interface mapping that stands between the syntactic and prosodic components.

4   Clitics in Prosodic Second Position

Two issues must be addressed in order to account for clitics in second prosodic position. First, we have to ensure that the functional information carried by the clitics is projected to a clausal f-structure. This is despite the fact that the clitics appear in the prosodic string between units corresponding to lexical items that may not be immediate daughters of the syntactic clause. Second, we have to allow for the clitics to be properly placed in the prosodic string, after the clause-initial prosodic

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[11]It is included in the Xerox finite-state machine calculus (Beesley and Karttunen 2003) and in the c-structure notation of the XLE system (Crouch et al. 2010).

word. In our analysis the syntactic and prosodic components have a shared responsibility: the syntactic component deals with the clausal scope of functional information while the prosodic component provides for proper placement.

Clitics would naturally have clausal functional scope if they appeared as immediate daughters of the clause node in the syntactic c-structure. This can be achieved by a simple extension of the c-structure rule that derives the normal patterns of clausal daughter sequences, as schematized in (23).

(23) $S \rightarrow RHS_S$

RHS_S denotes the possible expansions of the clausal S node, with left and right prosodic brackets possibly ignored or dispreferred according to the metarule convention in (22). We replace (23) by a rule that allows for clausally-scoped clitic clusters (CCL) to appear optionally as prefixes of normal S expansions, as in (24).

(24) $S \rightarrow LB_S$ (CCL) RHS_S
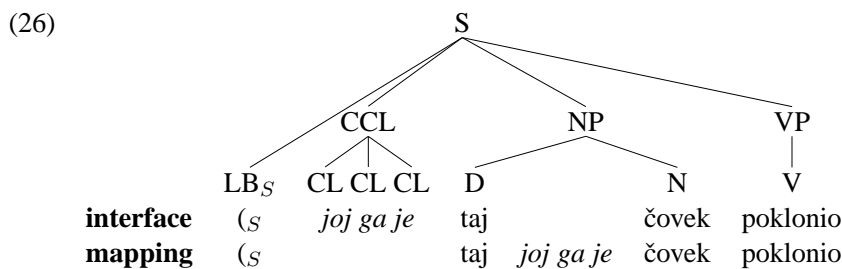 $\uparrow=\downarrow$

LB_S is a distinguished pre-terminal that marks the left edge of clauses and enables syntactic and prosodic constraints to be aligned with respect to clause boundaries. CCL expands to the set of clitic sequences that can appear together in second position, for example the singleton *li* in Russian or the sequence *joj ga je* for SCB.[12] The $\uparrow=\downarrow$ annotation provides for the clause-level functional scope of the clitics, as required. The tree in (25) is the c-structure that this rule assigns to our core SCB example *Taj joj ga je čovek poklonio*.

(25)
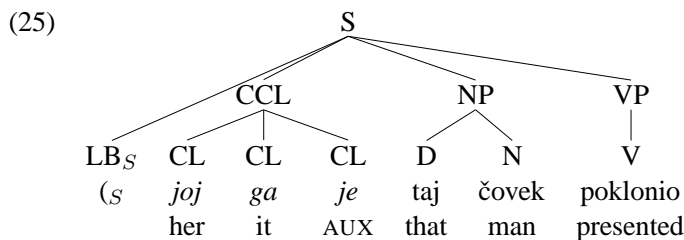
This syntactic configuration does not reflect the position of the clitics as attested in the prosodic representation. Due to prosodically determined constraints, the clitics are realized in second prosodic position. They cannot be realized at the beginning of a matrix sentence (because there is nothing prosodically heavy enough in front), and the clausal boundary LB_S is a barrier that prevents the initial clitics of a subordinate clause from attaching to a preceding matrix word. We resolve the conflict between these inconsistent requirements by distinguishing more carefully between the string of prosodic elements and the formatives of the c-structure terminal string. Rather than assuming the exact identity of these two

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[12]We assume that the particular clitic sequences are licensed by clitic-specific rules or templates that express appropriate generalizations. These details are not relevant to the present discussion.

representations, as we earlier proposed, we now add to the Bögel et al. (2009) architecture an explicit mapping as an interface between the syntactic and prosodic components. This interface mapping defines a correspondence between representations that are typically identical, as before, but it also allows for a limited amount of misalignment. Specifically, it provides a correlation between the first-position clitics in the c-structure terminal string with their attested realization after the first prosodic word.[13] Diagram (26) illustrates this mapping by showing the c-structure terminal string and the corresponding prosodic string as separate representations.

(26)

$$
\begin{array}{c}
\text{S} \\
\text{CCL} \quad \text{NP} \quad \text{VP}
\end{array}
$$

	LB_S	CL CL CL	D		N	V
interface	$(_S$	*joj ga je*	taj		čovek	poklonio
mapping	$(_S$		taj	*joj ga je*	čovek	poklonio

Since the clitics are drawn from a given set of lexical/prosodic formatives and since they cluster according to a fixed set of patterns, we know that there are only a finite number of clitic sequences that are subject to the interface mapping. This fact enables us to provide a characterization of the mapping within the formal space of regular relations. Let

(27) CS $=\{\text{CS}_1, \text{CS}_2, \ldots, \text{CS}_n\}$

denote the finite set of clitic sequences, the lexical/prosodic sequences that can be realizations of the CCL category. For SCB the sequence CS_1 might be the string *joj ga je*. Also let *W* stand for any prosodic word, presumably marked by distinc-

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[13]Our proposal that the clitics appear in clause-initial syntactic position but second prosodic position is consistent with the intuition behind *Prosodic Inversion* (Halpern 1995). According to Prosodic Inversion, syntactically clause-initial clitics are realized in second prosodic position because they must attach to a preceding prosodic word. Halpern does not as clearly separate the two levels of representation or characterize the formal properties of the inversion mechanism. He also does not embed his clitic proposal in a general architectural framework for syntax/prosody interactions.

Our proposal contrasts starkly with assumptions in the transformational literature that 2P clitics are moved from the particular positions where full form equivalents of the clitics may be base-generated (see Klavans (1982) for an overview of early strategies). Movement is needed by transformational theories to account for the fact that clitics do not co-occur with full forms. This is not an issue for our analysis because the Uniqueness Condition of LFG does not allow PRED semantic forms coming from different phrasal positions to fill the same grammatical function.

Our approach also contrasts with the LFG-based lexical-sharing analysis of Wescoat (2002). He relies on lexical rules to attach sequences of clitics as suffixes to all words in the lexicon, and then depends on a correlated family of modified c-structure rules that anticipate the categories of those clitics in fronted syntactic position. His solution thus treats second position clitics as a purely syntactic/lexical phenomenon that operates without reference to independent prosodic generalizations.

tive prosodic-word brackets.[14] Then the interface mapping is the regular relation denoted by the following expression:

(28) $[\Sigma^* (\bigcup_{CS_i} [(_S \; CS_i\text{:}0 \;\; W \;\; 0\text{:}CS_i \;] \,) \, \Sigma^* \;]^*$

In this traditional notation, the term Σ^* stands for any number of prosodic items. According to this relation, a clitic cluster appearing at the beginning of any c-structure clause (as indicated by the $(_S$ symbol visible to both prosody and syntax) may be treated by one of the expressions inside the optional union. The term $CS_i\text{:}0$ indicates that there is nothing (denoted by 0) on the prosodic side of the map corresponding to a particular cluster on the syntactic side (say CS_1=*joj ga je* of our SCB example). The following prosodic word *W* is unchanged in the mapping. After that word the term $0\text{:}CS_i$ indicates that the same i^{th} cluster appears on the prosodic side corresponding to nothing on the syntactic side. The effect is that strings with syntactically clause-initial clitic sequences are related to strings where those particular clusters appear on the other side of an adjacent word. The optionality of the union and the final asterisk allow for any number of such correlations to occur in a given sentence.

The finiteness of the set of possible clitic sequences is crucial for restricting the mathematical complexity of this analysis: correspondences between the elements of an unbounded set would require formal power lying beyond the capacity of regular relations.

Thus on our account the placement and interpretation of clitic clusters follows from the interaction of syntax and prosody: rule (24) restricts clitics so that they can appear and be functionally interpreted only at the beginnings of syntactic clauses, relation (28) provides for optional misalignment around the first prosodic word, and the misalignment becomes mandatory because clause-initial enclitics would otherwise lack a prosodic host. It is important to note that it is not accidental that our rule (24) generates the clitics in clause-initial position as opposed to some other syntactic positions. This is a necessary consequence of the fact that the clitics are realized in second prosodic position but have clausal functional scope together with our hypothesis that the mapping between syntactic and prosodic representations is characterized as a regular relation. Regular relations are mathematically restricted devices that cannot be sensitive to recursive structure, are therefore unable to identify the right boundary of initial syntactic constituents with possibly deep embeddings, and therefore cannot reliably define correspondences between clitics in prosodic second position and any clause-level positions further to the right. For the same reason a second position clitic cannot directly constrain the f-structures corresponding to any rightward NPs or other sub-clausal constituents.

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[14]If a language had a different prosodic constraint, e.g., it placed clitics after the first prosodic phrase, then one could similarly define a *P*, which would stand for any prosodic phrase, etc.

5   Clitics in Syntactic Second Position

The relation in (28) defines a correspondence only for clause-initial clitic sequences. Clusters not immediately preceded by $(_S$ will match against the Σ^*s, and their syntactic and prosodic positions will be the same. In particular, clitics that come after the first syntactic constituent (as in (11a), repeated as (29)) are not displaced by this relation.

(29) [Taj čovek]$_{\text{NP}}$ *joj ga je*   poklonio.
       that man   her it AUX presented
       'That man presented her with it.'

We require an extension to the c-structure rule for S to ensure that clitics not realized after the first prosodic word can appear in the second syntactic position and only in that position. We modify the S rule to allow also for the optional appearance of clitic clusters in the second position of every acceptable sequence of clausal daughters. This is specified schematically in (30).

(30)   S $\rightarrow$ LB$_S$ [(CCL) RHS$_S$ | Second(RHS$_S$, CCL)]
                       $\uparrow=\downarrow$ $\uparrow=\downarrow$

The expression Second(x, y) indicates the insertion of y in the second position of every string in a regular language x.[15] The schematic rule (30) thus allows c-structure clusters in either clause-initial or clause-second position, but not both. This means that clusters in a single clause cannot be split across the two positions, so that ungrammatical strings such as (18) are not possible. Since the category CCL is not found in any other phrase-structure rule, these are the only environments in which clitics can appear. If RHS$_S$ includes a NP–VP sequence as one of its expansions, the daughter paths in (31) will be included as instances of rule (30).

(31)   a.   LB$_S$ NP   VP
                     ($\uparrow$ SUBJ)=$\downarrow$ $\uparrow=\downarrow$

       b.   LB$_S$ CCL   NP   VP
                     $\uparrow=\downarrow$ ($\uparrow$ SUBJ)=$\downarrow$ $\uparrow=\downarrow$

       c.   LB$_S$ NP   CCL   VP
                     ($\uparrow$ SUBJ)=$\downarrow$ $\uparrow=\downarrow$ $\uparrow=\downarrow$

---

[15]Second(x, y) can be easily implemented by means of the ignore and intersection regular expression operators:

$$\text{Second}(x, y) \equiv x/y \cap [[\Sigma - y]\ y\ [\Sigma - y]^*]$$

The first term introduces the possibility of y appearing anywhere in the middle of the strings in the language x while the other term imposes the restriction that only occurrences after the first element of each of those strings are permitted.

Thus, languages like Russian which only have the prosodic placement option will have the rule in (24), while languages like SCB with a combination of prosodic and syntactic clitic placement will have the rule in (30). The rules we have used to account for second position clitic placement in LFG are repeated in (32).

(32) a. Prosodic Second Position:
$$S \rightarrow LB_S \quad (\text{ CCL }) \quad RHS_S$$
$$\uparrow = \downarrow$$

b. Prosodic or Syntactic Second Position:
$$S \rightarrow LB_S \quad [\text{ (CCL) } RHS_S \mid \text{Second}(RHS_S, CCL)]$$
$$\uparrow = \downarrow \qquad\qquad\qquad \uparrow = \downarrow$$

c. Interface Mapping:
$$[\Sigma^* (\bigcup_{CS_i} [(_S \; CS_i{:}0 \; W \; 0{:}CS_i \,]) \Sigma^*]^*$$

6 Examples

In this section we illustrate how our proposed architecture and the augmented rule set apply to some of the SCB data. In particular, we consider the three situations which any analysis needs to account for: no clitic cluster is present; the clitic cluster is prosodically placed; the clitic cluster is syntactically placed.

6.1 No Clitic Cluster

First consider the case where there are no clausal clitics, as in (33).

(33) a. Taj čovek spava.
        that man   sleeps
        'That man sleeps.'

   b. LB_S NP   VP
              ($\uparrow$ SUBJ)=$\downarrow$ $\uparrow$=$\downarrow$

This receives a straightforward LFG analysis, with the only unusual element the initial LB_S. The c- and f-structures for (33a) are shown in (34).[16]

(34) a.

$$
\begin{array}{c}
S \\
\diagup \quad \mid \quad \diagdown \\
LB_S \quad NP \quad VP \\
\mid \quad \diagup\diagdown \quad \mid \\
\quad D \quad N \quad V \\
(_S \quad taj \quad \text{čovek} \quad spava
\end{array}
$$

   b.
$$
\begin{bmatrix}
\text{PRED} & '\text{sleep}{<}\text{SUBJ}{>}' \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & '\text{man}' \\ \text{SPEC} & \text{that} \end{bmatrix} \\
\text{TENSE} & \text{present}
\end{bmatrix}
$$

---

[16]We represent only the left prosodic bracket (LB_S) because this is the prosodic boundary that can be reliably identified via a %L boundary tone (cf. Godjevac 2000, Radanović-Kocić 1988).
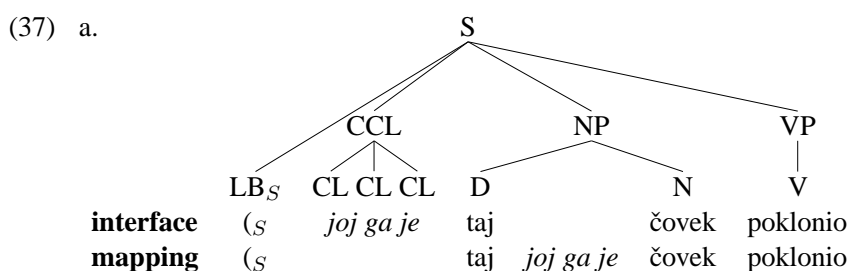
6.2 Clitic Cluster in Prosodic 2nd Position

Next consider when the clitic cluster follows the first prosodic word, as in (35a), which uses the realization in (35b).

(35) a. Taj *joj ga je* čovek poklonio.
   that her it AUX man   presented
   'That man presented her with it.'

  b. LB$_S$ CCL NP VP
     ↑=↓ (↑ SUBJ)=↓ ↑=↓

Given lexical entries as in (36) for the clitics, this will result in the c- and f-structures in (37).

(36) *joj* (↑ OBJ2 PRED)=′pro′
    (↑ OBJ2 PERS)=3
    (↑ OBJ2 NUM)=sg
    (↑ OBJ2 GEND)=fem
  ga (↑ OBJ PRED)=′pro′
    (↑ OBJ PERS)=3
    (↑ OBJ NUM)=sg
    (↑ OBJ GEND)=masc
  je (↑ SUBJ PERS)=3
    (↑ SUBJ NUM)=sg
    (↑ TENSE)=past

(37) a.

interface ($_S$ *joj ga je* taj   čovek poklonio
mapping   ($_S$ taj *joj ga je* čovek poklonio

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b.
$$
\begin{bmatrix}
\text{PRED} & '\text{present}<\text{SUBJ},\text{OBJ},\text{OBJ2}>' \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & '\text{man}' \\ \text{PERS} & 3_{je} \\ \text{NUM} & \text{sg}_{je} \\ \text{SPEC} & \text{that} \end{bmatrix} \\
\text{OBJ}_{ga} & \begin{bmatrix} \text{PRED} & '\text{pro}' \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{GEND} & \text{masc} \end{bmatrix}_{ga} \\
\text{OBJ2}_{joj} & \begin{bmatrix} \text{PRED} & '\text{pro}' \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{GEND} & \text{fem} \end{bmatrix}_{joj} \\
\text{TENSE} & \text{past}_{je}
\end{bmatrix}
$$

In the c-structure in (37a) it is the interface mapping that allows for the clitics to be hosted by the first prosodic word, here the demonstrative *taj*. (The clitic forms are shown as italicized indices on the f-structure for expository purposes.)

6.3   Clitic Cluster in Syntactic 2nd Position

Next consider when the clitic cluster follows the first syntactic constituent, as in (38a), which uses the realization in (38b) (licensed by the expression *Second(x,y)*).

(38)   a. Taj čovek *joj ga je*   poklonio.
        that man   her it AUX presented
        'That man presented her with it.'

    b. LB_S NP   CCL VP
              $(\uparrow \text{SUBJ})=\downarrow$ $\uparrow=\downarrow$ $\uparrow=\downarrow$

Using the same lexical entries for the clitics as in (36), the c- and f-structures are shown in (39). Note that the resulting f-structure is identical whether the clitics follow the first prosodic word or the first syntactic constituent; it is only the c-structure and interface correspondences that differ.

(39)   a.

```
                        S
        ┌───────┬───────┴────────┐
      LBS      NP      CCL       VP
       │      ╱  ╲    ╱ │ ╲       │
       │     D    N  CL CL CL     V
      (S    taj čovek joj ga je poklonio
```
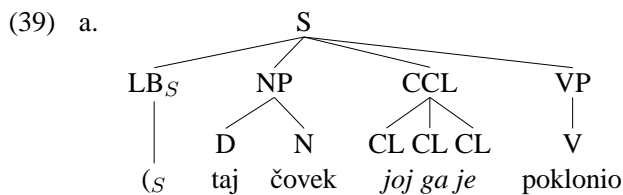
b. F-structure: same as (37b)

Thus, we account for the standard instances of second position clitics, either syntactic or prosodic, with the small set of rules in (32) along with a conception of the prosody-syntax interface in which prosody and syntax are taken to be separate and independent modules of grammar that interact through a restricted interface mapping. We have not discussed instances of clitic placement in clauses involving topicalization or contrastive focus. These depend on another set of syntactic and prosodic correlations; however, we are confident that our approach will extend to the more complex data.[17]

7   Conclusion

In Bögel et al. (2009), we outlined a new architecture for modeling the interaction between prosody and syntax: we proposed an arrangement of interacting components in which prosodic information is developed in a module that operates independently of the syntax while still allowing for syntactic rules and preferences to be conditioned on prosodic boundaries and other features. This was made possible because the terminal string of the syntactic tree was taken to be a sequence of lexical formatives intermixed with additional features that also satisfy the constraints and reflect the generalizations of a separate prosodic component. This architecture allows for misalignments between prosodic units and syntactic constituency, but it also incorporates a Principle of Prosodic Preference that disprefers syntactic structures that do not coincide with prosodic boundaries.

In this paper, we extended the 2009 proposal to account for prosodically second position clitics by allowing for clausally-scoped clitics to appear optionally as prefixes of the normal expansions of the S c-structure rules. We introduced a separate interface mapping to mediate between the possibly conflicting requirements of the syntactic and prosodic components. The interface mapping defines a correspondence between separate syntactic and prosodic strings that are typically identical, as in the original proposal, but now are allowed to differ in a limited number of ways. We showed how such a mapping can correlate the first-position clitics in the c-structure terminal string with their attested realization after the first prosodic word. This mapping is a regular relation that satisfies the clitics' need for a prosodic host.

As we have noted, it is a consequence of our analysis that clitics in second prosodic position can only have clausal functional scope and cannot directly modify the f-structures corresponding to other constituents. This is because a regular relation is mathematically restricted in its ability to recognize and operate on the recursive structures of the syntactic component. For the same reason our account

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[17]Radanović-Kocić (1988) also notes that appositions and relative clauses show interesting clitic placement patterns. We assume that these have to do with the prosodic phrasing of such clauses and that the basic generalization holds that clitics appear either after the first syntactic constituent or after the first prosodic word in the relevant prosodic and syntactic domain.

also predicts that second position clitics will always be drawn from a closed, finite set that a regular relation is able to correlate around arbitrary but locally specified prosodic units.

The approach to second position clitics described in this paper thus provides an elegant and new account of this phenomenon that fits comfortably within the collection of formal mechanisms that already exist within the LFG theoretical framework. This account offers further support for the architecture of the prosody-syntax interface that we previously proposed: prosody and syntax operate as separate modules that interact by virtue of a limited amount of shared information that can mutually constrain the behavior of both components.

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