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Miriam Butt and Tracy Holloway King (Editors)

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Contents

1 Editors' Note

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CONSTRUCTIVE NUMBER SYSTEMS IN MARORI AND BEYOND

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Abstract

This paper examines complex number systems with unusual constructive strategies in languages such as Marori. One challenge that such systems present is the existence of a dual number category without dual morphology and a plural number category without plural morphology. This paper demonstrates that these number systems can be accounted for in a surprisingly straightforward way by proposing that they involve the composite binary features [+/–SG], [+/–PL], [+/–DU] and [+/–AUG]. Languages vary with respect to which features are activated and the nature of their composition and coding. This study highlights the significance of constructive number systems within the broader context of a unification-based theory of grammar as well as the theory and typology of agreement.

1 Introduction*

This paper discusses the unusual constructive number system, primarily as encountered in Marori (isolate, Trans New Guinea (TNG)). The proposed analysis is extended to similarly complex number systems in other languages such as Nen (Evans 2009) and Murrinh-Patha (Nordlinger 2011; Seiss 2011). Of particular interest in these languages is the constructive expression of specific number categories without dedicated number morphology, e.g. dual without dual morphology in Marori and plural without plural morphology in Nen.

Constructive (or constructed) number systems are the ones with distributive coding strategies where different sets of binary number features combine together to encode specific number values. In such systems, there can be a mismatch between number marking of the different elements involved, e.g. dual in Hopi involves plural associated with the subject and singular with the verb (Corbett 2000:169). In the case of dual in Marori, there is no mismatch: it is constructed by combining two underspecified (non-singular and non-plural) elements.

The complexity of the constructive number systems in these languages calls for a sophisticated way of representing number in a parallel-based model of grammar such as LFG.

Drawing insights from earlier work on number systems -- cross-linguistic findings (Corbett 2000) and feature space analyses and

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underspecification (Dalrymple, King, and Sadler 2009; Sadler 2010; Dalrymple and Kaplan 2000) -- I propose an analysis that maintains the basic idea of LFG's treatment of NUM in a unification-based AVM (attribute-value matrix) model. The novel aspect is in the way NUM features are structured and interpreted. It is proposed that the nature of NUM features (e.g., whether PL and/or SG features are present and whether they should be analysed as having binary values or not) be determined on language-specific evidence. Building on Croft (2003), the features are mapped onto categories on the semantic conceptual map of number.

The paper is organised as follows. After an overview of Marori morphosyntax in section 2, a detailed description of the number system in Marori and similar constructive systems in other languages are given in section 3. The proposed analysis is given in section 4, explicated first for Marori (4.1) and then extended to Nen (4.2) and Murrinth-Patha (4.3). Conclusions are given in section 5.

2 Marori syntax: an overview

2.1 Clausal structure

Marori is a non-configurational language. Its basic clause structure is informally shown in (1). The predicate unit typically consists of a lexical verb and a light or auxiliary verb. The lexical verb typically immediately precedes the auxiliary.

(1) [NP* VERB AUX.VERB] S

Marori has no VP constituent.[1] While typically coming before the verb, subject and object NPs can move around, including to a position after the verb. In the following examples, the recipient Albert can freely occur in different positions:[2]

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[1] There is no standard orthography for Marori yet. This paper follows the Indonesian-like orthography commonly used by my Marori consultants, e.g. *y* represents the approximant /j/ and *ng* the velar nasal /ŋ/. Consonants with prenasals are written with more than one symbol, e.g. *mb*, *nd*, and *ngg*. Bilabial fricatives are written as *f* (voiceless) and *v* (voiced).

[2] Abbreviations used in the glosses: 1/2/3 'first/second/third person', A 'actor', ABS 'absolutive', AUX 'auxiliary', DET 'determiner', DU 'dual', ERG 'ergative', F 'female', FUT 'future', M 'male', NonPL 'non plural', NonSG 'non singular',O 'object', NrPST 'near past', PERF 'perfective', PL 'plural', POSS 'possessive', PROG 'progressive', REFL 'reflexive', SG 'singular', TAM 'tense, aspect and mood', PRES 'present', PST 'past', U 'undergoer'.

(2) a.

Nawa	*tamba*	*Albert=i*	*nji=me-ben*	*bosik*	*sokodu.*
1SG	already	Albert=U	3.give-AUX-1NPL.NrPST	pig	one

‘I already gave Albert a pig.’

b. *Nawa tamba nji=me-ben bosik sokodu Albert=i.*

c. *Albert=i nawa tamba nji=me-ben bosik sokodu.*

d. *Albert=i nawa tamba bosik nji=me-ben sokodu.*

Grammatical relations are encoded by verbal agreement as well as marking on the argument NPs. Undergoer NPs receive the *=i* clitic, e.g. the recipient NP Albert in examples (2).

(3) a.

na=i	*patar*	*yu-nggo-f*
1SG=U	cold	1SG-AUX-NrPST

‘I suffered from being cold.’

b.

efi	*ramon(*=i)*	*kundo-f*
that	woman	run.3SG-NrPST

‘She/the woman ran off.’

Free pronouns in Marori are not inflected for case to show their grammatical functions. They do, however, show different forms signifying a singular and non-singular number distinction, further discussed in 3.2 below.

2.2 Verbal morphology

The (auxiliary) verb is morphologically complex showing distributive exponence in the expression of argument roles (subject/actor or object/undergoer) and TAM. The morphological template is given in (4).

The template shows five verbal slots associated with arguments, including the (verbal) root. Broadly speaking, for a transitive verb, the prefixes (AFF1/AFF2) are associated with the undergoer whereas the suffixes (AFF3, AFF4) are associated with the actor. For an intransitive verb all the affixes can be associated with the sole core argument of the intransitive verb.

(4)

AFF1 -	AFF2 -	AUX.ROOT -	AFF3 -	AFF4
(PERS)	(NUM)	(NUM)	(ASP)	(TNS/MOOD)
	(TNS)	(GEND)		(PERS)
	(PERS)			(NUM)

AFF1 is filled in by the morpheme signifying PERS information of the S/O argument. Each PERS category has its own prefix: *y*- ‘1’, *k*- ‘2’ and ∅- ‘3’.

The AFF2 slot is filled in by portmanteau morphemes signifying person, number and tense information. These are for example *ar-/or-*, which are used for non-singular first and second persons. However, for the present imperfective aspect, *or*- is used for plural whereas *ar*- for dual as shown in (5). These affixes combine with the pronominal affixes (e.g. *y*- ‘1’, *k*- ‘2’) giving rise to *yar-/yor-* and *kar-/kor-*.

(5) *or*-1/2.PL.PRES or 1/2.NSG
ar-1/2.DU.PRES or 1/2.NSG

The AFF3 slot is filled in by the aspectual morpheme (or verbal number), indicating extended aspect (atelic), e.g. *-ri* for the third person singular male, otherwise *-ra* as in *kunggo* 'to nod once' vs. *kungra* 'to nod repeatedly'.

Finally, AFF4 is also the portmanteau suffix for (actor) subject. The suffix carries person, number and also possibly gender information, in addition to tense and mood. Thus, the first person (actor) subject varies, e.g., *-ru* for 'future/irrealis', *-du* 'for (macro) present', *-men*/*-mon* for 'near past, extended aspect' and *–ben/-bon* for 'near past completed aspect', *-maf/-mof* for 'remote past, extended aspect', and *-feri*/*-fori* for remote past, completed aspect. The different vowel quality is due to vowel harmony associated with gender, e.g. *kaswa=ma-mon* 'hit=AUX.3F/PL-1SG.NrPST = I was hitting her/them' vs. *keswe=mi-men* 'hit-AUX.3F-1SG.NrPST = I was hitting him'.

The auxiliary root can be of different kinds depending on the transitivity and aspectual properties of the lexical predicate that it co-occurs with. For example, the dynamic non-positional intransitive predicate (e.g., with inchoative meaning such as 'become small') takes the auxiliary root *ngg;* the dynamic positional predicate (e.g. 'stay lying') takes *kuye*, and non-positional states such as 'be hungry' take *ra*.

The lexical verb itself may show verbal number reflecting aspectual properties. The verb root meaning 'hit' in non-completive aspect is *ksw-*, realised as *kaswa*, *keswe* etc. depending on vowel harmony. For hit with completive aspect, the root *tr-* is used, realised in different forms depending on the vowel harmony, e.g. *ter*/*tor* as in *ter=me-ben* 'hit=AUX.3M-1NPL.NrPST = I hit him (once)' and *tor=mo-bon* 'hit=AUX.3F/PL-1NPL.NrPST = I hit her/it/them (once)'.

3 Number system and the constructive number in Marori

Morphologically, Marori distinguishes singular, dual and plural. However, considering the way number is expressed in the overall system in this language, especially the constructive strategy, plurals can be further distinguished between limited ('paucal') and large plurals. We can therefore argue that Marori has a five-way number system.

3.1 Number on the (auxiliary) verb

There are two kinds of number information associated with the verb. The first type is argument number agreement, i.e., number in formation associated with the arguments of the verb. This is realised by the morphemes in AFF2 and AFF4, and possibly by the vowel quality of the AUX root. This has been discussed in the preceding section, and is not repeated in this subsection.

However, there are a couple of points worth mentioning here in relation to argument number in Marori. Firstly, the main argument number (singular, dual and plural) is 'equally' morphologically marked on the verb. Secondly, the morphological marking can be either specified or underspecified. The specified number marking comes with dedicated number markers, e.g. specific morphology for SG, DU or PL. In Marori, this is restricted to the first person, non-past only. With other non-first person categories, the number marking is underspecified in the sense that it can be used for more than one number type. For example, *-ben* '1NPL.NrPST' is underspecified: it is used for SG and DU.[3] As we shall see in 3.3.1, underspecified number markers are important in constructive, distributive coding, e.g. non-plural and non-singular morphemes are needed in coding dual in Marori.

The second related kind of number information on the verb is what Durie (1986) calls verbal number. This is associated with plurality and aspectual properties of events. In Marori, this plural information is associated with the AFF3 position. Suffixes *-ri/-re/-ra/-ro* are used. Their distribution in the present habitual tense depends on the number of the object and subject, e.g. *kef-ri-du* 'I eat something regularly' vs. *kef-re-men* 'We eat something regularly' vs. *kaf-ra-du* 'I eat things regularly'.

In addition, verbal number can also be expressed by distinct forms of the (auxiliary/lexical) verb root, e.g. the distinction between *tr-* 'hit.once' vs. *ksw-* 'hit repeatedly/many times' mentioned earlier.

3.2 Number on the argument NPs

Argument NPs contribute number information when they are realised by pronouns or demonstratives. Common and proper nouns are not inflected for number.

Pronouns in Marori show a distinction of singular (SG) and non-singular (NSG) forms, as seen in Figure 1.

Demonstratives in Marori likewise encode a SG/NSG distinction. The distinction, however, crosscuts three points of relative distance ('proximal', 'semi-distal', and 'distal'), e.g. *kefi* 'this', *pafi* 'that, near the addressee', *nggafi* 'that, semi distal' and *nggwofi* 'distal'.

Figure 1: Free pronouns in Marori

Person	Singular	Non-singular
1	*na/nawa*	*Nie*
2	*ka*	*Kie*
3	*efi*	*emnde/eme*

[3]Even for the first person where SG, DU and PL have distinct morphology, these morphemes are not exclusively NUM morphology. They are portmanteau morphemes expressing GEND, TNS and PERS in addition to NUM.

3.3 Constructive Number

3.3.1 Constructive Dual

Constructive DUAL in Marori is achieved by composing two number exponents, non-singular from the free argument and non-plural from the verb. This is exemplified in (6)b below, where the free pronoun *emnde* ‘3NSG’ and the non-plural verbal affix *–m* combine to form a dual interpretation. Without *yanadu* ‘two’, sentence (6)b is still interpreted as involving a dual subject. For clarity, the dual structure is contrasted with the SG and PL in (6)a and(6)c respectively.

(6) a. *Efi yewrifam na=n bosik eyew ndam*(∅-nda-m)
3SG female 1SG=for pig see 3-AUX.3F-2/3NonPL.NrPST
‘She/the woman hunted a (female) pig for me.’

b. *Emnde (yanadu) na=n bosik eyew ndam* (∅-nda-m)
3NonSG two 1SG=for pig see 3-AUX.3F-2/3NPL.NrPST
‘They (2) hunted a (female) pig for me.’

c. *Emnde (usindu) fis na=n bosik eyew ndim*(∅-ndi-m)
3NonSG all yesterday 1SG=for pig see 3-AUX3.M-2 /3PL.NrPST
‘They all (>2) hunted a (male) pig for me yesterday.’

The constructive dual in (7)a below makes use of the lexically-specified verbal number of the predicate:

(7) a. *Emnde tanamba Merauke=ke kuye-∅*
3NSG now Merauke=LOC be.at.3NPL.REAL-2/3
‘They (2) are in Merauke now.’

b. *Emnde tanamba Merauke=ke mingg-ri-∅*
3NSG now Merauke=LOC be.at.3PL.REAL-PL-2/3
‘They are (>2) in Merauke now.’

Note that the predicate ‘be.at’ with the locational/positional meaning shows a number opposition, *kuye* ‘be.at.NPL.REAL’ vs. *mingg* ‘be.at.PL.REAL’. Dual is constructed in (7)a, in which case the NPL verb *kuye* must be used with *emnde* ‘3NSG’. This is contrasted with the plural structure in (7)b.

Dual is not always encoded constructively, however. Dedicated dual morphology is used, but only for the first person macro-present.[4] For

[4] The term ‘macro-present’ refers to the type of tense in Marori used for events taking place at the moment of speaking (today) and the immediate time (‘yesterday’, and possibly ‘tomorrow’). With a proper adjunct showing repetition this tense can

example, the root *kuye* 'be.at' can be inflected with TAM morphology to show a distinct dual category, e.g. *kuye-den:*

(8) a. *Nie* *kursi* *uyowe* *kuye-den*
1NSG chair on.top be.at.NPL.REAL-1DU.PRES
'We (2) sat/sit on the chair.'

There are three empirical points about constructive number in Marori. Firstly, only the analytic constructive dual pattern shown in (9)a is attested, not the pattern in (9)b. This is because, as discussed in 3.2, pronominal/demonstrative arguments in Marori only show a SG vs. NSG distinction, never a PL vs. NPL distinction.

(9) Constructive dual in Marori:

a. Attested		b. Not attested	
ARG	VERB	ARG	VERB
(NSG)	(NPL)	(NPL)	(NSG)

Secondly, pattern (9)a applies to subject, not object. This is because there is no morphological contrast showing NPL object on the verb in Marori. The number morpheme associated with object (AFF2 in (4)) is either underspecified NSG, or specified singular, dual or plural, depending on the tense (cf. (5)).

Finally, word-internal constructive number is also observed. This is particularly clear in relation to the second person. Examples:

(10) a. *kesweme* b. *kesneme*

a.	b.
ksw=Ø-Ø-me-Ø	ksw=Ø-n-me-Ø
hit=3-2SG-AUX.3M-2NPL.IRR	hit=3-2NSG-AUX.3M-2NPL.IRR
'You (SG) will hit him.'	'You (2) will hit him.'

c. *kesnemem*
ksw=Ø-n-me-m
hit=3-2NSG-AUX.3M-2PL.IRR
'You (>2) will hit him.'

The paradigm in (10) involves the lexical predicate *ksw* 'hit' in future/irrealis with the auxiliary *me* showing inflection for second person subject and third person male object. The second person subject is expressed by discontinuous morphemes, one exponent is before the AUX stem *me*, and the other is the (regular) final suffix morpheme:

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also be used to signify habitual events. The translation, depending on the context, is therefore given in either the past or the present tense in English.

(11) The second person subject exponents in Marori as exemplified in (10):

	exponent1-AuxRoot-exponent2	
singular :	*Ø-*	*-Ø*
dual :	*n-*	*-Ø*
plural :	*n-*	*-m*

Given the formal opposition shown in (11), the second person singular, dual and plural numbers are in fact all morphologically constructive.

3.3.2 Constructive paucal (limited plural)

Marori also has 'limited plural', similar to 'paucal' in Manam (Lichtenberk 1983; Turner1986), Yimas, Fijian and other languages (see Corbett 2000: 22-26)). It is roughly translated as 'a few' in English. 'Limited plural' is contrasted with 'large plural', translatable as 'a lot, in big number', further discussed in 3.3.3 below. The limited and large plurals are also expressed constructively.

The constructive strategy to express limited plural is exemplified in (12)c. As seen from its contrast with dual and generic plural (12)a-b, limited plural is achieved by means of augmentation. In this case, the numeral *yanadu* 'two' is augmented by PL morphology on the verb (*-re*):

(12) a. *ka-nam bosik yanadu te-Ø-Ø*
2SG-POSS pig two BE.3-NonPL.PRES
'Your pigs are two/you have two pigs.'

b. *ka-nam bosik usin te-re-Ø*
2SG-POSS pig many BE.3-PL-PRES
'Your pigs are many/you have many pigs.'

c. *ka-nam bosik yanadu te-re-Ø*
2SG-POSS pig two BE.3-PL-PRES
'Your pigs are few/you have few pigs.'

Augmentation can also be achieved by means of the augmenter *ndu* (roughly meaning 'very' or 'only'), in addition to plural agreement morphology on the verb. The reference of the subject *yanadupurfam* in (13), for instance, is augmented by the presence of both *ndu* within the NP and the plural suffix *-re* (realised as *-fre* for phonological reasons):

(13) *Yanadu purfam (ndu) awo=i ife-fre-f paya ke*
Two person AUG kangaroo=U 3SG.see-2/3PL-NrPST forest Loc
'(Very) few people saw a kangaroo (at a glance) in the forest.'

3.3.3 Large plural

Large plurals are also encoded by an augmenting strategy. The same augmenter *ndu* is used, or else, *famndu*. For example, *usin* ‘many’ is augmented to become *usinfamndu* or *usindu* ‘in a very large number’, as in (14)a-b. Neither large plural or limited plural use dedicated morphology, but rather make use of the available resources (e.g. plural morphemes) in a constructive way.

(14) a. *Usin famndu turis kurfenj-re-n-∅ Bali mbe*
many AUG tourist return-PL-HITHER-2/3NPST Bali to
‘A lot of tourists will come back to Bali.’

b. *Na fis bosik=i yefya-mon usin-ndu paya ke*
1SG yest pig=U 3nsU.see-3nsU.1sA.NrPST many-AUG forest Loc
‘I watched many pigs in the forest yesterday.’

There remains a question whether a large plural does indeed form a legitimate number category along with limited plural, on a par with singular and dual in Marori. While debatable, given the constructional opposition in the whole system (morphological as well as analytical), large and limited plurals are arguably number categories of their own right in Marori.

3.4 Constructive number in other languages

Other languages that have been reported to have complex three-way or multi-way number systems involving constructive strategies include Hopi (Hale 1997; Corbett 2000:169), Nen (Evans 2009), Murrinth-Patha (Nordlinger 2011; Seiss 2011), Manam (Lichtenberk 1983; Turner 1986). For reason of space, not all of these languages are discussed in this paper, but I believe the proposed analysis outlined in this paper can also be extended to these languages.[5]

Nen (Evans 2009) shows plural without dedicated plural morphology. Constructive plural in Nen makes use of non-singular and non-dual morphemes as seen in (15)c. In fact, all number categories are constructively encoded in Nen. Singular in (15)a and dual in (15)b are constructively determined by the combination of two number morphemes (prefixes and suffixes) on the verb.

(15) Nen (Evans 2009)

a. *Mngwy-trom-ngr*
house 3sgU-be.erected-STAT:ND
‘A house is standing.’

b. *mngw yä-trom-aran*
house 3nsgU-be.erected-STAT:D
‘Two houses are standing.’

[5]Hopi’s constructive number has been widely analysed in the literature (Harbour 2007; Sadler 2010, among others). My analysis of constructive number in this paper is in line with Sadler’s on Hopi. Hopi will not be further discussed in this paper.

c. *mngw yä-trom-ngr*
house 3nsgU-be.erected-STAT:ND
'Three or more houses are standing.'

d. *mngw y-trom-aran*
house 3sgU-be.erected-STAT:D
'All the houses are standing.'
['limited in number', 'paucal']

Murrinh-Patha (Nordlinger 2011), a polysynthetic Aboriginal language of Australia, shows a complex five-way number system with sibling/non-sibling relations also figuring into the system: singular, dual non-sibling, dual sibling, paucal non-sibling, and plural. The number system is constructive, consisting of a combination of a classifier stem and another number exponent signifying the gender-sibling relation. While the whole system shows a five-way contrast, the morphology of the classifier system itself shows a three-way contrast (singular, dual and plural). The Murrinh-Patha system is shown in Figure 2 below.

Figure 2: Number system in Murrinh-Patha **(**adapted from Nordlinger 2011)

NUMBER EXPONENTS		CONSTRUCTED NUMBER CATEGORIES
CLASSIFIER STEMS	EXTRA NUMBER FORMATIVES	
singular	∅	*singular*
singular	*ngitha* (F)/*nitha* (M)	*dual non-sibling*
dual	∅	*dual sibling*
dual	*ngime* (F)/*neme* (M)	*paucalnon-sibling*
plural	∅	*paucal sibling,* or *plural*

Of particular interest is the function, also therefore the gloss given to the extra number formatives in the second column. Nordlinger (2011) glosses *ngitha* (F) as 'dual.f' to capture the idea that it is associated with 'dual female sibling' as seen in the contrast between singular and dual subjects shown in (16).

(16) Murrinh-Patha (Nordlinger 2011)

a. *Bamkardu*
bam-ngkardu
3sg.SEE(13).nFut-see
'He/she saw him/her.'

b. *bam-ngintha-ngkardu*
3sS.SEE(13).nFut-dual.f-see
'They (2 female non-siblings) saw him/her.'

However, as noted, the expression of non-sibling dual in (16)b makes use of the combination of *ngitha* with a singular classifier stem (*bam*), not with a dual classifier stem (which is *pubamka*; see (17)). To capitalise on the significance of constructive strategy, I propose to extend the analysis in Marori to Murrinh-Patha by arguing that the function of *ngitha* (and likewise the other extra number formatives shown in Figure 2) is to augment the number of the classifier stem one level up. Thus, *ngitha* will be glossed as AUG.F, an augmenter for female referents. Showing this explicitly, (16)b can be re-glossed as follows:

b'. *bam-ngintha-ngkardu*
3sS.SEE(13).nFut-AUG.F-see
'They (2 female non-siblings) saw him/her.'

Other number formatives can therefore be re-analysed and re-glossed accordingly, e.g. *nitha* 'AUG.M', *ngime* 'AUG.F' and *neme* 'AUG.M'. The examples in (17) illustrate the contrast between dual and constructive paucal with *ngime* as the augmenter. As noted, the paucal makes use of the dual classifier stem *pubamka*.

(17) a. *pubamka-ngkardu*
3dS.SEE(13).nFut-see
'They (2 siblings) saw him/her.'

b. *pubamka-ngkardu-ngime*
3dS.SEE(13).nFut-see-AUG.F
'They (paucal, female non-siblings) saw him/her.'

Furthermore, the number augmenters must carry with them constructional constraints. For instance, *ngitha* 'AUG.F' can only be used to augment the singular classifier stem (to construct dual) whereas *ngime* 'AUG.F' is only used to augment a dual classifier stem (to construct paucal).[6]

Another important point to note is about the absence of the augmenter. It is functional. That is, a structure with a singular classifier stem without an augmenter constructs a singular category whereas a singular stem with an augmenter constructs a dual category. For this reason, its absence is represented as Ø in Figure 2. It will be shown later in 4.3 that the absence of an augmenter means that the feature structure contains [–AUG], in contrast to the one with an augmenter where [+AUG] is present.

Further evidence that the absence of an augmenter is functional comes from the fact that the construction with a plural classifier stem without an augmenter is ambiguous, as seen in (18). This is expected, because the zero augmenter is taken to form a contrast in the paradigmatic system with other 'marked' types of number, namely with paucal non-sibling.[7]

(18) *pubamkardu*
pubam-ngkardu
3pS.SEE(13).nFut-see
'They (paucal siblings/plural) saw him/her.'

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[6] This kind of constraint is easily imposed in LFG by means of a constraint on the functional equation.

[7] It remains to be checked whether there is a category of large plural in Murrinth-Patha and how such a category is expressed in this language.

4 Analysis

Any analysis of the constructive number systems should address the following two related issues. The first one is the descriptive-typological issue of the overall system, in particular the nature of the (sub)category of plural. The second issue is the formal-theoretical challenge in capturing the complexities of the overall system. Of particular interest in LFG in relation to the formal-theoretical challenge is the precise explication of the structural layers involved, particularly the nature of NUM feature in the f-structure and its associated meaning.

In this section, I address these issues. The key points of the proposed analysis with respect to number features are as follows. Firstly, drawing insights from earlier work on number systems, cross-linguistic findings (Corbett 2000) and feature space analyses and underspecification (Dalrymple, King, and Sadler 2009; Sadler 2010; Dalrymple and Kaplan 2000), I treat the category of number as a system consisting of composite binary primitive features.[8] Secondly, I provide an interpretation of these number features in terms of a semantic conceptual space, extending Croft's (2003) idea of semantic map.

I now turn to the discussion of each number system in the following order: Marori, Nen, and Murrinth-Patha.

4.1 Marori

Given the facts in Marori, as discussed earlier in this paper, I argue that there are three primitive number features in Marori, [+/–SG], [+/–PL] and [+/–AUG].[9] The feature space is shown in Figure 3. The three binary features are established based on the language-specific coding evidence, e.g. the existence of morphological contrast of singular vs. non-singular.

Figure 3: Primitive number features in Marori

	FEATURES		
CATEGORY	[+/– SG]	[+/–PL]	[+/–AUG]
SINGULAR	+	–	–
DUAL	–	–	–
LIMITED PLURAL	–	–	+
GENERIC PLURAL	–	+	–
LARGE PLURAL	–	+	+

[8] However, it is open to further empirical research whether number categories across languages can be treated this way.

[9] This is not to claim that they are universal, especially the [+/–AUG] feature. Evidence that they are not universal features can be seen in languages that have no number system.

The configuration of the three number features accounts for the five-way number system in Marori. The language-specific coding evidence (morphological and constructional) for the configuration includes, for example, the fact that the singular number category is expressed by combining a singular morpheme ([+SG]) on the argument and a non-plural morpheme ([–PL]) on the verb (e.g. as seen in example (6)). No augmentation is present for the singular category; hence [–AUG]. Likewise, as discussed in section 3.3.1, dual is expressed by composing non-singular (–SG) and non-plural (–PL) morphemes without augmentation (–AUG).

The binary number features have a solid conceptual basis. This can be explained by using Croft's semantic map. The key point is that the number system has a semantic cardinal basis, e.g. singular conceptually refers to 'one' (i.e. a single individual entity).[10] Croft's semantic map (Croft 2003:141), shown in Figure 4 originally designed to account for English, needs to be revised to account for complex number systems like Marori. The semantic map proposed for Maroriis shown in Figure 5.

Figure 4: The semantic space of number in English

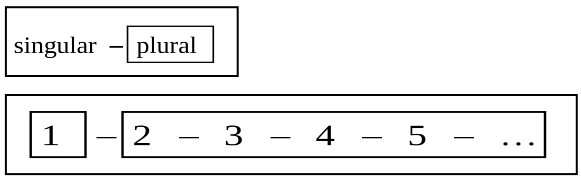
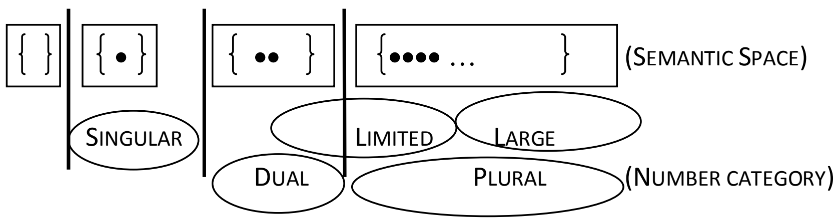


Figure 5: The semantic space of Number in Marori



In the proposed semantic map for Marori (Figure 5), the cardinality of number is represented by individual dots within curly brackets (to represent memberships of individuals within the relevant number group). Importantly, I include the left-most group with curly brackets containing no dot (i.e. the empty set). This is, for example, to capture the concept in negation. Marori, like English, can have either singular/non-plural or

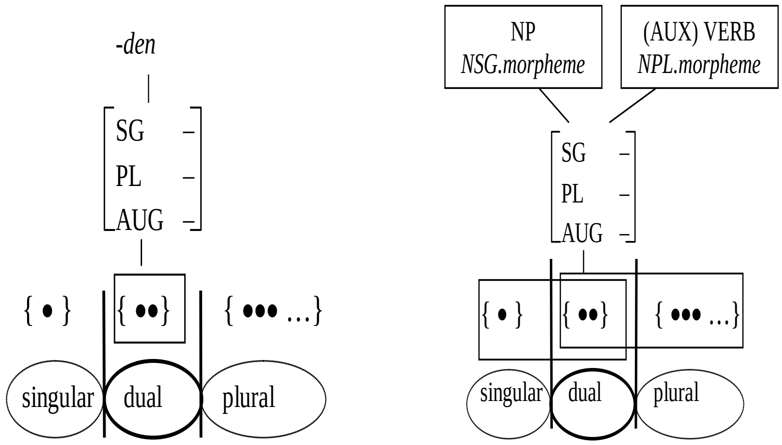
[10]Of course there is complication with reference to mass where individuality is not identifiable or not an issue.

plural/non-singular predicate-argument agreement for the case of no referents, e.g. as in English *there was no stone vs. there were no stones.*

The concept of dual with its related features is represented in Figure 6. As noted, dual refers to exactly two individuals, with the same feature structures (–SG, –PL, –AUG) irrespective of whether the expression involves a dual morpheme as in Figure 6a or without the dual morpheme (i.e. constructively) as in Figure 6b.

Figure 6: Dual in Marori

a. Non-constructive dual b. Constructive dual



It should be noted that the negative value associated with an underspecified morpheme e.g. [SG –] of the NSG form (in the NP box in (7)b means that the feature is present and the value is negative. It does not mean that the feature has no value. The negative value must be understood in the context of the semantic space shown in Figure 5. Thus, the combination of the agreement between the NSG ([SG –]) NP subject and the NPL [PL –] verb in (7)b means that the number of the subject is not singular and not plural (i.e. dual).

The proposed analysis can capture the constructive limited plural in terms of LFG's unification operation. Recall that the limited plural in Marori as described in 3.3.2 is achieved via the augmentation strategy. The augmentation involves the unification of the relevant features as seen in (19).

(19)

$$\begin{array}{ccccc} \textit{yanadu} & & \textit{ndu} & & \textit{yanadu=ndu} \\ \begin{bmatrix} \text{PL} & - \\ \text{SG} & - \end{bmatrix} & \text{U} & [\text{AUG} \quad +] & = & \begin{bmatrix} \text{PL} & - \\ \text{SG} & - \\ \text{AUG} & + \end{bmatrix} \\ \text{'two'} & & \text{augmenter} & & \text{'few/several'} \\ & & & & \text{(limited plural)} \end{array}$$

The numeral *yanadu* ‘two’ is specified in its entry with the relevant number features, [–PL, –SG]. When it combines with the augmenter *ndu*, which carries [+AUG], the outcome is the limited plural number category as shown in (19).

Likewise, the augmentation to construct a large plural can be captured in terms of feature unification as shown in (20).

(20)

$$\begin{array}{ccccc} \textit{usin} & & \textit{ndu} & & \textit{usin=ndu} \\ \begin{bmatrix} \text{PL} & + \\ \text{SG} & - \end{bmatrix} & \text{U} & [\text{AUG} \quad +] & = & \begin{bmatrix} \text{PL} & + \\ \text{SG} & - \\ \text{AUG} & + \end{bmatrix} \\ \text{'many'} & & \text{augmenter} & & \text{'very.many'} \end{array}$$

4.2 Nen

Recall that Nen (Evans 2009) also has a multi-way constructive number system. It has no dedicated plural morphology, even though it has a plural category in its overall number system; see sub-section 3.4. In this section, extending Marori’s analysis to Nen, I demonstrate that the complex number system in Nen can also be straightforwardly captured in the proposed analysis with a slight difference in the composition of the feature space.

I propose that composite number features be adopted in Nen too, as shown in Figure 7. However, on the basis of language specific evidence of formal coding in this language (shown in the last column), only two features [+/–SG] and [+/–DU] are included in the system. In this proposed analysis, Nen has a neat, simple constructive system with two composite binary features [+/–SG] and [+/–DU] to produce a four-way system: singular-dual-limited plural-large plural.

Figure 7: The number system in Nen

	FEATURES		
CATEGORY	[+/- SG]	[+/–DU]	FORM
Singular	+	–	SG-NDU
Dual	–	+	NSG-DU
Limited Plural	+	+	SG-DU
Large Plural	–	–	NSG-NDU

The two plural constructions deserve some comments. The large plural is conceptually motivated. This language has NSG and NDU morphemes. Plurals are negatively defined. That is, plurals are groups of individuals, which are neither one nor two.

However, the coding of limited plural with the combination of SG-DU morphemes should be understood holistically in the context of the contrast in the paradigmatic feature space of Nen. That is, with two features and with binary values, there are eight slots forming four categories with [+SG, +DU] left, and this is used for the limited plural. It appears highly unpredictable at first thought, but it makes perfect sense in the constructive system, given the available morphological resources for the paradigm.

Given the feature space in Figure 7, the formation of number categories and number agreement in Nen can be accounted for in a surprisingly simple way in LFG. As an illustration, let us consider the earlier limited plural example in (15)d, repeated as (21)a. The entries for the relevant morphemes, *y-* and *-aran* are shown in (21)b-c.

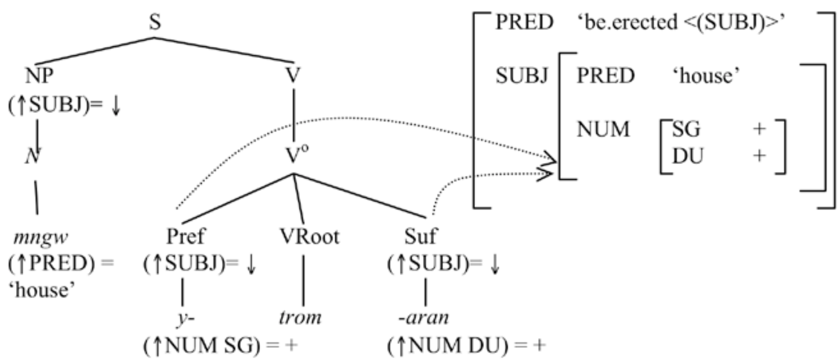
(21) a. *mngw* *y-trom-aran*
‘house 3sgU-be.erected-STAT:D
‘All the houses (limited in number) are standing.’

b. *y-*
Pref
(↑NUM SG) = +

b. *-aran*
Suf
(↑NUM DU) = +

Then, given the whole grammar imposing the features as shown in Figure 7, when *y-* and *-aran* enter into the verb formation, they construct a limited plural category. That is, each number exponent contributes a distinct feature, which then unifies with the other. The unified features ([+SG, +DU] in the f-structure) are interpreted as ‘few’. The c-structure and f-structure of sentence (21) are shown in Figure 8.

Figure8: c- and f-structures of sentence (21)a



4.3 Murrinth-Patha

The number system in Murrinth-Patha, as described in 3.4, is a five-way constructive system. A specific number category is encoded by a configuration of a classifier stem morpheme (showing singular, dual or plural morphological contrast) and an extra augmenter morpheme, which also carries kin-term sibling information.

Extending the Marori analysis to Murrinth-Patha, I propose an analysis of Murrinh-Patha where the notion of constructive number is made explicit, especially in relation to the augmenting strategy captured by the [+/–AUG] feature. To show the relevant features in the analysis explicitly, the number system in Murrinh-Patha given earlier as Figure 2 can be represented as Figure 9.

Figure 8: the number system in Murrinh-Patha

	CONSTRUCTED NUMBER CATEGORIES	NUMBER EXPONENTS	
		CLASSIFIER STEMS	EXTRA NUMBER FORMATIVES
(i)	*singular*	*singular* [+SG]	∅ [–AUG]
(ii)	*augmented dual non-sibling*	*singular* [+SG]	*ngitha* (F)/ *nitha* (M) [+AUG]
(iii)	*dual sibling*	*dual* [+DU]	∅ [–AUG]
(iv)	*augmentedpaucal non-sibling*	*dual* [+DU]	*ngime* (F)/ *neme* (M) [+AUG]
(v)	*pluralorpaucal sibling*	*plural* [+PL]	∅ [–AUG]

The composite number analysis is also adopted for Murrinth-Patha. The classifier stems carry positive values of SG, DU, and PL. The augmenter, as in Marori, carries the [+AUG] feature. The absence of an augmenter in the paradigm is associated with [-AUG]. Thus, a singular category in this language (line (i) in Figure 9) is a constructive number formation with [+SG, –AUG] specification. This contrasts, for example, with an augmented dual non-sibling which carries [+SG, +AUG] specification (line (ii) in Figure 9).

To illustrate the point of the analysis, consider the following sentence with the augmented paucal non-sibling number:

(22) *pubamka-ngkardu-ngime*
3dS.SEE(13).nFut-see-AUG.F
'They (paucal female non-siblings) saw him/her.'

The entries for the two relevant number morphemes (the classifier stem *pubamka* and the augmenter *ngime*) are shown in (23).

(23) a. *pubamka* b. *ngime*

a.	*pubamka*	b.	*ngime*
	$(\uparrow$SUBJ NUM DU$) = +$		$(\uparrow$SUBJ NUM AUG$) = +$
			$(\uparrow$SUBJ SIBLING$) =+$
			$(\uparrow$SUBJ GEND$) = $ F

Given the entries in (23), the unification of the features associated with the subject can be shown in (24). This is the result of the combination of the classifier stem *pubamka* and the augmenter *ngime*. The (partial) f-structure is shown in (24). It should be noted that there is no paucal feature as such in the f-structure. Rather the configuration of [+DU,+AUG] is interpreted as the ‘paucal’ category.[11]

(24)

$$\left[\begin{array}{ll} \text{SUBJ} & \left[\begin{array}{ll} \text{NUM} & \left[\begin{array}{ll} \text{DU} & + \\ \text{AUG} & + \end{array}\right] \\ \text{GEND} & \text{F} \\ \text{SIBLING} & + \end{array}\right] \end{array}\right]$$

Finally, there must be a constraint to rule out certain feature configurations in relation to augmented feature structures to ensure number features are well-formed and unified as intended. Note that the classifier stems in Murrinh-Patha have been analysed as carrying positive values, [+SG], [+DU] and [+PL] as shown in Figure 9. There remains a question regarding the negative values of these features.

I suggest that we adopt feature underspecification (Dalrymple, King, and Sadler 2009; Sadler 2010; Dalrymple and Kaplan 2000). The basic idea is that the morpheme does not carry a fully realised feature specification, e.g. the singular classifier stem in its entry is specified only with a [+SG] feature. The DU and PL features are underspecified. The exact value including [+DU] is only specified when the morpheme shows up in a specific construction. Assuming that there is a constructive rule where [+SG, +AUG] introduces [+DU], then nothing prevents two number features [SG] and [DU] from having the positive values for the dual number:

(25) Singular stem in dual category: [+SG, +DU, –PL, +AUG]

5 Conclusions

This paper has discussed complex number systems with unusual constructive strategies in Marori and other languages. The systems are

[11]How these features are interpretted in the semantic structure and how the quantificational meaning of ‘few’ is arrived at and represented is not pursued here.

analyzable as involving composite binary features: [+/–SG], [+/–PL], [+/–DU] and [+/–AUG]. The features are interpreted in terms of a conceptual semantic map and must be established on a language specific basis.

It has been demonstrated that there isn't a direct correlation between number categories, number coding and number features and that languages vary with respect to what features are 'activated' to encode particular categories.

It has also been demonstrated that complex number systems including constructive dual and limited plural can be accounted for in a surprisingly straightforward way in LFG.

This paper has highlighted an area of typological and theoretical research not yet well explored: the syntactic and semantic variation of number across languages, in particular a precise analysis of constructive strategies.

One theoretical point is the issue in relation to constructive number within the broader context of the theory of agreement. It is clear that agreement morphology is functionally more than simply ensuring compatibility of feature values. Rather, an agreement morpheme can introduce its own number features in order to construct a specific number category that is distinct from the number category of either of the contributory morphemes. This is exemplified by Murrinh-Patha where singular number feature appears as part of a constructive dual. In a unification-based grammar, the constructive strategy is a challenge to account for, given the mismatch between the morphological number and the constructive number. A proposal to deal with this has been outlined in 4.3.

Typologically, there is an issue of how to conceive the overall number system a language has. One of the questions is whether limited or large plural are legitimate number categories in a particular language. If yes, should they be treated on par with, or as a sub-type of, the existing number categories in the system? The answers to these questions are important for claiming whether a language has a three-, four- or five-way system. In this paper, I have treated different kinds of plurals as categories of equal status, at least in the languages discussed here. This is debatable and is open to further investigation and re-analysis. Whether other languages with similar multi-way number systems can be treated in the same way is a matter of future research.

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RESOURCE SPLITTING AND REINTEGRATION WITH SUPPLEMENTALS

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Abstract

Arnold and Sadler (2010) provides a 'Pottsian' analysis of supplemental constructions, in particular appositive (non-restrictive) relative clauses, in the framework of LFG and glue semantics. The account utilizes an inference rule that splits single glue resources into their 'at-issue' and supplemental sub-parts, and introduces other resources that re-integrate the at-issue and supplemental content, so that the supplemental content gets 'widest' scope, rather than (as in Potts' account) being scopeless. No proper justification is given for either of these aspects of the analysis. This paper shows that while the splitting rule is unnecessary, apparatus for re-integration is essential. The resulting treatment is both better justified and formally cleaner.

1 Introduction

Arnold and Sadler (2010) (hence A&S) gives a 'Pottsian' analysis of 'supplementals', specifically non-restrictive relative clauses such as the emphasised part of (1), in the framework of LFG with resource-sensitive ('glue') semantics (e.g. Asudeh, 2004; Dalrymple, 2001; Andrews, 2011).

(1) Kim, *who Sam dislikes*, did not come to the party.

The analysis involves two innovations, neither properly justified, and both potentially problematic:

i. an inference rule that 'splits' resources;
ii. apparatus for recombining at-issue and supplemental content.

The goal of this paper is to show that (i) is unnecessary (the splitting rule is dispensable, and dispensing with it produces a better analysis), but (ii) is necessary: without it the standard LFG approach to anaphora, as described in (e.g. Asudeh, 2004; Dalrymple, 2001), makes empirically wrong predictions about anaphora into and out of supplementals. The analysis we provide here has the virtues of the analysis presented in A&S, but is better motivated, and technically cleaner. More generally, (ii) relates to what has become one of the main conceptual and empirical issues in discussions of Potts' (2005) approach to semantics, namely, the question of how '*at-issue*' (normal) semantic content should be related to what Potts calls 'conventionally implicated' (*ci*) content, including supplemental content.

The paper is structured as follows. Section 2 gives a basic overview of the relevant phenomena, Potts' account, and the LFG implementation presented

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in A&S. Section 3 shows, based on straightforward and uncontroversial facts about anaphora, that assumption (ii) is necessary, given the standard LFG approach to anaphora. Section 4 discusses (i) – the need for an inference rule that splits resources – and shows that it is not necessary, and that in fact one can provide a basic account of the semantics of supplementals using only standard glue apparatus (specifically, the same apparatus that is used for anaphora). Unfortunately, a basic account is not quite a complete account. Recent work has shown that the relationship between supplemental and *at-issue* content is more subtle and varied than suggested in Potts (2005). Accordingly, Section 5 seeks to broaden the discussion of (ii) by considering some of the relevant data.

2 Background

2.1 The Phenomena

Focusing on appositive (non-restrictive) relative clauses, such as (2), A&S considers how the analysis of 'supplemental' expressions (e.g. appositives, parentheticals, emotives, and honorifics) developed in Potts (2005) can be implemented in the resource sensitive approach to the syntax-semantics interface characteristic of LFG.

(2) Kim, who Sam dislikes, left early.

The fundamental distinction between appositive relative clauses (ARCs) and superficially similar restrictive relative clauses (RRCs) is semantic, in that restrictive modifiers typically introduce an implicit 'contrast set', which can be the antecedent of an expression like *the others*. Thus, (3a) with an RRC is acceptable, but (3b) with an ARC is anomalous. There is also very often an intonational difference (non-restrictives are often set off by 'comma' intonation).

(3) a. Kim has three friends that I like (the others I don't). [RRC]
b. Kim has three friends, who I like (#the others I don't). [ARC]

Syntactically, the evidence for appositives being integrated into the syntactic structure in the same ways as the restrictives seems to be overwhelming (e.g. Jackendoff, 1977; Kempson, 2003; Arnold, 2007; Arnold and Sadler, 2010). But there is an impressive body of evidence that they are not similarly integrated semantically – for example, ARCs, instead of being interpreted where they appear syntactically, seem to behave in some ways like independent clauses.

For example, in (4) the natural interpretation of (4a) involves Kim having a belief about the set of linguists who are IPA users. By contrast, while the natural interpretation of (4b) still involves Kim having a belief about the set of linguists, neither the IPA nor its users need figure in Kim's beliefs at all – the proposition associated with the appositive relative clause (that linguists use the IPA) is outside the scope of the propositional verb. In essence, (4b) is interpreted as (4c),

(4) a. Kim believes that linguists who use the IPA are clever. [RRC]
b. Kim believes that linguists, who use the IPA, are clever. [ARC]
c. Kim believes that linguists are clever. They use the IPA.

Similarly, in the ARC in (5b), the proposition that linguists use the IPA is not part of the question (i.e. if one assumes that questions involve a question operator, then the content of the ARC has escaped its scope). (4b) is interpreted as something like (4c).

(5) a. Are linguists who use the IPA invariably clever people? [RRC]
b. Are linguists, who use the IPA, invariably clever people? [ARC]
c. Are linguists invariably clever people? (They use the IPA.)

The contrast in (6) shows that negative polarity items (NPIs) like *any* behave differently in RRCs and ARCs. Plausibly this is because RRCs, and hence any NPIs they contain, are in the scope of main clause negation. But an ARC, as in (6b), is not in the scope of the main clause negation, so the NPI it contains is unlicensed, just as it would be in an independent clause, as in (5c)

(6) a. But of course, we didn't introduce the president to the three guests that had any real opinions. [RRC]
b. *But of course, we didn't introduce the president to the three guests, who had any real opinions. [ARC]
c. *But of course, we didn't introduce the president to the three guests. They had any real opinions.

Given this data, ARCs are standardly analysed as being either 'scopeless' (as in Potts (2005)), or having wide – more precisely, 'widest' – scope (see Arnold (2007), and references there). The difference between these analyses is one of the main themes of this paper.

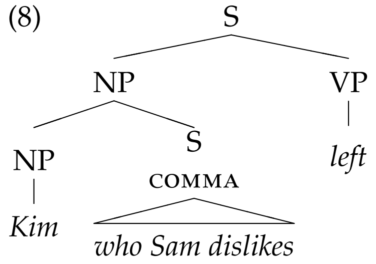
2.2 Potts' Approach

The fundamental idea of Potts' account of these constructions (as well as other supplements, emotives and honorifics) is that the interpretation of every expression involves (at least) two dimensions: (i) an *at-issue* dimension of normal truth-conditional content; and (ii) a 'conventional implicature' *ci*-dimension. The main technical apparatus he uses consists of syntactic and semantic parse-trees with associated conventions (admissibility conditions), and an extended type-theory. In addition to the normal ('at-issue') logical types (e, t, $\langle e, t\rangle$, etc), he introduces a collection of *ci-types*, in particular, the type t^c (the type of *ci*-propositions), and a collection of *at-issue to ci* types, such as $\langle e, t^c\rangle$ – the type of functions from normal '*at-issue*' entities to *ci*-propositions. Crucially, however, there are no types $\langle \sigma^c, \tau\rangle$ for any σ, τ – that is, there are no functions from *ci* objects (e.g. *ci* propositions) to *at-issue* objects. The immediate consequence of this is a radical separation of *ci* and *at-issue* content. In particular, *ci* content cannot be the argument of any function, cannot be in the scope of any operator, and is hence necessarily 'scopeless'.

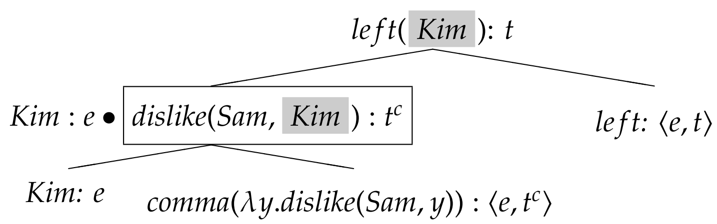
For Potts, the analysis of an example like (7) involves the syntactic parsetree in (8), and the semantic parsetree in (9), reflecting respectively the syntactic and semantic derivations (the syntactic parsetree is thus not necessarily a representation of the surface syntactic structure – however, the distinction will not be important here).

(7) Kim, who Sam dislikes, left.

(8)



(9)



With respect to the syntactic parsetree, the only points of interest are (a) the fact that the ARC is syntactically integrated, and (b) the presence of the COMMA feature. This feature provides the interface between the phonological and semantic properties: on the phonological side, it will trigger 'comma intonation'; on the semantic side it changes the type of the ARC from $\langle e, t\rangle$ (the type of a normal *at-issue* NP modifier) into $\langle e, t^c\rangle$ – the type of a function from entities to *ci*-propositions.

With respect to the semantic parsetree, the first point to notice is that the content associated with the root node is $left(Kim) : t$, this is normal *at-issue* content (type t), and just the content of (7) without the ARC. The second point to note is the presence of two kinds of content on the node corresponding to *Kim, who Sam dislikes*: the content of the ARC, and the content of the host NP *Kim*. The two kinds of content are linked by the $\bullet$ symbol, with the *ci*-content in a box (strictly speaking, every node should have both kinds of content, but for every other node in the tree the *ci*-content is empty, so we have omitted it). The third point to notice is that though the host NP *Kim* appears only once in the syntax, the corresponding content is used twice, once in deriving the *at-issue* content on the root node, and once in deriving the *ci* content (both uses are highlighted).

The main technical point of interest is the semantics of COMMA, defined as in

(10).

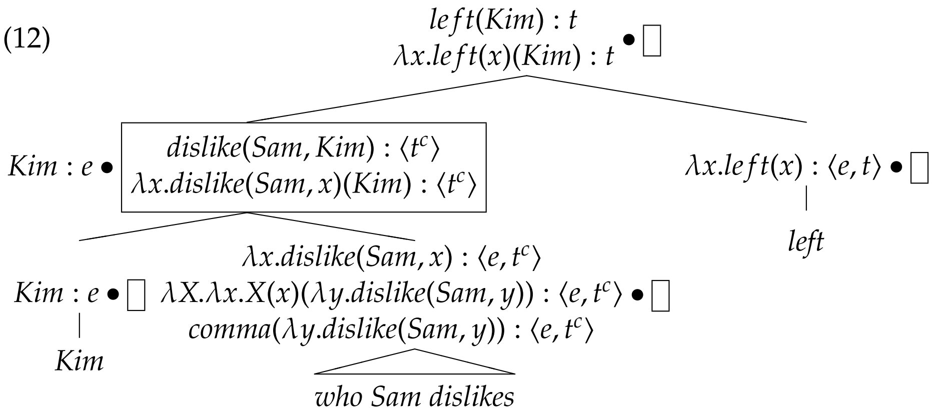
(10) COMMA: $\lambda X.\lambda x.X(x) : \langle\langle\sigma, t\rangle, \langle\sigma, t^c\rangle\rangle$ FOR $\sigma \in \{e, s, t\}$

In case it is applied to an expression of type $\langle e, t\rangle$, such as $\lambda y.dislike(Sam, y)$, corresponding to *who Sam dislikes*, the result is an equivalent expression of type $\langle e, t^c\rangle$, cf. (11):

(11) a. $comma(\lambda y.dislike(Sam, y)) : \langle e, t^c\rangle =$
b. $\lambda X.\lambda x.X(x)(\lambda y.dislike(Sam, y)) : \langle e, t^c\rangle =$
c. $\lambda x.dislike(Sam, x) : \langle e, t^c\rangle$

A more detailed view of the semantic derivation is given in (12), where every node is labelled with both *at-issue* and *ci* content (the later normally empty), the content of the ARC has been spelled out more precisely, and β-conversion of λ-expressions has been carried out. The content of the node corresponding to *Kim, who Sam dislikes* is produced by a node admissibility condition which requires that where one daughter of a node has a type like $\langle e, t^c\rangle$, the *ci* content of the mother will be produced by applying the content of this daughter to that of the other daughter, while the *at-issue* of content of the mother node will be the content of the other daughter (hence the double consumption of *Kim*, consumed once in the derivation of the *ci* content, once in the derivation of the *at-issue* content).

(12)



The interpretation of a semantic parsetree is as follows. Let $\mathcal{T}$ be a semantic parsetree with the *at-issue* term $\alpha : \sigma$ on its root node (a semantic expression α of type σ), and distinct terms $\beta_1 : \tau^c, \ldots, \beta_n : \tau^c$ on its nodes, then the interpretation of $\mathcal{T}$ is the tuple:

(13) $\left\langle [\![\alpha : \sigma]\!]^{Mg}, [\![\beta_1 : \tau^c]\!]^{Mg}, \ldots, [\![\beta_n : \tau^c]\!]^{Mg} \right\rangle$

In words, the interpretation of a semantic parsetree consisting of an *at-issue* formula and a collection of *ci* formulae is found by interpreting all formulae in the same model (M), with the same variable assignment function g. Thus, for example, the interpretation of (12) will be as in (14):

(14) $\left\langle [\![left(Kim) : t]\!]^{Mg}, [\![dislike(Sam, Kim) : t^c]\!]^{Mg} \right\rangle$

Notice that this means the model theoretic interpretation of *Kim, who Sam dislikes* is essentially the same as that of (15) (recall the intuition about ARCs and independent clauses above).

(15) Kim left. Sam dislikes Kim.

From a general theoretical point of view, the key point is that the approach involves a radical separation of *at-issue* and *ci* content: (i) because there are no expressions of type $\langle \tau^c, \sigma^a \rangle$, *ci* content cannot be an argument of (in the scope of) any semantic operator – *ci* content is scopeless; (ii) in fact *ci* and *at-issue* content is never integrated, even 'at the top', and the only semantic relation is that *at-issue* and *ci* content are interpreted in the same model(s).

From an LFG/glue perspective, however, there is an additional issue: the challenge to 'resource sensitivity' posed by the double consumption of the host of the ARC. Dealing with this is the main focus of A&S.

2.3 Resource-Sensitivity

From an LFG/glue perspective, a key problem with Potts's approach is that it involves a resource deficit: some semantic resources, specifically those associated with the host of an ARC, need to be consumed more than once. Following a suggestion of Potts', A&S proposes that ARCs and other supplementals should be associated with resources like (16), where np_e is the resource associated with the host NP, and np_{t^c} is the resource associated with the ARC.

(16) $np_e \multimap [np_e \otimes np_{t^c}]$

Schematically, the semantics of *Kim, who Sam dislikes* involves a glue derivation along the lines of (17). Here the inputs are the normal contents of *Kim*, and the (restrictive) relative clause *who Sam dislikes*. The vertical dots in (17) abbreviate a number of things, notably the change in the glue type from that of a restrictive relative to the type in (16), and a corresponding change in the logical type of the left part of the glue expression. These details are not relevant here.

(17)
$$\cfrac{\begin{array}{c}\text{Kim}\\ \\ \vdots\\ Kim : np_e\end{array} \qquad \begin{array}{c}\text{who Sam dislikes}\\ \lambda Q.\lambda X.dislike(Sam, X) \wedge Q(X) : [v \multimap r] \multimap [v \multimap r]\\ \vdots\\ \lambda Y.[Y, \lambda X.dislikes(Sam, X)(Y)] : np_e \multimap [np_e \otimes np_{t^c}]\end{array}}{[Kim, dislikes(Sam, Kim)] : np_e \otimes np_{t^c}}$$

In the conclusion of this proof fragment we have, on the meaning side, a pair of meanings corresponding to *Kim* and the proposition that Sam dislikes Kim; on the glue side, a 'tensor' resource consisting of two resources, one in the *at-issue* dimension, and one in the *ci* dimension.

A&S assumes we need to split these resources, so they can be used separately (for example, in the derivation of the *at-issue* content of the whole sentence), and so introduce a new inference rule: *at-issue-ci-split* (*ACiS*):

(18)
$$\frac{[M, M'] : R_e \otimes R_{t^c}}{M : R_e \quad M' : R_{t^c}} \text{ ACiS (at-issue-ci-split)}$$

The effect of this can be seen in the proof in (19), where the righthand part of the proof continues (17), first splitting the tensor resource, and combining one of the objects produced ($Kim : np_e$) with the resource associated with the main verb, so that we end up with two separate resources (a resource of type t corresponding to *Kim left* and a t^c resource corresponding to *Sam dislikes Kim*).

(19)
$$\dfrac{\begin{array}{c}\text{left}\\ \vdots \\ \lambda Y.left(Y) : \\ np_e \multimap s_t\end{array} \quad \dfrac{\dfrac{\begin{array}{c}\text{Kim}\\ \vdots \\ Kim : np_e\end{array} \quad \begin{array}{c}\text{who Sam dislikes}\\ \lambda Q.\lambda X.dislike(Sam, X) \wedge Q(X) : [v \multimap r] \multimap [v \multimap r]\\ \vdots \\ \lambda Y.[Y, \lambda X.dislikes(Sam, X)(Y)] : np_e \multimap [np_e \otimes np_{t^c}]\end{array}}{[Kim, dislikes(Sam, Kim)] : np_e \otimes np_{t^c}}}{Kim : np_e \qquad dislikes(Sam, Kim) : np_{t^c}}\ ACiS}{left(Kim) : s_t \qquad dislikes(Sam, Kim) : np_{t^c}}$$

A faithful implementation of Potts' ideas could stop here. A reasonable approximation to Potts' ideas would take the goal of a glue derivation to be a single *at-issue* resource with zero or more *ci* resources: $\left\{s_t, f^0_{t^c} \ldots f^n_{t^c}\right\}$ where s_t is associated with the root f-structure, each f^i is of type t^c. The final line of (19) is just like this.

However, on the standard view, a successful LFG-glue derivation should produce a single resource associated with the root S, and it is assumed in A&S, without discussion, that this should be the goal of a 'Pottsian-LFG' glue derivation.

A&S considers several approaches which produce the standard integration into a single resource. The one we will assume here associates a resource of the form (20) with each supplemental. This consumes the content of the supplemental itself ($\downarrow_{\sigma^{t^c}}$) and produces a resource which consumes the content of the main clause (s) and produces a conjunction of the main clause and supplemental content (this is again associated with the main clause – s).[1]

[1]Producing a definition of s is straightforward using inside-out functional uncertainty and off-path constraints. The definition can be found in A&S Section 5; see example (84) and surrounding discussion.

A&S also considers an alternative approach which associates an 'of course' '!' meaning constructor with the root S node, and an outside-in functional uncertainty to pick out supplemental content. The use of 'of course' resources – resources that can be used as often as desired – is somewhat at odds with the spirit of resource sensitivity, so we avoid it here.

This [**root-s**] resource violates Potts' requirement that there are no functions from the domain of *ci* types – this is the price we pay for integrating *ci* and *at-issue* content. However, A&S also mentions an alternative implementation which dispenses with this function from the *ci* domain

(20) **[root-s]** $\lambda q.\lambda p.(p \wedge q) : [\downarrow_{\sigma^{t^c}} \multimap [s \multimap s]]$

An example of the use of this resource can be seen in (21), where the other inputs are the (unsplit) resource associated with *Kim, who Sam dislikes*, and the resource associated with *left*.

(21)
$$\dfrac{\dfrac{\begin{array}{c}\lambda Y.left(Y) : \\ np_e \multimap s_t\end{array} \quad \dfrac{[Kim, dislikes(Sam, Kim)] : np_e \otimes np_{t^c}}{Kim : np_e \qquad dislikes(Sam, Kim) : np_{t^c}}}{left(Kim) : s_t \quad dislikes(Sam, Kim) : np_{t^c}} \quad \begin{array}{c}\lambda q.\lambda p.(p \wedge q) : \\ np_{t^c} \multimap [s_t \multimap s_t]\end{array}}{\dfrac{left(Kim) : s_t \quad \lambda p.(p \wedge dislikes(Sam, Kim)) : s_t \multimap s_t}{left(Kim) \wedge dislikes(Sam, Kim) : s_t}}$$

To sum up: A&S proposes an implementation of Potts' approach which involves several pieces of apparatus. Two in particular are introduced essentially without motivation. The first is an inference rule which splits a tensor resource into two separate resources. In what follows we will see that this rule is unnecessary. The second involves resources that allows *at-issue* and *ci* content to be integrated. In what follows we will see that this is necessary if we want to preserve the standard LFG-glue approach to pronouns.

We will begin with the second piece of apparatus, and show that integration of *at-issue* and *ci* content is necessary, if we accept standard LFG assumptions.

3 Integration is Essential

The basic structure of the argument here is straightforward: (i) if supplemental content is not integrated, supplementals should be anaphoric islands, given the standard LFG approach to anaphora; (ii) but supplementals are *not* anaphoric islands.

The empirical point is easily established: (22) gives examples of in- and outbound anaphora with a supplemental (an ARC). In (22a) a main clause pronoun has its antecedent inside the ARC. In (22b) the pronoun is in the ARC and its antecedent is in the main clause. Such examples are completely normal.

(22) a. Pissarro, *who Matisse$_i$ met in 1898*, encouraged him$_i$ greatly.
b. Matisse$_i$ was greatly encouraged by Pissarro, *who he$_i$ met in 1898*.

So far as we are aware, this state of affair holds quite generally: there are no cases where anaphora into and out of a supplemental is more constrained than anaphora into and out of the corresponding non-supplemental (e.g. restrictive

– one simply has to take the supplemental content to be a function that consumes the *at-issue* meaning of the root sentence and produces another *at-issue* meaning. While this is a technical fix, it is at odds with Potts' conception of there being two dimensions of content, associated with different semantic types.

relatives).[2] Supplementals are not anaphoric islands.[3]

We now turn to the theoretical point: the standard LFG approach to anaphora resolution requires anaphor and antecedent to co-exist in a single semantic structure. Demonstrating this requires a brief review of the standard LFG approach (e.g. Asudeh, 2004; Dalrymple, 2001). Consider example (23).

(23) Kim thinks she won.

The standard approach assumes that the pronoun *she* consumes its antecedent (*Kim*) and produces a resource like $Kim \times Kim : a \otimes p$, ($a$ being the resource corresponding to the antecedent and p the resource corresponding to the pronoun itself), and uses hypothetical reasoning to produce a 'context' into which pairwise substitution of antecedent and anaphor can occur, using a special inference rule.[4]

In (24), to derive the semantics of (23), we hypothesise two resources $[X : a]$ and $[Y : p]$, corresponding to the antecedent (main clause subject) and pronoun (embedded subject) respectively. With these we are able to produce a (hypothetical) glue expression for the whole sentence — $thinks(X, won(Y)) : s$. We also have the tensor resource formed by combining pronoun and antecedent ($Kim \times Kim : a \otimes p$). The rule for tensor elimination $\otimes\varepsilon$, allows simultaneous, pairwise substitution of the elements of the tensor resource in place of the hypothesised resources to produce the **let** expression, which can be β-reduced to give a semantics for the sentence as a whole.

[2]Notice we are not claiming there is no difference in the way anaphora works *inside* ARCs vs restrictive relatives. Safir (1986) presented examples which purport to show the existence of a WCO effect in restrictives like (b), which is absent from ARCs like (a):

a. John, who$_i$ his$_i$ wife loves t$_i$, arrived early.

b. *A man who$_i$ his$_i$ wife loves t$_i$ arrived early.

But this is a difference in the internal grammar of ARCs and restrictives, not a difference in the conditions on in- and out-bound anaphora. In any case, following Levine and Hukari (2006), we are persuaded that the problem with (b) reflects a processing problem, rather than something inherent to restrictive relatives. Restrictive relatives with the configuration of pronouns in (b) can be acceptable, as in (c). What seems to matter is how easy it is to determine the reference of the pronoun apart from the reference of the crossing element (the relative pronoun):

c Arthur is someone who$_i$ not even his$_i$ wife listens to t$_i$.

[3]Just one example: VP Ellipsis behaves in the same way as pronominal anaphora. In (a) ellipsis in a restrictive relative is anteceded by a VP inside the ARC. In (b) the situation is reversed:

a. Sandy, who *brought a bottle$_i$*, was rude to everyone who didn't Δ_i.

b. Everyone who *brought a bottle$_i$*, was rude to Sandy, who didn't Δ_i.

We will not pursue this here, however, because this is only relevant if VP Ellipsis is 'semantic' in the sense of involving a relation between semantic objects. If the all that is involved is some form of f-structure (near) identity between antecedent and ellipsis site, then these data would just be evidence of syntactic integration.

[4]Intuitively, hypothetical reasoning allows one to avoid ordering problems in glue derivations. Without it, resources must always be produced before they are needed. With it, one can at any point simply invent a hypothetical resource of the kind one needs. The proof will succeed if (and only if) one can later find a real resource of the right kind to discharge the hypothetical resource.

(24)

$$\dfrac{\dfrac{\begin{matrix}\vdots \\ Kim \times Kim : a \otimes p\end{matrix} \quad \begin{matrix}[X : a]^1 \quad [Y : p]^2 \\ \vdots \\ thinks(X, won(Y)) : s\end{matrix}}{\textbf{let}\ Kim \times Kim\ \textbf{be}\ X \times Y\ \text{in}\ thinks(X, won(Y)) : s}\otimes\mathcal{E},1,2}{thinks(Kim, won(Kim)) : s}\beta \Rightarrow$$

The point is quite straightforward: anaphora resolution requires pairwise substitution into a context, which plainly requires there to *be* a context. But if *at-issue* and *ci* content are not integrated, there will be no such context in cases involving supplementals. In other words, if *ci* and *at-issue* content are not integrated supplementals should be anaphoric islands, which they are not.

On the other hand, if *at-issue* and *ci* content *are* integrated, anaphora into and out of supplementals can be handled straightforwardly. Consider the case of in-bound anaphora in (25), parallel to (22a) (using *John*, *Mary* and *her* makes the proof easier to follow by making the pronoun-antecedent relation more obvious).

(25) John, who Mary$_i$ dislikes, admires her$_i$

We begin by assuming two hypothetical resources: $Z : a$ for the antecedent (*Mary*), and $Y : p$ for pronoun (*her*). With these we can produce resources corresponding to the VP (the verb plus its object, '*admire Y*'), the subject (*John*), and the ARC ('*Z dislikes John*' – the latter after we have used the splitting rule in the analysis of the ARC). The VP resource can then consume the subject resource so that we have a resource of type t associated with the root sentence, and a resource of type t^c. These can be integrated using the [**root-s**] constructor.to produce a 'context' $admire(John, Y) \wedge dislikes(Z, John) : s_t$. Independently, the pronominal resource associated with *her* can consume the resource associated with its antecedent *Mary*, to produce the tensor resource $Mary \times Mary : a \otimes p$. Tensor elimination ($\otimes\mathcal{E}$) and pairwise substitution do the rest. See (26).

(26)

$$\dfrac{\dfrac{Mary \times Mary : a \otimes p \qquad \dfrac{admire(John, Y) : s_t \quad \dfrac{dislikes(Z, John) : np_{t^c} \quad \begin{matrix}\lambda q.\lambda p.(p \wedge q) : \\ np_{t^c} \multimap [s_t \multimap s_t]\end{matrix}}{\lambda p.(p \wedge dislikes(Z, John)) : s_t \multimap s_t}}{admire(John, Y) \wedge dislikes(Z, John) : s_t}}{\textbf{let}\ Mary \times Mary\ \textbf{be}\ Y \times Z\ \text{in}\ admire(John, Y) \wedge dislikes(Z, John) : s_t}\otimes\mathcal{E},1,2}{admire(John, Mary) \wedge dislikes(Mary, John) : s_t}\beta \Rightarrow$$

where

$$\dfrac{\begin{matrix}[Y : p]^1 \\ \vdots \\ \lambda X.admire(X, Y) : \\ np_e \multimap s_t\end{matrix} \qquad \dfrac{\begin{matrix}[Z : a]^2 \\ \vdots \\ [John, dislikes(Z, John)] : np_e \otimes np_{t^c}\end{matrix}}{John : np_e \qquad dislikes(Z, John) : np_{t^c}}}{admire(John, Y) : s_t \qquad dislikes(Z, John) : np_{t^c}}$$

Example (25) and the proof in (26) involve anaphora into a supplemental. The case of anaphora out of a supplemental is equally straightforward.

(27) John, who she$_i$ dislikes, admires Mary$_i$

The proof required for (27) is just the same as (26) except that the antecedent (a) and pronoun (p) resources are switched (i.e. associate the variable Y with the antecedent resource a, and put Z with the pronoun resource p, and leave the rest of the proof exactly the same).

In short: if we want to do pronoun resolution using the standard LFG approach, then integration of *ci* and *at-issue* content is essential. Once we do this, pronoun resolution is straightforward.

4 No Need for Resource Splitting

Having shown that integration is necessary, in this section we will show that splitting is *not* necessary: it is not necessary to use an inference rule to split *ci* and *at-issue* content, as assumed in A&S. In fact, it turns out that if *at-issue* and *ci* content are integrated, we can dispense with splitting and treat supplementals and their hosts in the same way as pronouns and their antecedents, using hypothetical reasoning.

The change required to the apparatus assumed in A&S is almost trivial. The idea is that for a host plus supplemental like *Kim, who Sam dislikes* we produce (28), instead of (29), which is what was proposed in A&S, and what we have assumed so far. That is, we produce a resource whose meaning side is a product expression $A \times B$ rather than a pair expression $[A, B]$.[5]

(28) $\mathit{Kim} \times \mathit{dislikes}(\mathit{Sam}, \mathit{Kim}) : np_e \otimes np_{t^c}$
(29) $[\mathit{Kim}, \mathit{dislikes}(\mathit{Sam}, \mathit{Kim})] : np_e \otimes np_{t^c}$

Ignoring details, this gives a glue derivation like (30) for *Kim, who Sam dislikes*.

(30)
$$\dfrac{\begin{array}{c}\text{Kim}\\ \\ \vdots\\ \mathit{Kim} : np_e\end{array} \qquad \begin{array}{c}\text{who Sam dislikes}\\ \lambda Q.\lambda X.\mathit{dislike}(\mathit{Sam}, X) \wedge Q(X) : [v \multimap r] \multimap [v \multimap r]\\ \vdots\\ \lambda Y.Y \times \lambda X.\mathit{dislikes}(\mathit{Sam}, X)(Y) : np_e \multimap [np_e \otimes np_{t^c}]\end{array}}{\mathit{Kim} \times \mathit{dislikes}(\mathit{Sam}, \mathit{Kim}) : np_e \otimes np_{t^c}}$$

The derivation for a full sentence (*Kim, who Sam dislikes, left*) involves hypothetical reasoning. We begin by hypothesising two resources $[Y : e]^1$ for the host NP, and $[R : t^c]^2$ for the supplemental, and we use the [**root-s**] constructor associated with the supplemental to integrate *ci* and *at-issue* content. This allows the derivation of $left(Y) \wedge R : s_t$; together with the tensor resource from

[5]This requires only a trivial reformulation of the [**comma**] meaning constructor. Where A&S have (a), we would now have (b). We have highlighted the differences.

a. $\lambda P.\lambda Y.\, [\, Y, (P(\lambda Z.\mathit{true}))(Y)\,] : [[v \multimap r] \multimap [v \multimap r]] \multimap [np_e \multimap [np_e \otimes np_{t^c}]]$

b. $\lambda P.\lambda Y.Y \times (P(\lambda Z.\mathit{true}))(Y) : [[v \multimap r] \multimap [v \multimap r]] \multimap [np_e \multimap [np_e \otimes np_{t^c}]]$

(30), this gives us the glue resources we need to eliminate the tensor, and perform pairwise substitution for the host NP and the supplement. See (31).

(31)
$$\dfrac{\dfrac{\dfrac{\dfrac{[Y : np_e]^1 \quad \lambda X.left(X) : np_e \multimap s_t}{left(Y)} \qquad \dfrac{[R : t^c]^2 \quad \lambda q.\lambda p.(p \wedge q) : np_{t^c} \multimap [s_t \multimap s_t]}{\lambda p.(p \wedge R) : s_t \multimap s_t}}{left(Y) \wedge R : s_t} \qquad \begin{array}{c} \vdots \\ Kim \times dislikes(Sam, Kim) : \\ np_e \otimes np_{t^c} \end{array}}{\textbf{let}\ Kim \times dislikes(Sam, Kim)\ \textbf{be}\ [Y, R]\ \text{in}\ left(Y) \wedge R : s_t}\ \otimes\mathcal{E},1,2}{left(Kim) \wedge dislikes(Sam, Kim) : s_t}\ \beta \Rightarrow$$

In short, we see that there is no need for the 'at-issue-ci-split' rule assumed in A&S and given in (18) above. It can be eliminated by judicious use of standard apparatus – specifically, hypothetical reasoning and pairwise substitution, as used in the treatment of anaphora.

Formally, this is a useful result, because it means that glue derivations are always 'reducing', in the sense that inference rules do not produce more resources than they consume (cf. the A&S splitting rule takes one resource as input, and outputs two resources), and this means that we can remain within the standard tensor fragment of linear logic.[6]

Notice that nothing we have said in this section has any impact on the preceding discussion of issues relating to the scope and integration of *ci* and *at-issue* content. In particular, it is entirely consistent with 'widest scope' integration of supplemental and *at-issue*, and with the treatment of anaphora discussed above. More generally, the approach proposed in this section inherits all the virtues of the approach described in A&S. It differs only in the formal details.

For the most part this is obvious and unsurprising. However, there is one point where it is not obvious, and an interesting issue arises. The approach described in this section involves supplementals pairing with their hosts, and this might lead one to expect that they would have to be one-to-one with their hosts. The approach described in A&S does not have this property: once the resources associated with the supplemental and host have been split, the host resource is available for use with other supplementals, so each host can be associated with several supplementals. This might lead one to expect the A&S account and the account described here to make different predictions with respect to the possibility of 'stacking' supplementals.

In the following subsection we will show that this is wrong. There is no such difference between the accounts: an analysis of stacked supplementals is a straightforward consequence of the approach.

[6]As regards the formal apparatus, this approach establishes a strong link between the antecedent-anaphor relation and the host-supplemental relation – both involve tensor resources and pair-wise substitution. The difference between them is that the host-supplemental relation is far more constrained syntactically – the supplemental must be an adjunct of the host.

4.1 Stacking

Stacking of restrictive relatives is exemplified in (32):

(32) People who have liver problems who drink alcohol should take special care.

It was at one time standard wisdom that ARCs do not stack in this way (e.g. Jackendoff, 1977). This is untrue, as can be seen from attested examples like (33).[7]

(33) What a tragedy it is that so many of our talented sixth formers, *who really would do well in your universities, who are dying to get there, who queue, fight, struggle, work hard to get there, who have tremendous talents*, are denied access . . . [BNC KRG/1584]

(34) Kim, who Sam dislikes, who Les HATES, left early.

Clearly, there is no problem with this sort of example if the resources associated with host and supplement are split as on the original A&S proposal – after the host resource has been used with one supplemental, the 'splitting' rule will put it back in the resource pool, ready for re-use with another. Without splitting, since we substitute host and supplement resources pair-wise, there might seem to be a problem. However there is no problem in fact – we just need to make proper use of hypothetical reasoning.

This is most easily demonstrated by showing a proof.

Consider (35), a slightly simpler version of (34).

(35) Kim, who Sam dislikes, who Les hates, left.

We begin with a hypothetical proof that introduces three hypothetical resources, one ($[W]^1$) corresponding to *Kim*, and one for each of the supplementals ($[P]^2$, $[Q]^3$); and uses two instances of the root-s constructor (again, one per supplemental), to integrate main and supplemental content:

[7]Example (33) is from the British National Corpus. Arnold (2007) contains more examples. The observation that ARCs can stack is not novel (e.g. Grosu and Landman, 1998; Grosu, 2000; de Vries, 2002; Kempson, 2003; Arnold, 2007), but it is worth repeating because the alternative view survived so long unchallenged. It is true that not all examples of stacked non-restrictives seem equally good, which is why the myth of their unacceptability was relatively long lived, and there seem to be discourse constraints of some kind. In particular, the examples are much more acceptable if the supplementals in some sense 'make the same point', especially if the later ones re-enforce the earlier ones. Thus, (34) is better with the focus on *hates*, as indicated (the presumed point being Kim's unpopularity).

(36)
$$\dfrac{\dfrac{\dfrac{[W:k]^1 \quad \begin{array}{c}\lambda X.left(X):\\ k \multimap s\end{array}}{left(W):s} \quad \dfrac{[P:r]^2 \quad \begin{array}{c}\lambda q.\lambda p.(p \wedge q):\\ r \multimap [s \multimap s]\end{array}}{\begin{array}{c}\lambda p.(p \wedge P):\\ s \multimap s\end{array}}}{left(W) \wedge P : s} \quad \dfrac{[Q:r']^3 \quad \begin{array}{c}\lambda q'.\lambda p'.(p' \wedge q'):\\ r' \multimap [s \multimap s]\end{array}}{\begin{array}{c}\lambda p'.(p' \wedge Q):\\ s \multimap s\end{array}}}{left(W) \wedge P \wedge Q : s}$$

We can summarise this as:

(37)
$$\dfrac{[W:k]^1 \quad \lambda X.left(X) : k \multimap s \quad [P:r]^2 \quad [Q:r']^3}{\begin{array}{c}\vdots\\ left(W) \wedge P \wedge Q : s\end{array}}$$

We now deal with the relative clauses themselves. Recall that we want to produce tensor resources of the form $np \otimes r$, where np is an 'NP resource' corresponding to the host, and r is the resource associated with the supplemental relative. It is straightforward to produce such a resource from one of the ARCs (e.g. *who Kim dislikes*) and the NP *Kim*, as is show in abbreviated form in (38).

(38)
$$\dfrac{Kim : np_e \qquad \begin{array}{c}\lambda Q.\lambda X.dislikes(Sam, X) \wedge Q(X) : [v \multimap r] \multimap [v \multimap r]\\ \vdots\\ \lambda Y.Y \times (\lambda X.dislikes(Sam, X)(Y)) : k \multimap k \otimes r\end{array}}{Kim \times dislikes(Sam, Kim) : k \otimes r}$$

At this point there might seem to be a problem, because we have not done anything with the other relative clause (*who Sam hates*), and we do not have an 'NP resource' to combine it with. However, here we can avail ourselves of the flexibility afforded by hypothetical reasoning. We hypothesise a resource of the right kind, say $[Z]^1$, and procede as in (39).

(39)
$$\dfrac{\begin{array}{c}[Z]^1\\ \vdots\\ Z : k\end{array} \qquad \begin{array}{c}\lambda Q.\lambda X.hates(Les, X) \wedge Q(X) : [v \multimap r] \multimap [v \multimap r]\\ \vdots\\ \lambda Y.Y \times (\lambda X.dislikes(Les, X)(Y)) : k \multimap k \otimes r'\end{array}}{Z \times hates(Les, Z) : k \otimes r'}$$

Thus, by hypothesising $[W:k]^1$, $[P:r]^2$, $[Q:r']^3$, and $[Z]^4$, we have produced the following resources:

(40)
$$\begin{array}{lll} left(W) \wedge P \wedge Q : & Kim \times dislikes(Sam, Kim) : & Z \times hates(Les, Z) : \\ s & k \otimes r & k \otimes r' \end{array}$$

With these resources, the following proof is possible – it simply involves pair-wise substitution of tensor resources into the 'context' of the main content followed by β-reduction, as in (41). Here we first perform pair-wise substitution of the 'hypothetical' host plus supplemental $Z \times hates(Les, Z) : k \otimes r'$ and then perform the same inference step with the non-hypothetical host plus supplemental $Kim \times dislikes(Sam, Kim) : k \otimes r$. A moment's reflection should show that this approach can be extended to an arbitrary number of 'hypothetical' host plus supplemental resources, allowing an arbitrary number of stacked supplementals to be handled.[8]

(41)
$$\dfrac{\dfrac{Kim \times dislikes(Sam, Kim) : k \otimes r \qquad \dfrac{\dfrac{\begin{array}{c}[Z : k]^4 \\ \vdots \\ Z \times hates(Les, Z) : k \otimes r'\end{array} \qquad \begin{array}{c}[W : k]^1 \quad [P : r]^2 \quad [Q : r']^3 \\ \vdots \\ left(W) \wedge P \wedge Q : s\end{array}}{\textbf{let}\ Z \times hates(Les, Z)\ \textbf{be}\ W \times Q \text{ in } left(W) \wedge P \wedge Q : s}\otimes\mathcal{E},1,3}{left(Z) \wedge P \wedge hates(Les, Z) : s}\Rightarrow_{\beta}}{\textbf{let}\ Kim \times dislikes(Sam, Kim)\ \textbf{be}\ Z \times P \text{ in } left(Z) \wedge P \wedge hates(Les, Z) : s}\otimes\mathcal{E},4,2}{left(Kim) \wedge dislikes(Sam, Kim) \wedge hates(Les, Kim) : s}\Rightarrow_{\beta}$$

Once one appreciates the possibilities of using hypothetical reasoning there is nothing very radical here. However, in a Pottsian context there is an important theoretical point. As we have seen, dealing with stacked supplementals requires use of hypothetical reasoning – in particular, the use of a hypothetical resources corresponding to the supplementals, but hypothetical reasoning involves implication ($\multimap$) introduction and elimination: if one has a resource B, hypothesising a resource $[A]^1$ yields a resource $A \multimap B$, corresponding to a function from objects with the glue type A on the meaning side, and eliminating a hypothetical resource corresponds to function application on the meaning side, as can be seen from (42) and (43), (cf. Asudeh, 2004; Dalrymple et al., 1999). In the case of supplementals, the hypothesised meanings are of type t^c, objects in the *ci* domain, so the approach requires functions from the *ci* domain, which Potts forbids. Without hypothetical reasoning – without these types – one will only be able to deal with one supplemental per host, which is empirically incorrect.

(42)
$$\dfrac{\begin{array}{c}[x : A]^1 \\ \vdots \\ f : B\end{array}}{\lambda x.f : A \multimap B}\multimap_{x,1}$$

(43)
$$\dfrac{\begin{array}{c}\vdots \\ a : A\end{array} \qquad \begin{array}{c}\vdots \\ f : A \multimap B\end{array}}{f(a) : B}\multimap \mathcal{E}$$

[8]Though we have not seen it discussed in the literature, exactly the same trick can be used with pronouns. In an example with more than one pronoun dependent on one antecedent (e.g. *The boys$_i$ know their$_i$ mother loves them$_i$*), the approach that is normally described involves 'chaining', so that (e.g.) *their* is the antecedent of *them* (or *vice versa*), but careful use of hypothetical resources will also allow proofs where all pronouns are directly linked to a single antecedent, paralleling the situation here, where several supplementals depend on a single host. We are grateful to Ash Asudeh for insightful discussion on this issue.

5 Discussion

To sum up: on the purely technical level, we have shown that we do not need a special inference rule to split *ci* and *at-issue* content. In fact, dispensing with such a rule gives a formally neater treatment, since we are within the framework of the modality-free, multiplicative fragment of intuitionistic linear logic (MILL) that is assumed in, for example, Asudeh (2004), and it turns out that we do not need *any* special semantic apparatus to deal with supplementals – the only general apparatus required is that used independently in the analysis of anaphora. The fact that no special apparatus is required is a positive result for the Pottsian enterprise.

However, we have also seen that there are problems with the Potts' approach – in particular, problems for assumptions about the strict separation of *ci* and *at-issue* content. We have seen that the standard LFG approach to anaphora requires *ci* and *at-issue* content to be integrated, and we have seen that the treatment of stacked supplementals requires the existence of functions from the *ci* domain, which are forbidden under Potts approach.

While these conclusion are clear enough in themselves, their implications are less obvious because the issue of integration of *ci* and *at-issue* is more puzzling and complicated than we have suggested so far. In this final section we will broaden the discussion by considering some of these complications.

The discussion so far has assumed implicitly that there are only two positions worth considering: the Pottsian position, where supplementals are completely un-integrated, hence 'scopeless', and the position taken in much of the standard literature that they are integrated at the highest level – that they have 'widest' scope. In particular, while the evidence discussed at the start of Section 2 is consistent with both these positions, there is a growing body of research which shows this to be a great over simplification, for there appear to be cases where supplementals must be analysed as being semantically integrated, and having intermediate scope (e.g. Sells, 1985; Roberts, 2006; Amaral et al., 2007; Nouwen, 2006; Harris and Potts, 2010; Wang et al., 2005; Schlenker, 2010; AnderBois et al., 2010).

Sells (1985) drew attention to examples like (44), where the relative clause contains a relative pronoun and a definite noun phrase (*the box*) associated with a NP (*a spare pawn*) in the scope of a universal quantifier. Intuitively, this would appear to be a supplemental in the scope of a universal (cf. also Kempson, 2003).

(44) Every chess set comes with a spare pawn, which you will find taped to the top of the box.

Similarly, Roberts (2006) discusses examples like (45), where the interpretation of the subject of the relative clause depends on that of *his wife*, which is in the scope of the universal *every professional man*:

(45) Every professional man I polled said that while his wife, *who had earned a bachelor's degree*, nevertheless had no work experience, he thought she could use it to get a good job if she needed one.

Arnold (2007) notes examples like (46), where there seems to be a kind of scope paradox: the pronoun *her* is semantically dependent on the negatively quantified NP *no properly trained linguist*, so one might think that it, and presumably the whole supplemental, is in the scope of the negative NP. However, this cannot be the case, because if were so, then the negative polarity item *ever* should be licensed, which it is not.

(46) No properly qualified linguist, who would (*ever) have been taught phonetics as part of her training, would have made that mistake.

Examples like this indicate that the issue of scope of supplementals is complex. However, they are not necessarily indicative of supplementals taking narrow scope. Sells noted that the cases where this is possible are cases where the supplemental content can be conveyed with a separate clause, compare (47):

(47) Every chess set comes with a spare pawn. You will find it taped to the top of the box.

So it is possible that whatever mechanism is responsible for extending the scope of the universal in such cases is also operative in supplementals like (44) (Arnold (2007, 2004) develops this approach to account for examples like (46)). If this is correct, then these are not really examples of intermediate scope, but rather examples of widest scope/scopelessness subject to some other mechanism.

However, Schlenker (2010) discusses examples like (48) from French, which shows a subjunctive in a supplemental relative clause. Crucially, the supplemental here is interpreted as being in the semantic scope of *être concevable* (roughly the sense 'it is conceivable that John may have called his mother/Anne, who may conceivably have called her lawyer').

(48) Il est concevable que Jean ait appelé sa mère/Anne, *qui*
It is conceivable that Jean has-sub called his mother/Anne, who
ait appelé son avocat.
had-sub called her lawyer.

Harris and Potts (2010) provide an empirical study incorporating corpus and experimental data that make it clear that cases of narrow scope do exist. It is clear from the context of (49) that the supplemental *which was installed last week* is in the scope of *(Joan) believes*.

(49) Joan is crazy. She's hallucinating that some geniuses in Silicon Valley have invented a new brain chip that's been installed in her left temporal lobe and permits her to speak any of a number of languages she's never studied. Joan believes that her chip, *which was installed last month*, has a twelve year guarantee. (emphasis in original) (Harris and Potts, 2010).

There are also clear cases where other kinds of supplemental take narrow scope. Wang et al. (2005) gives examples like the following, where nominal appositive supplementals are in the scope of, respectively, *want*, *believe*, and *might*.

(50) Mary wants to marry an Italian, *a rich one*.
(51) John believes that a professor, *a quite famous one*, published a new book.
(52) A wolf, *a ferocious animal*, might come into your house.

However, Wang et al. (2005) note that it is much harder to give supplemental *relatives* (i.e. ARCs) narrow scope in this way, so for example while (50) has a *de dicto* interpretation with *an Italian* under the scope of *want*, (53) has only a *de re* interpretation, where Mary wants to marry a specific Italian. It is not obvious why this should be the case (but see Nouwen, 2006, for some discussion).

(53) Mary wants to marry an Italian, *who is rich/who is a rich one*.

Some of these examples involve quite subtle judgements or unusual situations, but it is worth emphasising that this is not always the case. Though it appears not to have been commented on in the literature, cases where supplementals appear to be integrated below the level of widest scope are rather commonplace. Consider (54).

(54) In this portait, the King, *who is dressed in armour and holding a commander's baton*, is wearing a the medallion of a Garter Sovereign.

Here it is clear that the supplemental content is to be interpreted with respect to the embedded situation of the picture, not the (widest) scope context. Of course, it is not completely obvious that there is an issue of scope here – one would need to provide a proper semantics to show this, but notice that it is quite possible for the host of the supplemental to be quantified, as in (55).

(55) In this picture, two knights, *who are evidently drunk*, are chasing two dragons, while several other knights look on.

Similar examples can be constructed with, e.g. *in my dream*, *in this novel*, *in this possible world*, and with the corresponding verbs (e.g. *dream*):

(56) Sam dreamed that she kissed George Bush, *who was wearing a strange uniform*.
(57) Sam dreamed that she kissed two strangers, *who were wearing strange uniforms*.

What is one to make of this? These data are clearly challenges for both 'scopeless' and 'widest scope' accounts, and while it is not at all clear to us what the right approach is, we can point to what we think would be a *wrong* approach.

In Section 2.3 we presented a meaning constructor that could be associated with each supplemental, and would integrate the supplemental content with that of the main clause. If the glue term s is associated with the f-structure of the root clause, this will give the supplemental content 'widest' scope (cf (20), repeated here):

(58) **[root-s]** $\lambda q.\lambda p.(p \wedge q) : [\downarrow_{\sigma^{t^c}} \multimap [s \multimap s]]$

The way to ensure that s picks out the root clause is to use an inside-out functional uncertainty, and an off-path constraint, which says that the relevant f-structure must not be the value of any attribute. It would be easy to replace this off-path constraint with another, e.g. one which says that the relevant f-structure must contain some value for TENSE. This would allow the supplemental to scope at the level of any f-structure containing a tense value (any clause, for example).

It seems to us that this is clearly the wrong approach to take. There are two key points. The first is that wide scope or something similar (e.g. scopelessness) represents something like the default case. The second is that deviation from this default case is something to do with maintaining some kind of discourse coherence. The reason we get narrow scope in (49) is that giving the supplemental wide scope would involve attributing to the speaker the same kind of delusional beliefs as Joan – beliefs that the speaker herself is characterising as delusional. Similarly, we interpret examples like (54)–(57) as we do because they 'make more sense that way' (e.g. in the case of (54), there is no king in the context outside the picture to support a wide scope reading). Whatever processes are involved here seem to be clearly pragmatic in nature, and not something that should be dealt with at the syntax-semantics interface which is the domain of glue logic.

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URDU/HINDI MODALS

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Abstract

In this paper we survey the various ways of expressing modality in Urdu/Hindi and show that Urdu/Hindi modals provide interesting insights on current discussions of the semantics of modality. There are very few dedicated modals in Urdu/Hindi: most of which has been arrived at constructionally via a combination of a certain kind of verb with a certain kind of embedded verb form and a certain kind of case. Among the range of constructions yielded by such combinations, there is evidence for a two-place modal operator in addition to the one-place operator usually assumed in the literature. We also discuss instances of the Actuality Entailment, which had been shown to be sensitive to aspect, but in Urdu/Hindi appears to be sensitive to aspect only some of the time, depending on the type of modal verb. Indeed, following recent proposals by Ramchand (2011), we end up with a purely lexical account of modality and the Actuality Entailment, rather than the structural one put forward by Hacquard (2010).

1 Introduction

Modality is an area of linguistics for which a considerable amount of work exists.[1] However, modality per se exhibits great empirical detail as well as considerable cross-linguistic variation. In this paper, we provide a brief survey of how modality can be expressed in Urdu/Hindi[2] and discuss the morphosyntactic and semantic differences among the modal verbs and modal constructions we identify. We then concentrate on exploring some issues raised in the literature from the particular perspective of Urdu/Hindi, namely raising vs. control, type of modal operator (one vs. two-place) and the Actuality Entailment (Bhatt 2006).

The paper is organized as follows: Section 2 provides a brief survey of how modality is expressed in Urdu/Hindi and makes the point that modality is generally expressed constructionally in Urdu/Hindi. That is, there are very few dedicated modal verbs in Urdu/Hindi. Instead, modal readings are arrived at constructionally via a combination of a certain kind of verb with a certain kind of embedded verb form and a certain kind of case. Given this general constructional nature of Urdu/Hindi modality and also given that Urdu/Hindi does not contain raising verbs *per se*, section 3 investigates whether Urdu/Hindi modal expressions can be analyzed as raising constructions. The syntactic evidence adduced in this section prompts us to argue in section 4 for a two-place modal operator for at least one of the modal expressions involved. Finally, in section 5 we investigate whether the

[1]We would like to thank several anonymous reviewers for comments and the audience of LFG11 and ParGram for spirited discussions. We would particularly like to thank Ash Asudeh, Dick Crouch and Annie Zaenen for comments and criticisms and we would like to acknowledge the DFG (Deutsche Forschungsgemeinschaft), whose funding of the Urdu ParGram project enabled the researching and the writing of this paper.

[2]Urdu is the national language of Pakistan and Hindi is one of the official languages of India. They are structurally almost identical and differ mainly in terms of orthography, choice of vocabulary items and some minor differences with respect to phonology and morphology. For our purposes, the languages are so close that they can be discussed in the same breath.

Actuality Entailment is also found in Urdu/Hindi and show that while it is found, there is some interesting variation in the data which leads us to adopt a lexical rather than a structural analysis of epistemic vs. root modality.

2 Modality in Urdu/Hindi

Modal verbs crosslinguistically often exhibit a defective paradigm; in Urdu, there is exactly one defective modal verb, derived from the verb *cɑh* 'want' (section 2.2). All other verbs involved in the expression of modality inflect according to the full verbal paradigm. Urdu does contains some explicit modal verbs, however modality is often expressed via a specialized use of the multifunctional verbs 'go, be, fall'. That is, the modal force is generally achieved *constructionally* rather than lexically.

Modal constructions in Urdu/Hindi fall into three morphosyntactic types that go hand in hand with semantic differences.

1. The verbs *sɑk* 'can' and *pa* 'find' in combination with a bare verb and a nominative subject (section 2.1).
2. The verbs *cahiye* 'need', *paṛ* 'fall' and *ho* 'be' in combination with an infinitive verb and a dative subject (section 2.2).
3. The verb *ja* 'go' in a complex predicate that looks superficially exactly like the passive (section 2.3).

The two dedicated modals *sɑk* 'can' and *cahiye* 'need' also allow finite complements (section 3). Further issues could be addressed with respect to Urdu/Hindi modals, such as the interaction of tense and modality as examined by Condoravdi (2002); however, we do not address such further topics within the confines of this paper.

2.1 Constructions with Bare Verbs

The two modals expressing possibility both require bare complements. In (1a), *sɑk* 'can' shows the ability to perform an action or the possibility of an event. The verb *pa* 'find/get/obtain' in (1b) shows the ability to perform an action depending on the circumstances the actor finds themselves in. The modal reading of ability and possibility with *pa* 'find' is only present when it is in a construction with a bare verb.

(1)	a.	yasin	vo	**kɑr**	**sɑk-a**
		Yasin.M.Sg.Nom	that.Nom	do	can-Perf.M.Sg
		'Yasin could do that.'			
	b.	yasin	vo	**kɑr**	**pa-ya**
		Yasin.M.Sg.Nom	that.Nom	do	find-Perf.M.Sg
		'Yasin was able to do that.'			

2.2 Constructions with Infinitival Verbs

In contrast, the three verbs signaling necessity or obligation all take an infinitive complement and a dative subject. *cahiye* 'need' in (2a) conveys the advisability of performing a certain action, whereas *paṛ* 'fall' as in (2b) carries the meaning of obligation. (2b) has a different interpretation than (2a) in that the circumstances force the performance of a certain action. The construction in (2c) with *ho* 'be' is ambiguous between obligation or external constraint to perform an action and the desire to perform the action. The modal reading is only possible when in a construction with an infinitive.

(2) a. **yasin=ko** ye **kɑr-na** **cahiye**
Yasin.M.Sg=Dat this.Sg.Nom do-Inf.M.Sg need.Sg
'Yasin needs to do this.'

b. **yasin=ko** ye **kɑr-na** **pɑṛ-a**
Yasin.M.Sg=Dat this.Sg.Nom do-Inf.M.Sg fall-Perf.M.Sg
'Yasin was obliged to do this.'

c. **yasin=ko** ye **kɑr-na** **hɛ**
Yasin.M.Sg=Dat this.Sg.Nom do-Inf.M.Sg be.Pres.3.Sg
'Yasin has/wants to do this.'

The only dedicated deontic modal in this set is *cahiye* 'need' which features a defective paradigm as is typical for modals across languages. In this case, the defective paradigm consists of just a singular (2a) and a plural (3) form.[3]

(3) **yasin=ko** ye cizẽ **kɑr-ni** **cahiyẽ**
Yasin.M.Sg=Dat this.Pl.Nom thing.F.Pl.Nom do-Inf.F.Pl need.Pl
'Yasin needs to do these things.'

2.3 The (Dis)ability Passive

The construction in (4) is generally known as the passive of (dis)ability (Glassman 1976, Van Olphen 1980).

(4) **rɑza=se** vo pɑṛh-a (nɑhĩ) gɑ-ya
Raza.M.Sg=Inst that.Nom read-Perf.M.Sg not go-Perf.M.Sg
'Raza was (not) able to read that.'

This construction looks exactly like a passive on the surface, but the instrumental is a subject. Butt (1997) analyzes this as a type of V-V complex predicate. Semantically, the construction predicates an absolute and fundamental (dis)ability on

[3] *cahiye* 'need' is historically derived from a perfect form of the verb *cah* 'want'. Exactly how the modality changed from 'want' to 'need' in the process is something that needs to be investigated.

the part of the subject. This means that in (4), there is some property of Raza that precludes him from being able to perform an action, i.e. he cannot read because he is illiterate and not because he is temporarily tired and cannot see.

Butt (1997) has analyzed the semantics of this construction as being one of dispositional predication as articulated by Lawler (1973a,b), but more specifically, they are an instance of *conditional necessity*. Bhatt (1998) points out that these constructions are negative polarity items of a sort in that some negative element is generally needed for the construction to be felicitous. However, there is a dialectal divide here. Urdu speakers generally find the examples without a negation acceptable, whereas Hindi speakers appear to have a stricter requirement on the presence of the negation. A detailed discussion of this construction, interesting as it is, falls outside the scope of this paper and so we will not pursue it any further in the following discussions.

3 Raising vs. Control

Given that Urdu/Hindi modality is expressed constructionally in the various ways presented above, a question that arises is whether modals in Urdu/Hindi should be analyzed as instances of raising, as is generally the case (Hacquard 2011), or whether they represent other types of syntactic constructions.[4] The (dis)abillity passive, for example, forms a complex predicate that does not involve raising.

In this this section, we first take a look at raising in Urdu/Hindi in general and establish that there is no straightforward equivalent to the English-style raising construction (section 3.1). We then examine modal+infinitive combinations in section 3.2 and look at the modal+bare verb constructions in section 3.3. We argue that while the modal+bare verb constructions can be analyzed as raising constructions, the modal+infinitive ones instead appear to be instances of control. We also briefly consider a copy-raising analysis as a possible alternative approach in section 3.4, but conclude that our Urdu/Hindi modal constructions cannot be analyzed as instances of copy-raising.

3.1 Raising

There is no straightforward equivalent to English-style raising constructions in Urdu/Hindi. To express the meaning of 'seem' one uses a verb that means 'attach to', as illustrated in (5).

(5) ye lɑg-ta hɛ
this.Nom attach_to-Impf.M.Sg be.Pres.3.Sg
[ke raza gʰɑr gɑ-ya hɛ]
that Raza.M.Sg.Nom home.M.Sg.Loc go-Perf.M.Sg be.Pres.3.Sg
'It seems that Raza has gone home.'

[4]As Hacquard (2011) puts it in her recent summary of the state-of-the-art in modality: modals are generally raising verbs, except for when they are not.

However, (5) involves a finite complement and is thus not a raising construction. *lag* 'attach to' cannot be used with non-finite complements as the English 'seem' (e.g. *John seems to be going home.*); it can only occur with adjectives or nominals forming a predicational construction, as shown in (6).

(6) a. raza cʰota lɑg-ta hɛ
Raza.M.Sg.Nom small.M.Sg attach_to-Impf.M.Sg be.Pres.3.Sg
'Raza appears small.'

b. raza ʊstad lɑg-ta h anotherɛ
Raza.M.Sg.Nom teacher.M.Sg attach_to-Impf.M.Sg be.Pres.3.Sg
'Raza looks like a teacher.'

Bearing in mind that raising does not seem to exist naturally and independently in Urdu/Hindi, let us now take a close look at the modal constructions in terms of a possible raising analysis.

3.2 Modals with Infinitives

The modals with infinitives all involve dative subjects. These dative subjects are not licensed by the (infinitive) verb. Regardless of whether the verb is transitive and normally requires an ergative subject in the perfect as in (7), or is intransitive and normally requires a nominative subject as in (8), when these verbs are placed in a modal construction with *cahiye* 'need' and *paṛ* 'fall, the subject is realized as dative. The relevant examples are in (9) and (10).

(7) **yasin=ne/*ko** ye ki-ya
Yasin.M.Sg=Erg/Dat this.Nom do-Perf.M.Sg
'Yasin did this.'

(8) **yasin/*=ko** gɑ-ya
Yasin.M.Sg.Nom/=Dat go-Perf.M.Sg
'Yasin went.'

(9) a. **yasin=ko** ye **kɑr-na** cahiye
Yasin.M.Sg=Dat this.Nom do-Inf.M.Sg need.Sg
'Yasin needs to do this.'

b. **yasin=ko** **ja-na** cahiye
Yasin.M.Sg=Dat go-Inf.M.Sg need.Sg
'Yasin should go.'

(10) a. **yasin=ko** ye **kɑr-na** pɑṛ-a
Yasin.M.Sg=Dat this.Nom do-Inf.M.Sg fall-Perf.M.Sg
'Yasin was obliged to do this.'

b. **yasin=ko** **ja-na** pɑṛ-a
Yasin.M.Sg=Dat go-Inf.M.Sg fall-Perf.M.Sg
'Yasin was obliged to go.'

This data shows that the case on the subject is not licensed by the infinitive verb. Indeed, this is in line with the overall *constructive case* (Nordlinger 1998) analysis that was independently put forward by Butt and King (2004) for the construction involving the modal use of *ho* 'be' in (11), in which the dative subject alternates with an ergative and the use of the ergative signals desire rather than obligation.

(11) a. **yasin=ko** ye kɑr-na hɛ
Yasin.M.Sg=Dat this.Nom do-Inf.M.Sg be.Pres.3.Sg
'Yasin has/wants to do this.'

b. **yasin=ne** ye kɑr-na hɛ
Yasin.M.Sg=Erg this.Nom do-Inf.M.Sg be.Pres.3.Sg
'Yasin wants to do this.'

Butt and King (2004) discuss this construction in some detail and analyze it as a control construction. Under the constructive case analysis, a lexical semantic approach to case marking is taken by which the case markers themselves contribute morphosyntactic and semantic information to the overall analysis of a clause. The case markers are thus not seen as being licensed by a verb, but are seen as having to fit broad compatibility constraints, some of which emanate from the case markers themselves.

The upshot is that the dative case in the modal constructions is not licensed by the infinitive verb, but the constructive case analyis does allow for the possibility that the dative case on the subject is directly connected to the type of modality expressed in the clause, and, hence, to the modal verb. That is, the verbs *cahiye* 'need' and *paṛ* 'fall' and *ho* 'be' in combination with a dative subject are what signals the modality. However, this analysis does not work either, as a modal meaning can also be expressed without a dative subject. This is illustrated in (12).

(12) a. aj **barıʃ** ho-ni cahiye
today rain.F.Sg.Nom be-Inf.F.Sg need.Sg
'It should rain today.'

b. aj gʰɑr=ki **sɑfai** ho-ni hɛ
today house.F.Sg=Gen.F.Sg cleaning.F.Sg.Nom be-Inf.F.Sg be.Pres.3.Sg
'Today house cleaning is to/should happen.'

In sum, if we analyze the modal+infinitives as raising constructions, we have no good explanation for the case marking of the subject. We established that the dative itself is not necessarily required to express modality. Given that Butt and King (2004) have independently analyzed the *ho* 'be' modal construction as a control construction and that embedded infinitives in Urdu/Hindi generally correspond to controlled XCOMPs, we conclude that a raising analysis is not well motivated for the modal+infinitive constructions, but that a control analysis is feasible.

3.3 Modals with Bare Verbs

In contrast, the modal constructions with *sak* 'can' and *pa* 'find' do not seem to involve control. The reasons for this conclusion are as follows. In addition to the ability uses we have already seen and repeated here for convenience in (13), *sak* 'can' and *pa* 'find' also allow for pure possibility readings as in (14). Here, no ability or agency is predicated of the subject and the subject is not directly thematically related to the ability modals. That is, *rain, decision* and *account* are thematically related to the bare verbs, but not to the modals. Since the subject is not related thematically to the modal, it becomes hard to defend a control analysis.

(13) a. yasin vo kɑr **sɑk-ta** hɛ
Yasin.M.Sg.Nom that.Nom do can-Impf.M.Sg be.Pres.3.Sg
'Yasin can do that.'

b. yasin vo kɑr **pa-ta** hɛ
Yasin.M.Sg.Nom that.Nom do find-Impf.M.Sg be.Pres.3.sg
'Yasin is able to do that.'

(14) a. aj **barɪʃ** **ho sɑk-ti** hɛ
today rain.F.Nom be can-Impf.F.Sg be.Pres.3.Sg
'It's possible that it will rain today.'

b. brasɪl=mẽ rɑʃtrɑpɑti=ka **fɛsla** nɑhĩ
Brazil=in president=Gen.M.Sg decision.M.Sg.Nom not

ho pa-ya
be find-Perf.M.Sg
'In Brasil a decision on the president was not able to be arrived at.'

c. cunav=mẽ sipiem=ka **kʰata** nɑhĩ
election.M.Sg=in CPM=Gen.M.Sg account.M.Sg.Nom not

kʰʊl pa-ya
open find-Perf.M.Sg
'The account of the CPM (Communist Party Marxist) couldn't be opened in the election.' (i.e., the CPM couldn't get even one seat in the election.)

An alternative analysis could be that the V+V modal constructions illustrated above are instances of V+V complex predicates of the type shown in (15) and known by various appellations in the literature such as *aspectual complex predicates* or *vector verbs* (see Butt 1995, Hook 1974).

(15) a. nadya=ne xɑt **lɪk^h li-ya**
Nadya.F=Erg letter.M.Nom write take-Perf.M.Sg
'Nadya wrote a letter (completely).'

b. ram **ga ʊṭ^h-a**
Ram.M.Sg.Nom sing rise-Perf.M.Sg
'Ram sang out spontaneously (burst into song).'

As can be seen, the modal+bare verb constructions look very much like the V-V complex predicates in (15) on the surface and thus a complex predicate analysis is tempting. The complex predicates in (15) are monoclausal (Butt 1995), so if the modal+bare verb constructions are to be analyzed as V-V complex predicates on a part with (15), then their monoclausality needs to be established. However, this turns out to be difficult if not impossible to do since the monoclausality tests established for Urdu by Butt (1995) cannot distinguish between the a monoclausal complex predicate analysis and a biclausal analysis because there are simply not enough of the right kinds of arguments around to test behavior with respect to anaphora, agreement and control.[5]

However, we can adduce some other evidence. Concerning the combinatory possibilities with auxiliaries and other types of complex predicates, the modal+bare verb constructions differ significantly from the aspectual complex predicates in (15). Consider the data in (16)–(17), which show an active and a passive version of an aspectual V-V complex predicate and a modal+bare verb construction, respectively.

(16) a. rɑza=ne g^{h}ɑr xɑrid li-ya
Raza.M.Sg=Erg house.M.Sg.Nom buy take-Perf.M.Sg
'Raza bought a house.'

b. g^{h}ɑr rɑza=se xɑrid li-ya gɑ-ya
house.M.Sg.Nom Raza.M.Sg=Inst buy take-Perf.M.Sg go-Perf.M.Sg
'A house was bought by Raza.'

(17) a. rɑza g^{h}ɑr xɑrid sɑk-a
Raza.M.Sg=Erg house.M.Sg.Nom buy can-Perf.M.Sg
'Raza was able to buy a house.'

b. g^{h}ɑr rɑza=se xɑrid-a ja sɑk-a
house.M.Sg.Nom Raza.M.Sg=Inst buy-Perf.M.Sg go can-Perf.M.Sg
'A house was able to be bought by Raza.'

In (16b), the passive auxiliary 'go' appears after the V-V complex predicate, indicating that the complex predicate as a unit has undergone passivization. In (17b),

[5] As Butt (1995) points out, scrambling possibilities and placement and scope of negation or adverbials do not function as tests for biclausality vs. monoclausality in Urdu/Hindi.

on the other hand, the passive auxiliary ‘go’ must be placed between the modal and the other verb. This is an indication that the modal construction is indeed biclausal. Given that a biclausal control analysis is out, an analysis of the modal+bare verb combinations as a biclausal raising construction is a reasonable alternative which is not ruled out on any empirical grounds. Indeed, consider the fact that *sak* ‘can’ also allows a modal expressions with finite complements. This is absolutely not typical of complex predicates, but is attested for raising constructions as in the English *John seems to be sleeping.* vs. *It seems that John is sleeping.* The relevant Urdu/Hindi example is shown in (18). Note that as in English, when a finite clause is used, an impersonal subject is introduced in the matrix clause.

(18)	**ho**	**sak-ta**	hɛ	[ke	vo	mehnɑt	kɑr-e]
	be	can-Impf.M.Sg	be.Pres.3.Sg	that	that.Nom	labour.F.Sg.Nom	do-Subj.3.Sg

‘It is possible that he will work hard.’

In sum, the modal+infinitive constructions appear to be instances of control, whereas the modal+bare verb constructions are probably instances of raising.

3.4 Copy-raising?

One of our reviewers suggested that the example in (18) as well as examples as in (19) could be analyzed as instances of *copy-raising* (Asudeh and Toivonen 2010). As (19) shows, the deontic modal *cahiye* ‘need’ also allows a finite complement with an impersonal subject, just like *sak* ‘can’.[6]

(19)	ye	**ho-na**	**cahiye**	[ke	vo	mehnɑt	kɑr-e]
	this.Nom	be-Inf.M.Sg	need.Sg	that	that.Nom	labour.F.Sg.Nom	do-Subj.3.Sg

‘This needs to happen, that he work hard.’

However, copy-raising crucially involves an anaphor in the embedded finite clause which refers back to the subject in the matrix clause, as illustrated in (20) for English. However, while in (18) and (19) there is an anaphor embedded in the finite clause that could potentially refer to the subject in the matrix clause, this need not be the case, as already illustrated by (18) and (19) and further demonstrated by (21)–(22).

(20) a. Chris$_i$ seemed like he$_i$ enjoyed the marathon.

b. *Chris$_i$ seemed like they$_j$ enjoyed the marathon.

c. *Chris$_i$ seemed like those people$_j$ enjoyed the marathon.

[6] Only these two verbs of the modals surveyed here allow finite complements. It is probably not a coincidence that these are also the only dedicated modals in Urdu/Hindi.

(21) a. **ho sɑk-ta** hɛ
be can-Impf.M.Sg be.Pres.3.Sg

[ke vo log mehnɑt kɑr-e]
that that.Nom people.M.Nom labour.F.Sg.Nom do-Subj.3.Sg
'It is possible that those people will work hard.'

b. ye **ho-na cahiye**
this.Nom be-Inf.M.Sg need.Sg

[ke vo log mehnɑt kɑr-e]
that that.Nom people.M.Nom labour.F.Sg.Nom do-Subj.3.Sg
'This needs to happen, that those people work hard.'

(22) a. **rɑza=ko**$_i$ **cahiye** [ke vo$_j$ mehnɑt kɑr-e]
Raza.M.Sg=Dat need.Sg that that.Nom labour.F.SgNom do-Subj.3.Sg
'Raza needs for her/him to work hard.'

b. **rɑza=ko**$_i$ **cahiye**
Raza.M.Sg=Dat need.Sg

[ke [vo log]$_j$ mehnɑt kɑr-e]
that that.Nom people.M.Nom labour.F.Sg.Nom do-Subj.3.Sg
'Raza needs for those people to work hard.'

In (21), the NP 'those people' does not need to refer back to the subject, which is impersonal. In (22), we have a thematic subject, 'Raza' and the anaphors 'her/him' or 'those people' also do not need to refer back to the subject. This stands in stark contrast with the English pattern in (20b–c).

Furthermore, if these were instances of copy-raising, we would not expect the copy-raised version to result in a meaning that is distinct from the version without copy-raising. That is, the meanings of the sentences in (23) do not seem to be distinct.

(23) a. John seems to be happy.

b. John seems like he is happy.

However, the same is not true for Urdu/Hindi, as shown in (24), in which (24a) shows the version with a non-finite embedded clause and (24b) a version which contains a finite embedded clause. Unlike in English, in Urdu/Hindi, these syntactic difference go hand in hand with a difference in semantic interpretation.

(24) a. bɑccõ=ko [vɑkt=pɑr skul pɑhõc
child.Pl=Dat time.M.Sg=on school.F.Sg.Obl arrive

ja-na] cahiye
go-Inf.M.Sg need.Sg
'It is neceesary that the children be at school punctually.'

b. bɑccõ=ko cahiye
child.Pl=Dat need.Sg

[ke vo vɑkt=pɑr skul pɑhõc ja-ẽ]
that Pron.3.Nom time.M.Sg=on school.F.Sg.Obl arrive go-Subj.3
'The children need to make sure they arrive at school on time.'

The example in (24a) is ambiguous as to who the *holder-of-obligation* is — it could be the children (the dative subject), or it could be some other person whose responsibility it is to make sure the children are at school on time. However, in (24b) with a finite complement, the holder-of-obligation **must** be the dative subject.[7] We therefore conclude that the Urdu/Hindi constructions are not instances of copy-raising.

4 One- or Two-Place Operator?

As already mentioned, the general assumption in the literature is that modals are raising verbs (see Hacquard 2011). This was shown not to hold for all Urdu/Hindi modal constructions (section 3). In this section, we look at the semantic assumptions that have been generated by the fact that modals generally are realized in terms of raising verbs.

The fact that raising constructions involve a proposition but no thematic subject argument at the matrix clause in the syntax has generally been translated into a one-place operator at the semantic level (a.o. Lewis 1944, Carnap 1947). That is, the modal operator is assumed to take a proposition and provide modal information about that proposition.

However, the data from the modal+infinitive constructions (*cahiye* 'need', *paṛ* 'fall' and *ho* 'be') showed that a raising analysis is not probable and the subject is thematically related to the modal verb. The latter point is made quite forcefully by the examples involving *cahiye* 'need' when it licenses a finite complement.

(25) rɑvi=ko cahiye [ke rɑza mehnɑt kɑr-e]
Ravi need.Sg that Raza.M.Sg.Nom labour.F.Sg.Nom do-Subj.3.Sg
'Ravi needs for Raza to work hard.'

In (25), the subject is clearly not raised up out of the finite clause and, as established in section 3.4, the embedded subject does not need to refer to the matrix subject. As such, the matrix subject must be thematically related directly to the modal *cahiye* 'need' and the dative case on the subject must be connected directly to the modal construction.

[7] Note that (24) also contains a V-V complex predicate, namely *pahõc ja* 'reach go', where the 'go' signals completion of the event. The presence or absence of complex predication is orthogonal to the point being made.

We take this data as establishing the need for a two-place modal operator in the semantic analysis. This two-place operator takes an individual and a proposition and relate the two to one another. In (25), the two-place modal operator would thus relate Ravi as the bearer of an obligation to the proposition that Raza work hard.

Further evidence for a two-place operator comes from *paṛ* 'fall'. Unlike *sak* 'can' ((21a)), *cahiye* 'need' ((12a), (21b)), *ho* 'be' ((12b)) and *pa* 'find' ((14b)), *paṛ* 'fall' requires a dative subject. This is shown in (26) and (27).

(26) a.

*ho	pɑṛ-ta	hɛ
be	fall-Impf.M.Sg	be.Pres.3.Sg

[ke	vo	mehnɑt	kɑr-e]
that	that.Nom	labour.F.Sg.Nom	do-Subj.3.Sg

'It is necessary that he will work hard.'

b.

*ye	ho-na	pɑṛ-a
this.Nom	be-Inf.M.Sg	fall-Perf.M.Sg

[ke	vo	mehnɑt	kɑr-e]
that	that.Nom	labour.F.Sg.Nom	do-Subj.3.Sg

'This needs to happen, that he work hard.'

c.

*aj	barıʃ	ho-ni	pɑṛ-i
today	rain.F.Sg.Nom	be-Inf.F.Sg	fall-Perf.F.Sg

'It should rain today.'

(27)

rɑvi=ko	mehnɑt	kɑr-ni	pɑṛ-ti	hɛ
Ravi.M.Sg=Dat	labour.F.Sg.Nom	do-Inf.F.Sg	fall-Impf.F.Sg	be.Pres.3.Sg

'Ravi has to work.'

The absence of a dative argument leads to ungrammaticality, as shown in (26). We conclude from this data that *paṛ* 'fall' directly and thematically selects its subject argument. This means that in (27), Ravi must be analyzed as a thematic argument of *paṛ* 'fall'. That is, Ravi is placed in a relationship with the proposition expressed by the non-finite clause and this relationship is mediated by *paṛ* 'fall'.

The Urdu/Hindi data shows that two-place modals exist in the syntax. In particular, Urdu/Hindi syntactically encodes the 'bearer of obligation' relation. There is a place for the 'bearer of obligation' in existing semantic theories of modals. For example, recent developments in semantic analysis via f-structure rewriting (Crouch 2005, 2006, Crouch and King 2006) explicitly posit contexts for the evaluation of situations. In this system, a two-place operator for modals is very natural. Furthermore, if one looks closely at standard approaches to modality in the literature, one finds that modal operators are often subscripted or that a two-place accessibilty relation is built into the operator (e.g., possible world semantics; Lewis 1944).[8]

[8] We thank Dick Crouch for pointing this out to us.

These treatments indirectly make reference to the bearer of obligation, which is identified pragmatically. What makes the Urdu/Hindi modals special is that they structurally encode this argument.

In sum, there is empirical evidence for a two-place modal operator and there are independently motivated theoretical reasons which also point towards the explicit adoption of a two-place operator for modal interpretation in general. In the context of this paper, however, we propose to remain conservative in that we only assume a two-place operator for those modals for which we have firm empirical evidence: *paṛ* 'fall' and *cahiye* 'need'. All other modals are assumed to be one-place operators for the time being.

5 The Actuality Entailment

In this section, we take a look at another issue, the *Actuality Entailment* in which syntax and semantics have been assumed to be closely tied to one another, and examine how this issue plays out with respect to Urdu/Hindi modals. We show that although the Urdu/Hindi patterns broadly conform to what has been established in the literature, there are some interesting differences which boil down to contrasts at a lexical, rather than a strutural level. We therefore adopt new ideas by Ramchand (2011) who associates interpretational differences with lexically coded differences as to how modality is evaluated.

5.1 The Actuality Entailment — Basic Data and Ideas

A long-standing puzzle about ability modals involves the contrast shown in (28) (Karttunen 1971). In (28b), the modal does not merely express a possibility, but implicates that Jane did swim across the lake. Bhatt (2006) showed with respect to a range of languages that this behavior of ability modals correlates with grammatical aspect: In the perfective, the proposition expressed must hold in the actual world (and not in some possible world, as is the case in (28b)). In the imperfective, on the other hand, no such requirement is imposed ((28a)). This difference in interpretation has to do with episodic statements vs. generic statements and has become known as the Actuality Entailment (Bhatt 2006).

(28) a. In her twenties, Jane was able to swim across Lake Balaton, though she never did.

b. ?? Yesterday, Jane was able to swim across Lake Balaton, but she didn't.

(examples based on Piñon (2003))

Hacquard (2009, 2010) argues that the Actuality Entailment is not confined to ability modals, but occurs with all *root* interpretations. This includes possibility and necessity modals, but crucially not epistemic modals or epistemic readings of possibility and necessity modals. As discussed in the next section, this prediction works out to be mostly right in an interesting way for Urdu/Hindi.

5.2 Urdu/Hindi Patterns

Root interpretations (modality connected to circumstances in the world surrounding the event) are found with: *sɑk* 'can', *pa* 'find', *paṛ* 'fall' and *ho* 'be'. Epistemic interpretations (modality connected to speaker's knowledge of the world) are found with: *cahiye* 'need' and *ho* 'be'.

5.2.1 Root Readings

As shown in (29) and (30), *sɑk* 'can' and *pa* 'find' are both root modals and are both subject to the Actuality Entailment. These two verbs are thus in total compliance with Hacquard's generalization.

(29) a. raza gari=ko cɑl-a **sɑk-ta** hɛ,
Raza.M.Sg.Nom car.F.Sg=Acc walk-Caus can-Impf.M.Sg be.Pres.3.Sg

mɑgɑr ʊs=ne gari=ko nɑhı̃ cɑl-a-ya
but Pron.3.Sg.Obl=Erg car.F.Sg=Acc not walk-Caus-Perf.M.Sg
'Raza is able to drive a car, but he didn't drive the car.'

b. ??raza gari=ko cɑl-a **sɑk-a**,
Raza.M.Sg.Nom car.F.Sg=Acc walk-Caus can-Perf.M.Sg

mɑgɑr ʊs=ne gari=ko nɑhı̃ cɑl-a-ya
but Pron.3.Sg.Obl=Erg car.F.Sg=Acc not walk-Caus-Perf.M.Sg
'Raza was able to drive a car, but he didn't drive the car.'

(30) a. raza gari=ko cɑl-a **pa-ta** hɛ,
Raza.M.Sg.Nom car.F.Sg=Acc walk-Caus find-Impf.M.Sg be.Pres.3.Sg

mɑgɑr vo gari=ko nɑhı̃ cɑl-a-ta
but Pron.3.Sg.Nom car.F.Sg=Acc not walk-Caus-Perf.M.Sg
'Raza can drive a car, but he didn't drive the car.'

b. ??raza gari=ko cɑl-a **pa-ya** hɛ,
Raza.M.Sg.Nom car.F.Sg=Acc walk-Caus find-Perf.M.Sg be.Pres.3.Sg

mɑgɑr ʊs=ne gari=ko nɑhı̃ cɑl-a-ya
but Pron.3.Sg.Obl=Erg car.F.Sg=Acc not walk-Caus-Perf.M.Sg
'Raza could drive a car, but he didn't drive the car.'

The other two verbs that allow for root modality, however, not only pattern differently from *sɑk* 'can' and *pa* 'find', but also differ with respect to one another. With respect to *paṛ* 'fall', the Actuality Entailment always holds, regardless of the type of grammatical aspect that is employed. That is, there is no possible world in which the holder of obligation could end up not performing that action, regardless of the aspect. This is illustrated in (31).

(31) a. ??rɑvi=ko skul ja-na
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg

pɑṛ-ta hɛ,
fall-Impf.M.Sg be.Pres.3.Sg

mɑgɑr vo nɑhı̃ ja-ta
but Pron.3.Sg not go-Impf.M.Sg
'Ravi has to go to school but he didn't go.'

b. ??rɑvi=ko skul ja-na
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg

pɑṛ-a hɛ,
fall-Perf.M.Sg be.Pres.3.Sg

mɑgɑr vo nɑhı̃ gɑ-ya
but Pron.3.Sg not go-Perf.M.Sg
'Ravi had to go to school but he didn't go.'

c. ??rɑvi=ko skul ja-na **pɑṛ-e-g-a**,
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg fall-3.Sg-Fut-3.M

mɑgɑr vo nɑhı̃ ja-e-g-a
but Pron.3.Sg not go-3.Sg-Fut-3.M
'Ravi will have to go to school but he won't go.'

With respect to the root reading of *ho* 'be', in contrast, no Actuality Entailment effect can be identified at all. This may be due to the simple morphosyntactic fact that *ho* 'be' does not occur with aspectual morphology and so no situation is created in which the Actuality Entailment could hold.[9]

(32) a. rɑvi=ko skul ja-na **hɛ**,
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg be.Pres.3.Sg

mɑgɑr vo nɑhı̃ ja-ta
but Pron.3.Sg not go-Impf.M.Sg
'Ravi has to go to school but he doesn't go.'

b. rɑvi=ko skul ja-na **tʰ-a**,
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg be.Past-M.Sg

[9] Note that one could in principle assume the presence of a covert aspectual operator. In this case, if the covert aspectual operator PERF is present, one would expect the Actuality Entailment to hold. However, the covert aspectual operator IMPF could also be assumed and in this case no Actuality Entailment should follow. Given that neither is overt, the example in (32) would thus in principle be ambiguous — there is no way to identify the Actuality Entailment and it therefore does not hold in (32). Furthermore note that *ho* does have overt imperfect and perfect forms (*hota/hoti/hote* and *hua, hui, hue*, respectively). There is thus no inherent motivation to assume a covert aspectual operator in the present, past and future forms. The situation here is quite different from forms involving infinitives, for example, where an aspectual opposition cannot be made overtly.

mɑgɑr vo nɑhĩ gɑ-ya
but Pron.3.Sg not go-Perf.M.Sg
'Ravi had to go to school but he didn't go.'

c. rɑvi=ko skul ja-na **ho-g-a**,
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg fall-3.Sg-Fut-3.M
mɑgɑr vo nɑhĩ ja-e-g-a
but Pron.3.Sg not go-3.Sg-Fut-3.M
'Ravi will have to go to school but he won't go.'

5.2.2 Epistemic Readings

In line with Hacquard's generalization, the Actuality Entailment does not apply with respect to epistemic modals or epistemic readings of possibility or necessity modals. A set of examples for *cahiye* 'need' are provided in (33); the examples for the epistemic reading of *ho* 'be' look just as in (32).

(33) a. rɑvi=ko skul ja-na **cahiye**
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg need.Sg
mɑgɑr vo nɑhĩ ja-ta
but Pron.3.Sg not go-Impf.M.Sg
'Ravi has to go to school but he doesn't go.'

b. rɑvi=ko skul ja-na **cahiye** **t^h-a**
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg need.Sg be.Past-M.Sg
mɑgɑr vo nɑhĩ gɑ-ya
but Pron.3.Sg not go-Perf.M.Sg
'Ravi had to go to school but he didn't go.'

c. rɑvi=ko skul ja-na **cahiye** **ho-g-a**
Ravi.M.Sg=Dat school.M.Sg.Obl go-Inf.M.Sg need.Sg be-Fut-M.Sg
mɑgɑr vo nɑhĩ ja-e-g-a
but Pron.3.Sg not go-3.Sg-Fut-M.Sg
'Ravi will have to go to school but he won't go.'

5.3 Discussion and Analysis

Hacquard (2009, 2010) proposes to tie the different interpretation possibilities of modals to syntactic structure, generally following proposals in the line of Cinque (1999). In her analysis, root modals are situated just above the VP, whereas epistemic modals occur right above TP. The difference in semantics is related to how the modals are evaluated. Hacquard proposes that modals situated just above VP are evaluated with respect to the event of the VP; modals situated above TP are evaluated with respect to a speech or attitude event (thus giving rise to epistemic readings). The interaction with aspect comes about because modals situated above VP are bound by the aspectual projection that appears above the VP and the modal. She can thus explain Bhatt's Actuality Entailment and why root modals in general display the Actuality Entailment.

Looking at Urdu and Hindi, the root modals *sak* 'can' and *pa* 'find' behave as predicted by Hacquard. The epistemic modal *cahiye* 'need' and the epistemic reading of *ho* 'be' also conform to theory. The root reading of the modal construction with *ho* 'be' does not show an Actuality Entailment. This at first glance would appear to be contrary to expectation. However, recall that the clauses with *ho* 'be' as a modal do not contain any aspect (cf. (32)). If there is no aspect in the clause, then aspect cannot interact with the VP and cannot bind it. And if there is no interaction with aspect, then Actuality Entailment is not expected, so the behavior of this verb can be interpreted as expected in Hacquard's system.

However, it is not clear why the Actuality Entailment for *paṛ* 'fall' is insensitive to aspect and always exists. The modal contribution of *paṛ* 'fall' differs from the other modals in that it predicates of a participant that the event described by the VP had to be performed by the participant so that the participant had no choice in the matter. That is, it does not seem to open up the possibility of several possible worlds, but only allows for a single actual world with respect to which the modal must be interpreted. In essence, this is parallel to the conditions that the perfective creates and which Bhatt factored in as part of the Actuality Entailment.

Unlike with the perfective, which can be argued to be encoded structurally at a projection like AspP, accounting for the difference in behavior with respect to just *paṛ* 'fall' would appear to be difficult if one only had recourse to a structural syntactic explanation. Instead, it seems likely that a difference is encoded at the lexical level by which the entry for *paṛ* 'fall' contains lexical information which predicates an obligation ('bearer-of-obligation') to perform a certain action with no choice in the matter. That is, the modal force is evaluated with respect to just one specific possible world, but not with respect to multiple possible worlds.

Interestingly, Ramchand (2011) argues that rather than tying the different interpretive possibilities to a structural configuration, the different interpretive possibilities should be triggered by encodings in the lexicon. She distinguishes between *indexical* (≈ epistemic) and *anaphoric* (≈ root) modals, following Kratzer (2008) in claiming that propositions are not sets of possible worlds, but sets of situations. Modal operators therefore quantify directly over situations. She follows Hacquard's event evaluation/anchoring idea for modals in that modals then differ in how they resolve what the situation denoted by the proposition refers to, i.e., with respect to what it must be evaluated. Indexical modals require the proposition situation to be evaluated with respect to the current utterance situation, which means they are speaker-oriented (epistemic). Anaphoric modals can bind the proposition situation to any number of other situations (certain laws, cultural values, etc.) — this makes the interpretation circumstantial and results in a root reading.

We could thus see *paṛ* 'fall' as being lexically identified as an anaphoric modal in Ramchand's sense and as being interpreted via a two-place modal operator that evaluates a proposition with respect to just one specific situation, rather than a set of situations. This special restriction with respect to *paṛ* 'fall' would thus not follow from a specialized structural configuration, but from a particular restriction with respect to its lexical content.

6 Conclusion

Our survey of Urdu/Hindi modals revealed interesting patterns that have not as yet been noted or accounted for in the general literature on modality. For one, Urdu/Hindi contains just two dedicated modal verbs — the bulk of modal expressions are formed constructionally out of a combination of a verb, a certain type of case on the subject and a particular morphosyntactic form of the embedded verb. We explored the structures of these different types of modal constructions and concluded that while some of the modal constructions can be analyzed as raising constructions (the expected case for modals), others must be seen as instances of functional control. A closer look at the functional control cases also showed that there is solid evidence for a two-place modal operator in Urdu/Hindi.

We then investigated whether the Actuality Entailment that has been long documented in the context of modality also holds in Urdu/Hindi. We found that it does, but with some interesting deviations from what would be expected under the generalization formulated by Hacquard (2009, 2010), who proposes a structural explanation of differences between epistemic and root readings with respect to the Actuality Entailment. We therefore propose an analysis by which differences in modal verbs are encoded at the lexical level and, in particular, follow Ramchand's (2011) analysis which distinguishes between indexical and anaphoric modals in terms of lexical encoding.

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REFLEXIVITY WITHOUT APPARENT MARKING:

THE CASE OF MASHAN ZHUANG

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Abstract

This paper analyzes the distribution of nominals in Zhuang, a Tai-Kadai language spoken in southwestern China. Zhuang, like many Tai-Kadai and Southeast Asian languages, displays binding phenomena in which pronouns and names can be bound, thus having consequences for the binding theory (e.g. Chomsky 1981, Radford 1997, Reuland 2001, Buring 2005), in particular whether or not these facts of Zhuang violate principles of the classical binding theory. Two main approaches explaining how these facts are aligned with binding theory (e.g. Lasnik 1991 and Lee 2003) are discussed before proposing a functional-predicational approach based on Lexical-Functional Grammar (LFG) analyses of binding (e.g. Bresnan 2001, Dalrymple 1993) to explain some intricate binding relations in Zhuang.

1 Introduction

1.1 Binding in Languages without Surface Reflexivization

Among some of the most salient facts of binding in Zhuang are cases in which pronouns and names can be bound to their antecedents, thus challenging principles B and C of the binding theory as espoused in works such as Chomsky (1981), Radford (1997), Reuland (2001), Reuland and Everaet (2001), and Buring (2005). These are illustrated in (1) and (2)[1].

(1) *Gou1*$_i$ *maeng4* *gou1*$_i$
1.SG like/love 1.SG
'I like/love myself.'

(2) *Da6Gin6*$_i$ *raem3* *da6Gin6*$_i$
personal name cut personal name
'Gin cut herself.' (This is usually said by a third party.)

Interestingly enough, these cases are not limited to Zhuang alone. Other Southeast Asian languages like Thai (Lasnik 1991, Lee 2003), Vietnamese and Hmong

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[1] These distributional patterns obtain in the Qinzhou dialect of Zhuang only if one includes the unintentionality marker *tik*:

i. *?Guz honx guz*
1.SG hit 1.SG
Intended: 'I hit me (unintentionally).'

ii. *Guz honx tik guz.*
1.SG hit TIK 1.SG
'I hit me (unintentionally).'

iii. *Guz honx tik sahga.*
1.SG hit TIK self
'I hit myself (unintentionally).'

iv. *Guz honx tik guz sahga.*
1.SG hit TIK 1.SG self
'I hit myself (unintentionally).'

(Mortensen 2003), and the Mexican language, Zapotec (Black 2000, Lee 2003), also exhibit such phenomena. The issue is how to deal with the binding theory in the face of such data showing binding phenomena without reflexivization and making the distinction between anaphors and pronouns quite fuzzy. Proposals have been made in the literature to address this issue. As early approaches, Lasnik (1991) and Black (2000), among others, proposed a parametric approach to this issue, such that Principle C would be parametrized, thus behaving differently in Thai and Zapotec from the way the principle applies in other languages with overt reflexivization. Another approach, espoused by Lee (2003) and Mortensen (2003), has been to suggest that the pronouns and R-expressions that are bound to earlier pronouns and R-expressions in this way are not pronouns and names at all but are instead bound variables spelled out as copies of their antecedents. Questions may be asked about each of these two proposals. First, it is not clear how to parametrize Principle C, such that it is satisfied differently across languages. For one thing, the empirical evidence of NPs being co-indexed by other NPs is just too daunting to explain away. And even if we were to find a neat solution to explain away these clear cases of bound R-expressions, one would still have difficulties accounting for Principle B violations. For the second approach in the literature, there is an inherent problem in the denial that the pronouns and R-expressions we see clearly and overtly are not actually pronouns and names but are actually bound variables spelled out as copies of their antecedents.

In this paper, I show that an alternative (and hopefully better) way to handling binding relations is to interpret binding in functional-predicational terms, in which I abstract away from distinguishing between terms such as reflexives and pronouns, and in which I interpret binding, not just in phrase structure terms, but more importantly in functional structure terms, where I look more closely at argument relations within the event structure. Under this approach all three principles of the classical binding theory would be adhered to.

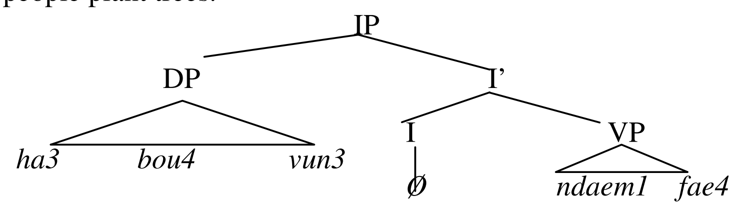
1.2 Fieldwork in Guangxi

With the above statement of our position in the debate about binding in languages without obvious reflexives, I now turn to brief statements about the particular dialect of Zhuang from which data were collected through fieldwork (Bodomo in preparation for a grammar book, Bodomo 2010, Bodomo 2007, Bodomo and Pan 2007, and Pan 2010). Zhuang, a Tai-Kadai language, is spoken in southwestern China, particularly in the Guangxi Zhuang Autonomous Region of the PRC. The dialect under study here is the Mashan dialect of Mashan county. Mashan county lies north of Nanning, capital of the autonomous region. Baishan Town, the capital of Mashan county is about 126km kilometers from Nanning. The towns and localities visited for fieldwork in the county are: Baishan Town, Jinchai and the village of Nadang. Mashan Zhuang, spoken by about 480 000 people, forms part of the group of northern Zhuang dialects which may not always be mutually intelligible with southern Zhuang dialects. Most people, especially the older generation, speak Zhuang, but there is a linguistic variety known as Guiliu, a variety of Mandarin, that is spoken by most people as a lingua franca in the county. Of course, Mandarin is the official language, as in all parts of the PRC and, as such, is used in most official contexts: offices, official bus stations, mass media, etc.

1.3 The Structure of (Mashan) Zhuang

Zhuang is a configurational language with an SVO word order, but like Chinese (Cantonese, Mandarin, etc.), it has a quite flexible word order. The sentence in (3) illustrates the SVO word order in the language.

(3) *Ha3* *bou4* *vun3* *ndaem1* *fae4*[2]
five CL person plant tree
'Five people plant trees.'



Zhuang, like Mandarin and other sinitic languages, has very little morphology.
Phonologically, the dialect under study is well-known for its dental fricatives:

(4) *Ae1ba5* *gou1* *yw5* *van6seu3* *son1* *saw1*
father 1.SG at primary school teach book
'My father teaches at a primary school/My father is a primary school teacher.'

[2] All the Zhuang data in this paper are romanized. The preliminary romanization scheme is based on the work of our research group members. The number after a syllable is the tone for that syllable. There are eight tones altogether: 1 = 53, 2 =11, 3 = 35, 4 = 24, 5 = 33, 6 = 42. Tones 7 and 8 are checked tones ending with a stop /p/, /t/ or /k/. Tone 7 is for syllables ending in a voiceless stop and tone 8 is for syllables ending in a voiced stop.

1.4 Organization of the Paper

I will first present aspects of the pronominal system of Zhuang. Then I will examine each of the Principles A, B, and C of the classical binding theory (Chomsky 1981). Following this, I will represent A-binding phenomena in LFG, leading to what I call a functional-predicational account of binding relations in Mashan Zhuang.

2 The Pronominal System of Mashan Zhuang and Structural Binding

Pronominal systems around the world are often described and differentiated among each other along the lines of grammatical features such as person, number, gender and overt case. As the table of personal pronouns in (5) and the sentences in (6) and (7) show, Zhuang encodes neither gender nor overt case.

(5)

Person \ Number	Singular	Plural
1st Person	*gou*	*raw (Inclusive)*
		dou (Exclusive)
2nd Person	*meng*	*sou*
3rd Person	*de*	*gyongde*

(6) *Gou1* *maeng4* *meng2*
1.SG like/love 2.SG
'I like/love you.'

(7) *Meng2* *maeng4* *gou1*
2.SG like/love 1.SG
'You like/love me.'

More crucially, Zhuang does not have an overt reflexive marker, *-self*.

(8) a. *Gou1$_i$* *raem3* *gou1$_i$*.
1.SG cut 1.SG
'I cut myself.'

b. *Mwng2$_i$* *raem3* *Mwng2$_i$*.
2.SG cut 2.SG
'You cut yourself.'

c. *De1$_i$* *maeng4* *de1$_{i/j}$*.
3 SG like/love 3 SG

Interpretation 1: ‘S/he$_i$ likes/loves him/her$_j$.’
Interpretation 2: ‘S/he$_i$ likes/loves himself/herself$_i$.’

2.1 Principle A in Zhuang

At first blush, the data from Zhuang reflexive binding pose a serious threat to the classical principle A.

First, there do not seem to be reflexive pronouns in the language, so the principle is irrelevant, one would say (indeed, Principle A appears irrelevant and it is rather Principle B that apparently is being violated here):

(9) *Gou$_i$* *maeng4* *gou1$_i$*
1.SG like/love 1.SG
‘I like/love myself.’

However, it turns out that Mashan Zhuang has at least two ways of addressing Principle A phenomena.

2.1.1 Reflexive Marker Borrowing from Mandarin

(10) *Gou1$_i$* *raem3* *gou1* *sei6gei3$_i$* (Mandarin Zhuang)
1.SG cut 1.SG self
‘I cut myself.’

Mashan Zhuang and presumably most northern Zhuang dialects often borrow the Mandarin (and Mandarin-based dialects like Guiliu) reflexive marker, *sei6gei3* to express reflexivity as shown in (10) above. In this case then principle A is “rescued” or, in reality, made relevant in Zhuang.

Further, and interestingly enough, on a second look at the strategies for expressing reflexivity even if reflexives are unexpressed, it looks as if there is ‘reflexive-drop’ in Zhuang, as illustrated in (11), where a gap is created from the unexpressed or dropped reflexive:

(11) *Gou1* --- *maeng4* *gou1*
1.SG like/love 1.SG
‘I like/love myself.’

The clearest and most unambiguous way to express reflexivity, according to speakers, is the addition of what looks like a reflexive marker: *gag8*, as shown in (12):

(12) *Gou1* *gag8* *maeng4* *gou1*
1.SG self like/love 1.SG
'I like/love myself.'

It would seem then that indeed reflexive pronouns exist in the language, except that there is extraction/displacement of the reflexive particle away from the pronoun, as shown in (13) and (14):

Underlying:
(13) [*Gou1* *maeng4* *gou1* *gag8*]
1.SG like/love 1.SG self
'I like/love myself.'
becoming:
(14) *Gou1* *gag8* *maeng4* *gou1* ____
1.SG self like/love 1.SG
'I like/love myself.'

One might, however, say that *gag8* is not a reflexive but an emphatic particle indicating that it is the subject/agent and no one else who is performing the action expressed by the verb. Actually, there are two instances of *gag8* in the language. It is thus possible to posit two lexical entries for *gag8* in the Zhuang lexicon:

(15) a. *gag8*[1]
- meaning 'only' as in *gou1 gag8 nwn2* 'I am the only one sleeping'; and
b. *gag8*[2]
- the reflexive as in *gou1 gag8 maeng4 gou1*, meaning 'I like/love myself' but not 'I am the only one who likes me'.

The first strategy, involving reflexive particle borrowing from Mandarin or Mandarin-based dialects, would pose no problems to configurational treatments of Principle A in Zhuang.

2.1.2 Reflexive Particle Extraction/Disposition: A problem for Configurational Binding

However, the strategy of having 'gag' adjacent to the pronoun would need some amount of explanation in a structural analysis since *gou1* and *gag8* are no longer in c-command relations but indeed, together, form part of the same NP.

2.1.2.1 Principle B

Despite the apparent cases of (9) where we have a reflexive anaphor behaving like a pronominal, Principe B does not seem to be under any threat in Zhuang, as it is quite clear that prominals must be free in their binding domains (indeed, it may be Principle C that is being violated in (16), but see below). The sentences are indeed out when pronouns are bound in their binding domains, as shown in (16) below

(16) a. *De1* *maeng4* *Penny.*
3.SG like/love personal name
'S/he likes Penny.'

b. * *De1*$_i$ *maeng4* *Penny*$_{i.}$
3.SG like/love personal name
Intended: 'S/he likes Penny.'

However, because of the breakdown in complementarity between reflexives (if they are at all to be called like that) and pronouns, there can sometimes be problems in explaining principle B in Zhuang. Consider the following:

(17) a. *Mwng2* *gang3* *Penny*$_i$ *maeng4* *de1*$_j$.
2.SG say personal name like 3.SG$_j$
'You say that Penny likes him/her (someone else).'
b. *Mwng2* *gang3* *Penny*$_i$ *maeng4* *de1*$_i$.
2.SG say personal name like 3.SG
Preferred interpretation: 'You say that Penny likes him/her.'
Possible but dispreferred interpretation: 'You say that Penny likes herself.'

While (17a) is a clear case of principle B renditions, the same cannot be said of (17b), where there is a dispreferred and unusual interpretation interfering with the preferred reading (a principle B rendition).

Again, as with Principle A, Zhuang adopts a number of strategies to address this. One of them is to use the Mandarin Chinese particle *sei6gei3* to indicate cases where a reflexive (Principle A) but not a pronominal (Principle B) reading is intended:

(18) *Mwng2*	*gang3*	*Penny*$_i$	*maeng4*	*de1*	*sei6gei3*$_i$.
2.SG	say	personal name	like/love	3.SG	self

'You say that Penny likes/loves herself.'

Thus, it can be said that in cases where *sei6gei3* is not used, the preferred readings of sentences such as (17a) are Principle B readings.

2.1.2.2 Principle C

Principle C requires an R-expression to be free, but this is clearly not the case in Zhuang as sentences such as (19) are attested in the field data:

(19) *Da6Gin6*$_i$	*raem3*	*da6Gin6*$_i$
personal name	cut	personal name

'Gin cut herself.' (This is usually said by a third party.)

Again, as with the other two principles, the use of *sei6gei3* is preferred to the use of the bound full NP (which clearly is against Principle C). The following in (20a), (20b) and (20c) are in order of preference in the expression of reflexivity:

(20)	a.	*Da6Gin6*$_i$	*maeng4*	*de1 sei6gei3*$_i$ (most preferred)
		personal name	like/love	herself
		'Gin likes/loves herself.'		
	b.	*Da6 Gin6*$_i$	*maeng4*	*Da6Gin6*$_i$
		personal name	like/love	personal name
		'Gin likes/loves herself'		
	c.	*Da6 Gin6*$_i$	*maeng4*	*de1*$_i$ (least preferred)
		personal name	like/love	her
		'Gin likes/loves herself.'		

Even in English, Principle C is largely falsified with identity statements such as *Mary*$_i$ *is Jesus' mother*$_i$. What is surprising in Zhuang is that even full NPs behave like reflexives as shown in (19) above.

2.1.2.3 Restrictions on bound R-expressions and pronouns

It is not the case that R-expressions and pronouns can be freely bound in the language. It is also known that for those languages like Thai and Zapotec that bind R-expressions and pronouns, this binding is not unrestricted. On the basis of this works such as Lee (2003) claim that what is actually happening is not a Principle violation. This conclusion is based on Reinhart and Reuland (1991) which indicates that reflexive predicates represent functions mapping a single argument to both argument positions.

First, as Lee notes and as we see here throughout, R-expressions can only be bound by identical elements, what Lee (2003) terms the Identical Antecedent Requirement:

(21) *Dei*$_i$ *yaw* *Daegin*$_{j*i}$
3.SG look.PERF Daegin
'He$_i$ looked at Daegin$_{j*i}$.'

(22) *Daegin*$_i$ *gyae* *lausae*$_{j*i}$
Daegin like.HAB teacher
'Daegin$_i$ likes the teacher$_{j*i}$

Lee (2003) shows that pronouns and even wh-traces (thus showing weak crossover effects) cannot be locally bound by R-expressions in Zapotec, but actually as we have seen here so far, this is possible in Zhuang (23), except that it is a far less preferred reading to when it is not bound and instead disambiguated with *seigei* (as 24):

(23) ?*Daegin*$_i$ *gyae* *de*$_i$.
Daegin like/love 3.SG
'Daegin$_i$ likes/loves herself$_i$.'

(24) *Daegin*$_i$ *gyae* *de* *seige*$_i$.
Daegin like/love 3.SG self
'Daegin$_i$ likes/loves herself$_i$.'

It would therefore seem that there are still real cases in which I can say that either Principle B or Principle C is under apparent violation in Zhuang.

2.2 Long Distance Reflexives

A further challenge to the approach taken by classical binding theory is that Principles

A, B, and C cannot account for phenomena where an anaphor and its antecedent are far apart, sometimes several clauses away, from each other and thus cannot be in a c-command relationship. This is often referred to as long distance binding and languages like Japanese, Scandinavian languages and Mandarin exhibit this phenomenon. The Norwegian example in (25), taken from (Bresnan 2001) below illustrates long distance binding:

(25)	*Jon*$_i$	*bad*	*oss*	*snakke*	*om*	*seg*$_i$
	John	asked	us	to speak	about	self
	'John asked us to speak about him.'					

Long distance binding is quite pervasive in Zhuang. Anaphoric pronouns like *de1* can be bound by an antecedent from several clauses far afield, just as in (26).

(26)	*Da6Gin6*$_i$	*heu6*	*ba2ma5*	*de1*	*gang3*	*de1*$_i$
	personal name	ask	mother	3.SG	say/speak	3.SG
	'Gin asked her mother to speak about her.'					

These may not be classical cases of long distance binding as in Scandinavian as the *de1* here cannot be used for long distance binding when *sei6gei3* is added to it:

(27)	**Da6Gin6*$_i$	*heu6*	*ba2 ma5*	*de1i*	*gang3*	*de1*$_i$	*sei6gei3*
	personal name	ask	mother	3.SG	say/speak	3.SG	self
	Intended: 'Gin asked her mother to speak about herself.'						

If there is a *sei6gei3* expression it must be bound in the same clause:

(28)	*Da6Gin6*	*heu6*	*ba2 ma5*	*de1*$_i$	*gang3*	*[de1*	*sei6gei3]*$_i$
	personal name	ask	mother	3.SG	say/speak	3.SG	self
	'Gin asked her mother to speak about herself.'						

Even referentials can be bound by an R-expression not within the same clause, again violating Principle C.

(29)	*Da6gin6*$_i$	*heu6*	*ba2ma5*	*de1*$_i$	*gang3*	*Da6Gin*$_i$
	personal name	ask	mother	3.SG	say/speak	personal name
	'Gin asked her mother to speak about Gin (her).'					

2.3 Section Conclusion

This section of the paper has presented an overview of the pronominal system of Zhuang and described how the nominals in this system respond to the principles of binding theory. I have noticed that the concept of overt reflexivity is hard to maintain in Zhuang. There are hardly any reflexives in Zhuang, as we know them in other languages. We have noticed a number of strategies used to address reflexive binding in Zhunag and to differentiate it from pronominal binding. This includes (i) borrowing the particle *sei6gei3* from Mandarin, and (ii) the use of the particle *gag8*. I have also noted that, like Mandarin and other languages, Zhuang exhibits, albeit a limited case of, long-distance binding. In section 3, we propose a formal treatment of binding in Zhuang.

3. Functional-Predicational Binding

A major problem with the classical binding theory is that when structural notions like c-command and binding domain are used to define binding, which is not only a structural (syntactic) notion, but as well a semantic/functional notion, problems arise in generalizing rules and principles across languages.

In this part of the paper I will propose an analysis and formalization of binding in Zhuang based on notions developed in the formal grammatical framework of Lexical-Functional Grammar (LFG), as contained mainly in Bresnan (2001). This is what we call a functional-predicational approach to binding, based on the idea that we need to understand the predicate-argument relations of an event in order to understand how it is represented at the functional structure (f-structure).

3.1 Basic Concepts in LFG Binding

Since binding is more than just a structural phenomenon, LFG treatments of binding emphasize the functions encoded by a predicate which is at the centre of the binding event. One concept that is important here is the notion of relational hierarchy as shown in (30):

(30) Relational Hierarchy
SUBJ > OBJ > OBJ_θ > COMPL > ADJUNCT

This is supposed to be a universal hierarchy, a concept first proposed by Keenan and

Comrie (1977) to show the prominence relations between grammatical roles/functions across languages. According to this hierarchy, subjects are more prominent than objects, which are in turn more prominent than complements with adjuncts and other non-argument functions being least prominent. This notion is exploited by Bresnan (2001) to define the notion of syntactic rank as shown in (31):

(31) Syntactic Rank (Bresnan 2001:213)

'A locally outranks B if A and B belong to the same f-structure and A is more prominent than B on the relational hierarchy. A outranks B if A locally outranks some C which contains B.'

The notion of syntactic rank replaces the structural notion of c-command, and the illustrations later on will show how this is done. Another structural notion needing replacement is that of the governing domain. Rather than talking of government domain in structural notions of clausehood, the domain in which binding is deemed to occur is within the nucleus of the predicate and its argument functions, hence the name functional-predicational binding. The following English sentence (32) illustrates the notion of syntactic rank in (31). The diagram in (33) is the f-structure of (32).

(32) I think she likes me.

(33)
$$\left[\begin{array}{ll} \text{PRED} & \text{'think <(}\uparrow\text{SUBJ)(}\uparrow\text{COMP)>'} \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 1 \\ \text{CASE} & \text{Nom} \end{array}\right] \\ \text{COMP} & \left[\begin{array}{ll} \text{PRED} & \text{'like <(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{GEND} & \text{F} \\ \text{CASE} & \text{Nom} \end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 1 \\ \text{CASE} & \text{Acc} \end{array}\right] \end{array}\right] \end{array}\right]$$

(34) Nucleus (Bresnan 2001:213)

'Given an f-structure, the nucleus of f is the subset of f consisting of the PRED element and all of the elements whose attributes are functions designated by the PRED.'

The nucleus is defined in Bresnan (2001) as shown in (34). This notion is rather apt for describing a-binding, which is what co-referentiality in formal accounts is all about. Another attractive notion of LFG binding is the idea of abstracting away from distinguishing between reflexives and pronouns by introducing a concept of [+/- NUCLEAR]. This is especially advantageous for our Zhuang data where the same formal item can serve as a reflexive or a pronominal. The concept of [+/- NUCLEAR] is introduced as shown in (35).

(35) The [Nuclear +/-] Feature (Bresnan 2001)

This feature is part of the lexical property of nominals.

a. Anaphors or nuclear pronouns have [NUCLEAR +].

b. Pronouns or nonnuclear pronouns have [NUCLEAR -].

c. Referring expressions do not have a value for this feature. They are governed by the negative existential constraint –(↑NUCLEAR).

The term exploits the notion of feature structures that is central in computational approaches to grammar. The feature [+/- NUCLEAR] is posited as part of the lexical properties of nominals, such that referentially dependent or bound nominals like *himself, herself, gou, gou sei6gei3, de1, de1 sei6gei3* are [+NUCLEAR] while referentially independent or non-bound nominals like *him, her, de1*, are [-NUCLEAR].

A final notion necessary for the definition of binding is the notion of indexation. The structural notion of encoding indices is maintained, as in (36), but is encoded as part of the feature specification of a nominal, such that if two nominals have the same indices, they co-refer and take part in what I will call a 'binding unification'.

(36) The [Index *i*] Feature (Bresnan 2001)

This is another feature in the lexical entries of nominals.

With the ingredients above we can now define binding in the LFG perspective as shown in (37):

(37) Definition of LFG binding

A binds B if (i) A outranks B, and (ii) (A INDEX) = (B INDEX)

In section 3.2, I now illustrate the principles of binding based on this new notion of *functional-predicate argument binding*.

3.2 A Functional Rendition of Principles A, B, and C

The basic binding principles in LFG are as follows:

(38) Binding Principles in LFG (Bresnan 2001)

a. Principle A:

A nuclear (reflexive) pronoun must be bound in the minimal nucleus that contains it and a subject outranking it.

b. Principle B:

A nonnuclear pronoun must be free in the minimal nucleus that contains it.

c. Principle C:

(Other) nominals must be free.

I can now illustrate a representation and formalization of Principles A, B and C with the Zhuang sentences in (39)-(41):

(39) a. *Gou1*$_i$ *raem3* *gou1*$_i$

1.SG cut 1.SG

'I cut myself.'

b.

$$\left[\begin{array}{ll} \text{PRED} & \text{'raem3 <(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 1 \\ \text{NUCL} & - \\ \text{INDEX} & i \end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 1 \\ \text{NUCL} & + \\ \text{INDEX} & i \end{array}\right] \end{array}\right]$$

(40) a. *de1*$_i$ *maeng4* *de1*$_{i/j}$

3.SG like/love 3.SG

'S/he likes/loves herself/himself/her/him'

b.

$$\left[\begin{array}{ll} \text{PRED} & \text{'maeng4 <(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{NUCL} & - \\ \text{INDEX} & i \end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{NUCL} & +/- \\ \text{INDEX} & i/j \end{array}\right] \end{array}\right]$$

(41) a. *Da6gin6*$_i$ *raem3* *da6gin6*$_i$

personal name cut personal name

'Gin cut Gin (herself).'

b.

$$\left[\begin{array}{ll} \text{PRED} & \text{'raem3 <(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Da6gin6'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{GEND} & \text{F} \\ \text{NUCL} & - \\ \text{INDEX} & i \end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Da6gin6'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{GEND} & \text{F} \\ \text{NUCL} & - \\ \text{INDEX} & i \end{array}\right] \end{array}\right]$$

(42) a. *De1*$_i$ *gang3* *Carmen*$_j$ *maeng4* *gou1*$_k$
3.SG say personal name like/love 1.SG
'S/he said Carmen likes me.'

b.

$$\left[\begin{array}{ll}
\text{PRED} & \text{'gang3 <(}\uparrow\text{SUBJ)(}\uparrow\text{COMP)>'} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{NUCL} & - \\ \text{INDEX} & i \end{array}\right] \\
\text{COMP} & \left[\begin{array}{ll}
\text{PRED} & \text{'like <(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Carmen'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{GEND} & \text{F} \\ \text{INDEX} & j \end{array}\right] \\
\text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 1 \\ \text{NUCL} & - \\ \text{INDEX} & k \end{array}\right]
\end{array}\right]
\end{array}\right]$$

In (42b), the matrix SUBJ outranks the (COMP SUBJ) and the (COMP OBJ). Since the three functions all have different indices, the SUBJ does not bind the (COMP SUBJ) or the (COMP OBJ). The (COMP SUBJ) *Carmen*, which is a full NP, is free and therefore Principle C is satisfied. The (COMP OBJ) *gou1* is also free as, having a different index, it is not bound by the (COMP SUBJ) although the (COMP SUBJ) does outrank it. Both nonnuclear pronouns *de1* and *gou1* are free and so, Principle B is satisfied also.

3.3 Further Issues

In this section of the paper I touch on various issues that may be considered in a further analysis of binding in Zhuang.

3.3.1 Long-Distance Anaphora

What we have seen and represented so far in this section involves argument binding within a strict governing domain (c-command/syntactic rank).

However, there are reflexives that live a 'double life' meaning 'they can be locally bound, similar to English, herself; or they can find an antecedent outside their minimal clause' (Buring 2005:72). As seen in section 2.2, Zhuang, like Mandarin, Cantonese, Japanese and the Scandinavian languages manifests issues of long distance anaphora. Long distance anaphora challenge classical notions of binding. The sentence in (43), repeated from (26) illustrates this notion.

(43)	*Da6Gin6*$_i$	*heu6*	*[ba2ma5*	*de1]*$_j$	*gang3*	*de1*$_i$
	personal name	ask	mother	3.SG	say/speak	3.SG
	'Gin asked her mother to speak about her.'					

(44)	*Da6Gin6*$_i$	*sieng3*	*Daeg8Bin5*$_j$	*maeng4*	*de1*$_{i/*j}$
	personal name	hope	personal name	like/love	3.SG
	'Gin hopes that Bin likes/loves her.'				

There have been two approaches to the representation and formalization of long distance anaphora in the literature, movement and non-movement approaches. Most movement approaches analyze these such that the reflexive moves back into the local binding domain of the antecedent. (The claim is that this is a more unified account for both short and long distance anaphora, something like clitic climbing.) Some analyses posit a much larger syntactic domain of binding (Progovac 1992, Manzini and Wexler 1987). Others claim that LDR fall outside the domain of sentence grammar, and should be treated as a matter of speaker view (logophoricity) (Hellan 1988, Kuno 1987).

The question now is, how do I analyse this in a functional-predicational binding approach? With an extended notion of syntactic rank I can represent the Zhuang long distance anaphoric relations as follows:

(45)
$$\left[\begin{array}{ll}
\text{PRED} & \text{'heu6 <(}\uparrow\text{SUBJ)(}\uparrow\text{COMP)>'} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Da6gin6'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{GEND} & \text{F} \\ \text{INDEX} & i \end{array}\right] \\
\text{COMP} & \left[\begin{array}{ll}
\text{PRED} & \text{'gang3 <(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>'} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'ba2ma5 <(}\uparrow\text{POSS)>'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{GEND} & \text{F} \\ \text{INDEX} & j \\ \text{POSS} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \end{array}\right] \end{array}\right] \\
\text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'Pro'} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{NUCL} & + \\ \text{INDEX} & i \end{array}\right]
\end{array}\right]
\end{array}\right]$$

In (45), the matrix SUBJ outranks the (COMP SUBJ) and the (COMP OBJ). The (COMP SUBJ) *ba2ma5 de1* is a full NP and is free because it has a different index. Principle C is satisfied. The (COMP OBJ), being a nuclear pronoun, is bound by the matrix SUBJ because it is outranked by and shares the same index with the matrix

SUBJ. Principle A is satisfied also.

3.3.2 Distribution of Gag8 'Self': Emphatic Reflexive?

In the literature, mention has been made of complex reflexives, some of which are used as emphatic reflexives, such as:

(46) *I, myself, went there!*

There is a particle in Zhuang, *gag8*, as seen in section 2.1.1, whose distribution and functions I am still not sure of at this point. We suspect that it is partly an emphatic and partly some kind of reflexive particle. At this point, we just note a few of the facts of its distribution:

The use of *gag8* is the most 'natural' way of expressing reflexives, according to our field informant. But it is worth noting that the interpretation is more like 'It is ____ who hurt self.' A question may be asked if this is topicalization, rather than reflexivisation.

(47)	*gou1*$_i$	*gag8*	*raem3*	*gou1*$_i$
	1.SG	self	cut	1.SG

'It was I who cut myself.'

(48)	*mwng2*$_i$	*gag8*	*raem3*	*mwng2*$_i$
	2.SG	self	cut	2.SG

'It was you who cut yourself.'

(49)	*de1*$_i$	*gag8*	*raem3*	*de1*$_i$
	3.SG	self	cut	3.SG

'It was s/he who cut himself/herself.'

(50)	*raeu2*$_i$	*gag8*	*raem3*	*raeu2*$_i$
	1.PL	self	cut	1.PL

'It was we who cut ourselves.'

(51)	*sou1*$_i$	*gag8*	*raem3*	*sou1*$_i$
	2.PL	self	cut	2.PL

'It was you who cut yourselves.'

(52)	*gyoeng5*	*de1*$_i$	*gag8*	*raem3*	*gyoeng5*	*de1*$_i$
	group	that	self	cut	group	that

'It was they who cut themselves.'

(53)	**gou1*$_i$	*gag8*	*raem3*	*gou1*	*gag8*$_i$
	1.SG	self	cut	1.SG	self

Intended: 'I cut myself.'

(54) *$gou1_i$ *raem3* *gou1* $gag8_i$

1.SG cut 1.SG self

Intended: 'I cut myself.'

Furthermore, *gag8* cannot be 'self' because it cannot appear in the OBJ position. However, it may turn out that *gag8* means 'alone' and this may be compared with a language like Cantonese, as shown in (55):

(55) a. *Ngo5* *zi6gei2* *zyu6*

1.SG self live

'I live alone.'

b. *Ngo5* *jat1* *go3* *jan4* *zyu6*

1.SG one CL person live

'I live alone.'

Finally, it is worth noting that one cannot use this particle in conjunction with all verbs, especially those that involve reciprocal actions or actions in which one needs two participants, such as with the verb "quarrel". This is shown in (56):

(56) **Gou1* *gag8* *do6ceng1*

1.SG self quarrel

3.3.3 Disambiguation Through Social Status Pronouns

It is possible that some of the complementarity between reflexives and pronominals can be salvaged by specific social status pronominals, which are very characteristic of the Zhuang language and society:

(57) a. $De1_i$ *maeng4* $daeg8de1_{*i/j}$

3.SG like/love 3.SG.M

'S/he likes him (*himself).'

b. $de1_i$ *maeng4* $daeg8de1_j$

3.SG.F like/love 3.SG.M

'She likes him.'

(58) *De1* 'that/it/he/she'

Daeg8de1 'the/that boy'

Da6de1 'she/ that girl'

Ae1de1 'that man (who has a child)'
Ba2de1 'that woman (who has a child)'

Again, at this point it is still too preliminary to explore the role of social-status coded pronominals in the binding theory.

4. Conclusion

In this paper, I have provided a description and proposed a formalization of Zhuang in terms of the binding theory. A number of issues have been raised. It has been shown that Zhuang and other Southeast Asian languages such as Thai, Vietnamese and Hmong, along with Zapotec, a language spoken in Mexico, exhibit a peculiar form of binding phenomena in which pronouns and names can be bound, in apparent contravention of binding Principles B and C. Two main approaches, which I term the parametric approach and the anaphoric variable approach have been advanced to explain how the binding principles can be adhered to. In this paper, I have proposed a functional-predicational approach as a new (and hopefully better) approach to understanding issues of binding in Zhuang and related languages. I have reinterpreted binding principles in terms as presented in Bresnan (2001), illustrated in (29) and repeated as (59).

(59) Binding Principles in LFG (Bresnan 2001)
- b. Principle A:
  A nuclear (reflexive) pronoun must be bound in the minimal nucleus that contains it and a subject outranking it.
- b. Principle B:
  A nonnuclear pronoun must be free in the minimal nucleus that contains it.
- c. Principle C:
  (Other) nominals must be free.

Based on this reinterpretation of binding in functional-predicational terms, where emphasis is placed on the argument functions in the event structure, several aspects of nominal and pronominal distribution in Zhuang can be explained in relation to the binding theory.

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AN OPTIMAL APPROACH TO PARTIAL AGREEMENT IN KAQCHIKEL

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Abstract: Kaqchikel is a Mayan language spoken in Guatemala, with both full and partial agreement for core grammatical functions. The word order of Kaqchikel is very free, and the possibilities for partial agreement differ according to whether the source is adjacent to the target or not. We argue for an OT-LFG approach in which constraints on agreement are sensitive to both c-structural and f-structural information

1 Introduction

Within LFG, agreement is normally handled within f-structure, but languages which have partial agreement in coordinate structures show us that c-structure may also play a role in such agreement systems. Solutions to this problem vary, but include special annotations on PS-rules (Sadler 1996, 2003) and direct or indirect reference to f-precedence (Sadler 1999, Falk 2006, Kuhn and Sadler 2007, Dalrymple and Hristov 2010). Kaqchikel, a Mayan language of Guatemala, shows both full and partial agreement with conjoined subjects. Full agreement is largely unproblematic, and operates via an INDEX feature that is resolved in familiar ways (Dalrymple and Kaplan 2000). Partial agreement, however shows surprising complexity, which we argue shows a sensitivity to c-structure that goes beyond f-precedence to include *adjacency* of target and controller.

2 Background on Kaqchikel[1]

2.1 Word order

Kaqchikel is a Mayan language spoken in highland Guatemala. As shown in Broadwell (2000), most Kaqchikel sentences show the possibility of two word orders; one in which the subject is initial, and another in which the verb is initial:[2]

1)	X-u-b'a	**ri tz'i'**	ri me's.
	com-3sErg-bite	the dog	the cat

'The dog bit the cat.'

[1] The paper largely uses the conventions of the standardized national orthography for Kaqchikel, in which <x> = a voiceless alveopalatal sibilant (English *sh)*, <tz> = a voiceless dental affricate , <ä> = schwa, <q> is a uvular stop and apostrophe = glottal stop (following a vowel) or glottalization (following a consonant). Kaqchikel dialects differ in the number of phonemic vowels. Although the national orthography represents ten distinct vowels, the dialects represented here have six (*a, ä, e, i, o, u*) and we write only those vowels here.

Glosses use the following abbreviations: abs = absolutive, cl = personal classifier (markers of the age and sex of human referents), com = completive aspect, dir = directional, erg = ergative, inc = incompletive aspect, p = plural, s = singular.

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[2] In the following examples, we will bold-face the noun phrase with which the verb agrees.

2) **Ri tz'i'** x-u-b'a ri me's.
the dog com-3sErg-bite the cat

'The dog bit the cat.'

2.2 V-initial and SVO orders

The unmarked order for a Kaqchikel sentence is verb-initial, but the ordering principles for the noun phrases that follow are somewhat surprising. If a transitive verb is followed by two NPs with equal degrees of definiteness, then either order is grammatical and the sentence is ambiguous.

3) X-r-oqotaj ri tz'i' ri me's.
com-3sErg-chase the dog the cat

'The dog chased the cat.'
'The cat chased the dog.'

4) X-r-oqotaj ri me's ri tz'i'.
com-3sErg-chase the cat the dog

'The dog chased the cat.'
'The cat chased the dog.'

There is no special discourse function associated with either of the postverbal NP positions, so far as we can tell. There are several preverbal positions for topical, contrastive, and interrogative elements, but we do not believe that the two postverbal positions show any difference in c-structure realization, or in the grammatical or discourse functions assigned to these positions.

If one of the NPs is definite and the other is indefinite, then a.) the definite NP must follow the indefinite (a strong preference) and b.) the definite is interpreted as the subject (an inviolable rule).

5) X-r-oqotaj jun me's **ri tz'i'.**
com-3sErg-chase a cat the dog

'The dog chased a cat.'
* 'A cat chased the dog.'

6) ?*X-r-oqotaj ri tz'i' jun me's.
com-3sErg-chase the dog a cat

?*'The dog chased a cat.'
* 'A cat chased the dog.'

There is also a clear but violable preference for proper nouns to follow common nouns, even if the nouns are definite:

7) X-u-loq' ri wä'y **ri xta Maria.**
com-3sErg-buy the tortilla the cl Maria

'Maria bought the tortillas.'

? X-u-loq' **ri xta Maria** ri wä'y.
com-3sErg-buy the cl Maria the tortilla

If two proper nouns follow the verb, the sentence is ambiguous:

8) X-r-oqotaj ri xta Maria ri a Juan
com-3sErg-chase the cl Maria the cl Juan

'Maria chased Juan.'
'Juan chased Maria.'

SVO is freely available as an alternative order. As Broadwell (2000) shows, SVO is obligatory for indefinite transitive subjects.

2.3 S and IP in Kaqchikel

Broadwell (2000) argues that the verb-initial and SVO orders in Kaqchikel correspond to syntactic structures like the ones shown in figures (1) and (2). (1) shows a flat, non-endocentric S, while (2) shows a phrase headed by Infl.

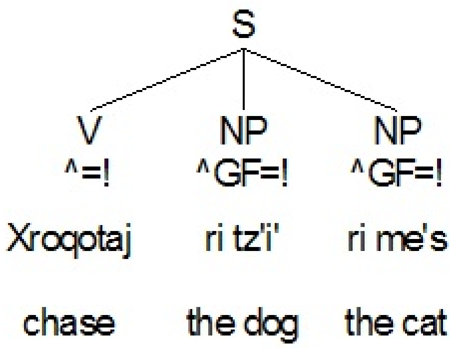

Figure 1 Non-endocentric structure

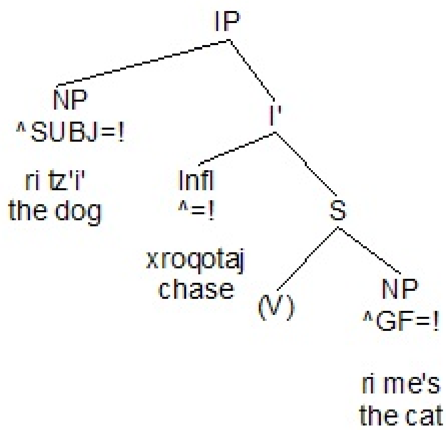

Figure 2 Endocentric structure

The difference between these two structures is supported by data from adverb placement.

For the verb-initial structure, a temporal adverb like *iwir* 'yesterday' may appear at the beginning or end of the S, but not in other places:[3]

9)	Iwir	x-r-oqotaj	ri tz'i'	ri me's.	✓Adv V S O
	yesterday	com-3sErg-chase	the dog	the cat	

'Yesterday the dog chased the cat/Yesterday the cat chased the dog.'[4]

*X-r-oqotaj iwir ri tz'i' ri me's.	*V Adv S O
*X-r-oqotaj ri tz'i' iwir ri me's.	*V S Adv O
?X-r-oqotaj ri tz'i' ri me's iwir	?V S O Adv

However, possibilities for adverb placement are notably different in the SVO order:

[3] Alberto Esquit-Choy finds final adverbs to be somewhat odd, but possibly acceptable in some contexts.

[4] The same adverb placement facts obtain, regardless of the interpretation.

10) Iwir ri tz'i' x-r-oqotaj ri me's. ✓Adv S V O
yesterday the dog com-3sErg-chase the cat

✓Ri tz'i' iwir x-r-oqotaj ri me's. ✓S Adv V O
✓Ri tz'i' x-r-oqotaj iwir ri me's. ✓S V Adv O
? Ri tz'i' x-r-oqotaj ri me's iwir. ? S V O Adv

We can account for the distribution of temporal adverbs with the following statement:

11) Temporal adverbs are (left-)adjoined to S or an extended projection of S.

Thus Kaqchikel has two options for the syntactic structure of a clause: it may project a minimal, non-endocentric S or a more elaborated, endocentric IP.

3 Agreement in Kaqchikel

Agreement in Kaqchikel works on an ergative-absolutive basis. Various Kaqchikel dialects have slightly divergent paradigms, but the following are the most common:

	Ergative		**Absolutive**
	Preconsonantal	Prevocalic	
1 sg	nu- ~ in-	w-	in-
2 sg	a-	aw-	at-
3 sg	r(u)- ~ Ø	r-	Ø
1 pl	qa-	q-	oj-
2 pl	i-	iw-	ix-
3 pl	ki-	k-	e- ~ Ø

The following examples illustrate the agreement system in simple examples.

12) X-in-ki-k'utuj.
com-1sAbs-3pErg-ask
'They asked me.'

13) X-e-wär.
com-3pArg-sleep
'They slept.'

14) Y-e-ru-näq kan ri alab'om.
inc-3pAbs-3sErg-bother dir the children
'She was bothering the children.'

The general pattern for a Kaqchikel verb is (Aspect Marker)-(Absolutive Agreement)-(Ergative Agreement)-Verb Root. The two aspects that show up in this paper are /x-/ 'completive aspect' and /y- ~ n-/ 'incompletive aspect'. The allomorphy of the incomplete is conditioned by the following agreement marker; it is /y-/ before an overt absolutive prefix or the 1sgErg /-in-/ and /n-/ elsewhere.

4 First conjunct subject agreement

4.1 V[SS]O Word Order

V[SS]O is the unmarked word order in Kaqchikel. In this format, the preferable verbal agreement pattern with the conjunct subjects is partial agreement with the first conjunct (FC).

15) N-ki-tz'ibaj **riye'** i riyin jun wuj $V_{3p}[S_{3p}S_{1s}]O$

inc-3pErg-write they and I a letter

They and I write a letter.

16) Y-in-tz'ibaj **riyin** i riye' ri wuj $V_{1s}S_{1s}S_{3p}O$

inc-1sgErg-write I and they the letter

I and they write the letter.

Full agreement with the index (semantic) values of the conjunct set of subjects is also possible, but this pattern was infrequently volunteered by our consultant, and it seems less common than partial agreement with the FC.

17) N-i-taj **riyet i riya**' wäy $V_{2p}[S_{2S}S_{3s}]O$
Inc-2pErg-eat you(sg) and he tortilla

*He and you eat tortilla*s

18) N-qa-tz'ibaj **riyin i rix** jun wuj $V_{1p}S_{1[SS]2p}O$
inc-1pErg-write I and you(pl) a letter

You all and I write a letter.

The set (x+y) of the index values of the conjunct subjects follows the familiar pattern below:

(x+y) Values		
x	y	(x+y)
1	1;2;3	1p
2	2;3	2p
3	3	3p

4.2 The order of the conjuncts

We also found that the order of the conjuncts matters. Conjunct order in VSO preferentially shows the highest-ranking conjunct first, where local persons outrank non-local persons and plurals outrank singulars. Agreement must be with the adjacent, higher-ranking conjunct.

19) *? N-tz'ibaj **riya'** i riyin ri wuj — $*?V_{3s}S_{3s}S_{1s}O$

inc-write s/he and I def letter

S/he and I write the letter.

20) Y-in-tz'ibaj **riyin** i riya' ri wuj — $V_{1s}S_{1s}S_{3s}O$

inc-1sgErg-write I and s/he def letter

I and s/he write the letter.

4.2.1 SSVO Word Order

The SVO word order in Kaqchikel emphasizes the subject of the phrase and is therefore marked in comparison to the VSO word order. In the SSVO word order, only full agreement with the index values of the conjunct set of subjects is grammatical.

21) **Riyin i riya'** n-qa-tz'ibaj jun wuj — $S_{1s}S_{3s}V_{1p}O$

I and he inc-1pErg-write a letter

He and I write a letter.

22) **Rix i riyin** x-qa-taj — $[S_{2p}S_{1s}]V_{1p}$

you(pl) and I com-1pErg-com-ate

You all and I ate it.

It is interesting to note that partial agreement with the FC subject is ungrammatical.

23) *Riyin i **riyet** n-a-tz'ibaj jun wuj — $*S_{1s}S_{2s}V_{2s}O$

I and you(sg) inc-2sErg-write a letter

I and you write a letter.

24) ***Riyin** i riyet n-i-tz'ibaj jun wuj — $*S_{1s}S_{2s}V_{2s}O$

I and you(sg) inc-1sErg-write a letter

I and you write a letter.

4.2.2 VOSS Word Order

In VOSS word order, full agreement on the verb with the index values of the conjunct set of subjects is grammatical and preferred.

25) N-qa-tz'ät ri achi'a **riyin** **i** **riyet** $V_{1p}OS_{1s}S_{2s}$

inc-1pErg-see the boys I and you(sg)

You and I see the boys.

Partial verbal agreement is also possible. But surprisingly, the partial agreement is not with the closest subject, but for local persons (1^{st} and 2^{nd} person), whether these are the closest or not.

26) Y-in-tz'ät ri achi'a **riyin** i riya' $V_{1s}OS_{1s}S_{3s}$

inc-1sErg-see the boys I and he

He and I see the boys.

27) Y-in-tz'ät ri achi'a riya' i **riyin** $V_{1s}OS_{3s}S_{1s}$

inc-1sErg-see the boys he and I

He and I see the boys.

Summary of patterns with subject agreement

	closest conjunct	full agreement	highest-ranking conjunct
VSSO	yes, preferred; higher ranked first	yes, possible	no
SSVO	no	yes	no
VOSS	no	yes, preferred	yes, possible

5 Conjunct Object Agreement in Verbs

5.1 SVOO Word Order

In SVOO word order, verbal absolutive agreement with the first conjunct is grammatical and preferred.

28) Ri achi'a y-in-ki-tz'ät **riyin** i rix $SV_{1s}O_{1s}O_{2p}$

the boys inc-1sAbs-2pErg$_{2p}$-see I and you(pl)

The boys see me and you.

29) Ri achi'a y-at-ki-tz'ät **riyet** i riya' $SV_{2s}O_{2s}O_{3s}$

the boys inc-2sAbs-3pErg-see you(sg) and he

The boys see you and him.

Full agreement is also grammatical in SVOO word order. Our native speaker said that full agreement is a "quicker" or more "informal" way of saying the phrase, while partial agreement is the "more correct" way.

30) Ri achi'a y-oj-ki-tz'ät **riyin i riye'** $SV_{1p}O_{1s}O_{3p}$

the boys inc-1pAbs-3pErg-see I and they

The boys see me and them.

31) Ri achi'a y-ix-ki-tz'ät **riye' i riyet** $SV_{2p}O_{3p}O_{2s}$

the boys inc-2pAbs-3pErg-see they and you(sg)

The boys see you all and them.

5.2 VSOO Word Order

Full agreement is grammatical and preferred in VSOO word order:

32) Y-oj-ki-tz'ät ri achi'a **riyin i riyet** $V_{1p}SO_{1s}O_{3s}$

inc-1pAbs-3pErg-see the boys I and you(sg)

The boys see you and me.

33) Y-ix-ki -tz'ät ri achi'a **riya' i rix** $V_{2p}SO_{3s}O_{2p}$

inc-2pAbs-3pErg-see the boys he and you all

The boys see you all and him.

As was the case for the subjects in VOSS word order, the objects in VSOO are not adjacent to the verb. Partial agreement is possible, but agreement is with the higher ranking conjunct, not the closest conjunct.

34) Y-ät-ki-tz'ät ri achi'a **riyet** i riya' $V_{2s}SO_{2s}O_{3s}$

inc-2sAbs-2pErg-see the boys you(sg) and he

The boys see him and you.

35) Y-in-ki-tz'ät ri achi'a riya' i **riyin** $V_{1s}SO_{3s}O_{1s}$

inc-1sAbs-3pErg-see$_{1s}$ the boys he and I

The boys see me and him.

36) *Y-Ø-ki-tz'ät ri achi'a riya' i **riyin** $V_{1s}SO_{3s}O_{1s}$

inc-3sAbs-3pErg-see$_{1s}$ the boys he and I

The boys see me and him.

5.3 VOOS Word Order

Full agreement is grammatical in the VOOS word order:

37) Y-ix-ki-tz'ät **riyet i riya'** ri achi'a $V_{2p}O_{2s}O_{3s}S$

inc-2pAbs-3pErg-see you(sg) and he the boys

The boys see you and him.

Although sentences like this are accepted, our speaker tends to prefer and volunteer the partial agreement instead

The partial agreement pattern in VOOS phrases is similar to other word orders in which conjunct object or subject is adjacent to the inflected verb: partial agreement with the FC is grammatical in most situations.

38) Y-in-ki-tz'ät **riyin** i riya' ri achi'a $V_{1s}O_{1s}O_{2p}S$

inc-1sAbs-3pErg- see I and he the boys

The boys see me and him.

As with partial agreement with the subject, our speaker strongly prefers to order the higher ranking conjunct so that it is adjacent to the verb:

39) Y-at-ki-tz'ät **riyet** i riya' ri achi'a $V_{2s}O_{2s}O_{3s}S$
inc-2sAbs-3pErg-see you(sg) and he the boys
The boys see you and him.

40) *?N-ki-tz'ät **riya'** i riyet ri achi'a $V_{3s}O_{3s}O_{2s}S$
inc-3pErg-see he and you the boys
The boys see him and you.

Summary of patterns with object agreement

	closest conjunct	**full agreement**	**highest-ranking conjunct**
VOOS	yes, preferred; higher ranked first	yes, possible	no
SVOO	yes, preferred; higher ranked first	yes, possible	no
VSOO	no	yes, preferred	yes, possible

Notice that the VOOS and SVOO patterns are the same; the important thing for the agreement is the adjacency or non-adjacency of target and source.

6 Comparing the subject and object agreement properties

Summary of patterns with subject agreement

	closest conjunct	**full agreement**	**highest-ranking conjunct**
VSSO	yes, preferred; higher ranked first	yes, possible	no
SSVO	no	yes	no
VOSS	no	yes, preferred	yes, possible

Summary of patterns with object agreement

	closest conjunct	**full agreement**	**highest-ranking conjunct**
VOOS or SVOO	yes, preferred; higher ranked first	yes, possible	no
VSOO	no	yes, preferred	yes, possible

Comparing these, we see that SSVO is really the special case; it has obligatory full agreement and neither of the partial agreement patterns. There is not a directly comparable OOVS, since OVS order is marginal in Kaqchikel.

If we focus on agreement with post-verbal arguments, however, we arrive at the following combined table:

	closest conjunct	full agreement	highest-ranking conjunct
V and NP adjacent	yes, preferred; higher ranked first	yes, possible	no
V and NP not adjacent	no	yes, preferred	yes, possible

7 Problems and desiderata

There are several aspects of this pattern that are difficult for current LFG approaches.
a.) An approach in terms of f-precedence fails to capture the importance of adjacency. Consider subject agreement. In the VSSO and VOSS patterns, the precedence relations between between the verb and the subject are the same.
b.) The pattern of agreement with the highest conjunct is novel. Person/number hierarchies have been observed in other aspects of morphology, but I am not aware of other examples where it interacts in this way with coordination.
c.) We do not think that LFG has a good solution to the problem of preferred conjunct order at c-structure.
Note that there may be a preference like this for agreement with the postverbal NP in the English *there* sentences. Our own intuitions, and those of the speakers we consulted, are approximately as follows:

41) ??There is a man and two women at the door.
* There is two women and a man at the door.
*? There are a man and two women at the door.
There are two women and a man at the door.

Thus it seems to us that other languages also have preferences for certain orders of conjuncts at c-structure, where the order preference is tied to an agreement preference.

8 Toward a solution

8.1 A first attempt

We propose an Optimality Theoretic solution, where constraints can refer to both f-structural and c-structural conditions.

a.) a constraint which penalizes target (here a verb) which fails to agree with a SUBJ/OBJ which has a [PER 1] feature in its set of features, *Target [PER ¬1], Source { [PER 1]}

b.) an equally ranked constraint which penalizes a target which fails to agree with a a source (here a SUBJ or OBJ) which has a [NUM PL] feature in its set of features, *Target [NUM SG], Source { [NUM PL]}[5]

c.) a constraint which penalizes adjacency between a target and source if the two have different values for INDEX, *Adjacent(Target [INDEX:α], Source [INDEX:β]), where α≠β, abbreviated here as

[5] Kaqchikel only has a singular/plural contrast in its number system, but to handle languages with a more complex system, we might restate this constraint as *Target [NUM ¬ PL], Source { [NUM PL]}

*Adjacent (Tα, Sβ). The intuition here is that speakers try to avoid a perceived feature clash between adjacent elements.

Tableau 1 shows two high-ranked conjuncts. The top portion of the tableau shows VSO order; the bottom portion shows VOS.

42) Tableau 1

$\begin{bmatrix} \mathit{PRED}\ \text{'}\mathit{write} < \mathit{SUBJ}, \mathit{OBJ} > \text{'} \\ \mathit{SUBJ} \left\{ \begin{matrix} \begin{bmatrix} \mathit{PER}\ 1 \\ \mathit{NUM}\ \mathit{SG} \end{bmatrix} \\ \begin{bmatrix} \mathit{PER}\ 3 \\ \mathit{NUM}\ \mathit{PL} \end{bmatrix} \end{matrix} \right\} \\ \ldots \end{bmatrix}$	*Adjacent (Tα, Sβ)	*Target [PER ¬1], Source { [PER 1]}	*Target [NUM SG], Source { [NUM PL]}
V_{1sg} [they and I]…	*!		*
☞ V_{1sg} [I and they] …			*
☞ V_{3pl} [they and I]…		*	
V_{3pl} [I and they] …	*!	*	
☞ V_{1sg} ... [they and I]			*
☞ V_{1sg} ... [I and they]			*
☞ V_{3pl} ... [they and I]		*	
☞ V_{3pl} ... [I and they]		*	

In a case like this, the verb can either show plurality or 1st person, both of which are favored by the constraints. The *Adjacent (Tα, Sβ) penalizes candidates where the verb has an agreement feature which is different from its adjacent target.

Tableau 2 shows the various options when there is one high-ranked conjunct and one low-ranked conjunct. The top portion of the tableau shows VSO order and the bottom portion shows VOS order.

43) Tableau 2

$\left[\begin{array}{ll} PRED & \text{'write} < SUBJ, OBJ > \text{'} \\ SUBJ & \left\{ \begin{array}{l} \left[\begin{array}{l} PER\ 1 \\ NUM\ SG \end{array}\right] \\ \left[\begin{array}{l} PER\ 3 \\ NUMSG \end{array}\right] \end{array} \right\} \\ & \ldots \end{array}\right]$	*Adjacent (Tα, Sβ)	*Target [PER ¬1], Source { [PER 1]}	*Target [NUM SG], Source { [NUM PL]}
V_{1sg} [s/he and I] …	*!		
☞ V_{1sg} [I and s/he] …			
V_{3sg} [s/he and I] …		*!	
V_{3sg} [I and s/he] …	*!	*	
☞V_{1sg} … [s/he and I]			
☞ V_{1sg} … [I and s/he]			
V_{3sg} … [s/he and I]		*!	
V_{3sg} …[I and s/he]		*!	

This analysis is subject to some provisos and cautions:

– The tableaux so far do not include whatever factors of definiteness/giveness determine the VSO/VOS alternation, so all are presented in the same candidate set. However, since both VSO and VOS are possible, we think that they must involve somewhat different inputs, possibly with additional features not shown in this input.

– We propose that the SVO structure involves a covert pronoun in its f-structure representation, and that the INDEX value of the pronoun is equal to the INDEX value of the entire coordinate structure.

– The constraint *Target [PER ¬1], Source { [PER 1]} only handles failure to agree with a first person source; we would also need a constraint *Target [PER ¬2], Source { [PER 2]} . It might seem possible to formulate a constraint *Target [PER ¬1|2], Source { [PER 1|2]} , but this would fail to make the right prediction in a tableau like the following where one candidate has a verb which is 2nd person plural:

44) Tableau 3

$\begin{bmatrix} PRED\ 'write < SUBJ,OBJ > ' \\ SUBJ \left\{ \begin{matrix} \begin{bmatrix} PER\ 1 \\ NUM\ SG \end{bmatrix} \\ \begin{bmatrix} PER\ 3 \\ NUM\ PL \end{bmatrix} \end{matrix} \right\} \\ \dots \end{bmatrix}$	*Adjacent (Tα, Sβ)	*Target [PER ¬1|2], Source { [PER 1|2]}	*Target [NUM SG], Source { [NUM PL]}
V_{1sg} [they and I]…	*!		*
V_{1sg} [I and they] …			*
V_{3pl} [they and I]…		*	
V_{3pl} [I and they] …	*!	*	
V_{1sg} ... [they and I]			*
V_{1sg} ... [I and they]			*
V_{3pl} ... [they and I]		*	
V_{3pl} ... [I and they]		*	
☹ V_{2pl} ... [I and they]			

8.2 Some corrections and elaborations

The constraints and tableaxu given so far only deal with partial agreement with post-verbal arguments. Recall, however, that full agreement is also possible. To handle this possibility, we need to add another constraint along the lines of our *Adjacent (Tα, Sβ) constraint. In the previous tableau we assumed that the first conjunct is adjacent to the target, but there is also adjacency between the target and the entire conjoined structure. We hypothesize that languages may also try to avoid feature clash between the verb and this larger structure. We can use the abbreviation $Source^{MAX}$ for the coordinate structure and $Source^{MIN}$ for the individual conjuncts, we can posit the following constraints:

*Adjacent(Target [INDEX:α], $Source^{MAX}$ [INDEX:β]) – Penalize a candidate if an agreement target bears an INDEX feature α and the maximal constituent of the agreement source bears an INDEX feature β.

*Adjacent(Target [INDEX:α], Source^{MIN} [INDEX:β]) – Penalize a candidate an agreement target bears an INDEX feature α and a conjunct of the agreement source bears an INDEX feature β.

In Kaqchikel, these two constraints must be equally ranked, since both full and partial agreement are possible. Using these assumptions, the following tableau shows the outcome when candidates with full agreement are added.

45) Tableau 4

$\begin{bmatrix} PRED\ 'write < SUBJ,OBJ > ' \\ SUBJ \left\{ \begin{bmatrix} PER\ 1 \\ NUM\ SG \end{bmatrix} \begin{bmatrix} PER\ 3 \\ NUMSG \end{bmatrix} \right\} \\ \ldots \end{bmatrix}$	*Adjacent (Tα, S^{MIN} β)	*Adjacent (Tα, S^{MAX} β)	*Target [PER ¬1], Source { [PER 1]}	*Target [NUM SG], Source { [NUM PL]}
V_{1sg} [s/he and I] …	*!	*		
V_{1sg} [I and s/he] …		*		
V_{3sg} [s/he and I] …		*	*!	
V_{3sg} [I and s/he] …	*!	*	*	
V_{1pl} [I and s/he] ...	*			
V_{1pl} [s/he and I] ...	*			
☞V_{1sg} … [s/he and I]				
☞ V_{1sg} … [I and s/he]				
V_{3sg} … [s/he and I]			*!	
V_{3sg} …[I and s/he]			*!	
☞V_{1pl} ... [s/he and I]				
☞V_{1pl} .... [I and s/he]				

This almost gives the correct results, but the problem is that every VSO candidate violates one of the adjacency constraints, since it is not possible to avoid a clash with the entire coordinate structure and the first conjunct at the same time unless both conjuncts are 3pl.

If we return, however, to the idea that VSO and VOS structures represent different candidate sets, then we arrive at the following two tableaux. The first is for the VSO order, and the second is for the VOS order.

46) Tableau 5

$\left[\begin{array}{l} PRED\ 'write < SUBJ, OBJ > ' \\ SUBJ \left\{ \begin{bmatrix} PER\ 1 \\ NUM\ SG \end{bmatrix} \\ \begin{bmatrix} PER\ 3 \\ NUMSG \end{bmatrix} \right\} \\ \quad \ldots \end{array}\right]$	*Adjacent (Tα, S^{MIN} β)	*Adjacent (Tα, S^{MAX} β)	*Target [PER ¬1], Source { [PER 1]}	*Target [NUM SG], Source { [NUM PL]}
V_{1sg} [s/he and I] …	*!	*		
☞V_{1sg} [I and s/he] …		*		
V_{3sg} [s/he and I] …		*	*!	
V_{3sg} [I and s/he] …	*!	*	*	
☞V_{1pl} [I and s/he] ...	*			
☞V_{1pl} [s/he and I] ...	*			

Tableau 6

$\left[\begin{array}{l} PRED\ \text{'write} < SUBJ, OBJ > \text{'} \\ SUBJ\ \left\{ \begin{array}{l} \left[\begin{array}{l} PER\ 1 \\ NUM\ SG \end{array}\right] \\ \left[\begin{array}{l} PER\ 3 \\ NUMSG \end{array}\right] \end{array} \right\} \\ \quad \ldots \end{array}\right]$	*Adjacent (Tα, S^{MIN} β)	*Adjacent (Tα, S^{MAX} β)	*Target [PER ¬1], Source { [PER 1]}	*Target [NUM SG], Source { [NUM PL]}
☞V_{1sg} … [s/he and I]				
☞ V_{1sg} … [I and s/he]				
V_{3sg} … [s/he and I]			*!	
V_{3sg} …[I and s/he]			*!	
☞V_{1pl} ... [s/he and I]				
☞$V_{1pl\ ....}$ [I and s/he]				

8.3 Extensions and speculations

We ranked *Adjacent (Tα, S^{MIN} β) and *Adjacent (Tα, S^{MAX} β) equally in Kaqchikel, because both full and partial agreement are found in this language. However, if we give the ranking *Adjacent (Tα, S^{MIN} β) ≫ *Adjacent (Tα, S^{MAX} β), then we predict a language with only partial agreement, like Welsh. If we use the ranking *Adjacent (Tα, S^{MAX} β) ≫ *Adjacent (Tα, S^{MIN} β), then we get a language with only full agreement, like Spanish.

Comparing our approach with the system of INDEX features proposed in Dalrymple and Hristov (2010), our equally ranked {*Adjacent (Tα, S^{MIN} β), *Adjacent (Tα, S^{MAX} β)} corresponds to their functional metavariable *($f_{(L)}$ INDEX)* or *($f_{(R)}$ INDEX).* This would be the parameter setting for a language with optional partial agreement. Our ranking {*Adjacent (Tα, S^{MIN} β) ≫ *Adjacent (Tα, S^{MAX} β)} corresponds to their *(f_L INDEX)* or *(f_R INDEX),* which is the parameter specification for a language with only partial agreement. Finally, our ranking {*Adjacent (Tα, S^{MAX} β) ≫ *Adjacent (Tα, S^{MIN} β)} corresponds to their *(f INDEX)*.

While both systems describe a full range of systems, we note that the Dalrymple and Hristov approach builds the notions of left and right into their functional metavariables, and that as a consequence the partial agreement must be specified in terms of direction. Since the information about the left and right order is present in the c-structure, we would prefer to minimize the amount of c-structural information referred to by f-structure metavariables. In contrast, our constraints are able to evaluate candidates based on both their c-structural and f-structural properties. Constraints are purposely designed to evaluate correspondences between different structures, and to our mind they are an optimal mechanism for the description of linguistic phenomena that involve the interaction of linear order and features.

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RESTRICTIVE RELATIVE CLAUSES IN MALTESE

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Abstract

This paper provides a descriptive overview of restrictive relative clauses (henceforth RRCs) in Maltese, a construction which has received little attention to date and which is poorly described in existing grammars. We outline an LFG approach to the facts we describe bulding on existing LFG work on relatives. Further we explore some issues raised by Maltese for approaches to resumption.

1 Maltese Restrictive Relative Clauses

Maltese is a mixed language belonging to the South Arabic branch of Central Semitic, with a Maghrebi/Siculo-Arabic stratum, a Romance (Sicilian, Italian) superstratum and an English adstratum. Our data judgements are based mainly on the Naxxari dialect, a Noth-Western dialectal variety spoken by the native speaker author: we note where different judgements would hold in formal (high register) Maltese. We can distinguish between three broad types of RRC in Maltese (i) *li* initial RRCS, (ii) wh-fronted RRCS and (iii) 'partitive' RRCS introduced by *milli* (from.COMP). The latter category raises some interesting questions of analysis, but for reasons of space we exclude them from consideration in this paper.

1.1 li Relatives

The invariant element *li* is found introducing a range of clause types (including relative clauses) and is most likely a cognate of the element *li, illi, yalli* found in the Arabic vernaculars (which has received a range of different analyses including COMP, DET and RELPRON). In Maltese this element is a COMPlementiser and may (for example) introduce an embedded complement to a verb (1), a noun complement clause (2) or a sentential subject (3).

(1) *N(a)-ħseb li n-af-u*
1SG-think that 1SG-know-3SGM.ACC
I think that I know him.

(2) *Il-fatt li wasal-na tard ma j-ħabbat-ni-x*
DEF-fact that arrived-1PL late NOT 3SGM-bother-1SG.ACC-NEG
The fact that we arrived late does not bother me.

(3) *Li l-ġimgħa d-dieħla se t-kun vaganza*
That DEF-week DEF-entering.PROG.SGF FUT.part 3SGF-be holiday
hija stqarrija sorprendenti
COP.3SGF statement surprising
That the coming week will be a holiday is a surprising statement.

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There are few restrictions on the use of *li* in RRCS: it may be used in short and long-distance relativization on many GF functions and co-ocurs with both gaps and resumptive pronouns, with both definite and indefinite antecedents. In Maltese, gap and RP are not in complementary distribution and are freely interchangeable in many positions. However it shows the familiar **Highest Subject Restriction** (Borer, 1984; McCloskey, 1990) which excludes a resumptive pronoun from this position (compare (4) and (5)), and also excludes an RP from the highest OBJ position in relatives with definite or quantified heads (compare (6) to (7)).

(4) *It-tifel li (*hu) ra-ni lbieraħ*
DEF-boy COMP (*he) saw.3SG-1SG.ACC yesterday
the boy who saw me yesterday

(5) *It-tifel li qal-u-l-i li (hu) kien*
DEF-boy COMP said-3PL-DAT-1SG COMP he was.3SGM
ra-hom
saw.3SGM.3PL.ACC
the boy who they told me that saw them

(6) *Iltqat-t mat-tifel li kellem*
met-1SG with.DEF-boy COMP spoke.3SGM
I met with the boy he spoke to.

(7) *Kull tifel li ħsib-t li kellim-t-(u) lbieraħ*
All boy COMP thought-1SG COMP spoke-1SG-(3SGM.ACC) yesterday
every boy that I thought I spoke to yesterday

(8) shows relativisation on a OBJ$_\theta$ function: since the morphology does not provide an appropriate affixal resource, a gap is obligatory. There is, however, what we might call a dative pronominal affix and goal/recipient arguments may be gaps (under certain conditions) or resumptives, as shown in (9). The possibility of a gap, and the fact that the dative marker itself does not appear to share the characteristics of a typical preposition in the language, suggest to us that the affixal elements *-li*, *-lu* etc. corresponds to a direct function, and so we suggest that they mark a particular thematically restricted object, namely OBJ$_{goal}$.[1]

(8) *Il-grammatika/somma li għid-t-l-i għallim-t-hom*
DEF-grammar/sum COMP told-1SG-DAT-2SG taught-1SG-3PL.ACC
the grammar/a sum that I told you I taught them

[1]Note that OBJ$_\theta$ is a collection of (thematically restricted) functions: Maltese is not alone in providing a morphological means of expression for just the OBJ$_{goal}$ among these functions. In what follows we sometimes mention OBJ$_{goal}$ explicitly (and redundantly) alongside OBJ$_\theta$ for clarity.

(9) *Ir-raġel li bgħatt-(lu) l-ittra weġibni*
DEF-man COMP sent.1SG.(-DAT.3SGM) DEF-letter responded.3SGM.1SG
The man that I sent (him) the letter responded.

A gap is not licensed as OBL OBJ or as POSS.

(10) *Il-forn, li ħmej-na l-ħobż fi-*(h)*
DEF-oven COMP baked-1PL DEF-bread in-3SGM.ACC
the oven in which we baked the bread

(11) *It-tarbija li n-af 'l omm-*(ha)*
DEF-baby COMP 1SG-know ACC.mother-3SGF.ACC
the baby whose mother I know

The following summarises the distribution pattern for *li* RRCs in both immediate (IDD) and long-distance (LDD) dependencies, a distribution which raises some interesting questions for further work. We suggest that the underlying pattern is that resumptives and gaps are in free distribution, subject to some additional restrictions.

(12) Summary for Li Relatives

GF	IDD	LDD	
SUBJ	Gap	Gap/RP	Highest Subject Restriction
OBJ	Gap/RP	Gap/RP	Indefinite RCs
OBJ	Gap	Gap/RP	Definite/Quantified RCs
OBJ_{θ}	Gap	Gap	
OBJ_{goal}	Gap/RP	RP	
OBL OBJ	RP	RP	
POSS	RP	RP	

1.2 wh Relatives

Maltese also has wh-relatives, introduced by a range of *wh-* pronouns including: *min* 'who' (SUBJ), *'l min* 'whom' (OBJ, OBJ_{goal}), *fejn* 'where' (locative ADJ, OBL), and *xiex* 'which' (OBL OBJ).[2] The inanimate pronoun *xiex* occurs only as the complement of a preposition: its counterpart in direct function positions is *x'* and this element is grammatical in wh-questions but not in RRCs. The result of this is that relativisation with the wh-strategy on direct (nominal) grammatical functions is only possible for animate elements. With direct functions the antecedent must also be definite. Finally, wh-relatives always involve a gap rather than a RP.[3] Examples (13) to (15) illustrate relativisation on direct functions (with definite antecedents).

[2]A further wh-pronoun, *ma*, 'what' exists in the dialect but is rather archaic and used only in very restricted and highly conventionalised contexts. We do not take it to be productive.

[3]But see Section 4 on relativization in islands.

(13) *Ir-raġel min għid-t-l-ek fetaħ-l-i il-bieb*
DEF-man who told-1SG-DAT-2SG opened.3SGM-DAT-1SG DEF-door
the man who I told you opened the door for me SUBJ

(14) *It-tifel 'l min n(a)-ħseb j-għallem-*u*
DEF-boy ACC.who 1SG-think 3-teaches.3SGM-3SG.ACC
the boy who I think he teaches OBJ

(15) *It-tifel 'l min għadni kemm xejjir-t-*l-u*
DEF-boy ACC.who yet.1SG just waved-1SG-DAT-3SGM
the boy who I just waved to OBJ$_{goal}$

(16) to (18) involve relativisation on non-term functions (OBL and ADJ) and permit indefinite antecedents.[4]

(16) *(Ir)-raġel ma'/fejn/għand min ħsib-t li raj-t-ek*
(DEF)-man with/near/at who thought-1SG COMP saw.1SG-2SG.ACC
the/a man with/near/next to whom I thought I saw you OBL

(17) *(Il-)barmil b'xiex soltu n-tella l-ilma mill-bir*
(DEF)-bucket with.what usually 1SG-get.up DEF-water from.DEF-well
the/a bucket which I usually get the water from the well with

(18) *(It-)triq minn fejn (mnejn) n-għaddi*
(DEF-)street from where (from.where) 1SG-pass
the/a street from where I pass ADJ

(19) summarises for RRCs introduced by a wh-relative pronoun.

(19) Summary for Wh Relatives

ANT	GF			
DEF	SUBJ	Gap	*min*: Human	dialect only
DEF	OBJ	Gap	*'l min*: Human	dialect only
DEF	OBJ$_\theta$	Gap	*'l min*: Human	dialect only
DEF	DAT$_{goal}$	Gap	*'l min*: Human	dialect only
	OBL	Gap		dialect + standard
	ADJ	Gap		dialect + standard

In summary, we find gaps and RP in overlapping distribution in *li* RRCs: we assume that RP is available everywhere subject to specific constraints (e.g. HSR). Wh-relatives involve gaps. The antecedent of a wh-RRC on direct (term) functions is required to be both definite and human. In the following section, we outline an analysis of this data building directly on existing analyses of RRCs in LFG.

[4] Relativisation on POSS is not possible with the wh-strategy:

(i) **It-tifel 'l min n-af lil omm-u*
DEF-boy ACC.who 1SG-know ACC mother-3SGM.ACC
The boy whom I know his mother

2 Basic Analysis

We start with an account of gapped RRCs, drawing on the analysis of English RRCs in Dalrymple (2001). The facts outlined above concerning the distribution of the (invariant) element *li* suggest that it is a complementiser. A RRC introduced by *li* has a null (ϵ) TOPIC: we assume the rule in (20) for such relative clauses.[5] The annotation (ADJ $\in \uparrow$) places an existential constraint ensuring that the null TOPIC occurs only when the CP is a relative clause. Subject to general syntactic constraints, a gap may correspond to any direct (that is, non-prepositional) GF of a clause. The path DIRGF is defined in (24). The TOPIC is identified with some within-clause function defined by means of the path RGAPPATH, defined in (21). [6]

(20) CP $\longrightarrow$ ϵ C′
($\uparrow$ TOPIC PRED) = 'PRO' $\uparrow = \downarrow$
(ADJ $\in \uparrow$)
($\uparrow$ COMPFORM) $=_c$ LI
($\uparrow$ TOPIC) = ($\uparrow$ RGAPPATH)

(21) RGAPPATH $\equiv$ { COMP } * DIRGF
Constraints

Turning now to wh-relatives, in these structures a *wh*-phrases (NP or PP) appears in the specifier of CP position. If the relative dependency ends in a direct (NP) function, that is SUBJ, OBJ, OBJ$goal$ or OBJ$_\theta$, then the antecedent is subject to the constraint that it must be [+Human] and [+Def]. The TOPIC is identified with some within-clause function defined by means of the pathname RWHGAPPATH, defined in (23). Finally, in the case of wh-relatives, the RELPRO may correspond to either the TOPIC or an OBJ function embedded within the TOPIC - the latter in the case of pied-piping in examples such as (16) and (17).

(22) CP $\longrightarrow$ XP C′
($\uparrow$ TOPIC) = $\downarrow$ $\uparrow = \downarrow$
($\uparrow$ TOPIC) = ($\uparrow$ RWHGAPPATH)
($\uparrow$ RELPRO) = ($\uparrow$ TOPIC (OBL* OBJ))

(23) RWHGAPPATH $\equiv$ { COMP } * DIRGF | INDIRGF
Constraints @DEFHUM

(24) DIRGF $\equiv$ SUBJ|OBJ|OBJ$_{goal}$|OBJ$_\theta$

(25) INDIRGF $\equiv$ OBL|ADJ $\in$

(26) DEFHUM $\equiv$ ((ADJ $\in$ COMP* $\uparrow$) DEF) = +
((ADJ $\in$ COMP* $\uparrow$) ANIM) = HUM

[5] The element *li* is obligatory in null TOPIC relatives but obligatorily absent in wh-relatives.
[6] We assume for the moment that all Maltese verbal complements are COMPs.

An f-structure along the lines of (28) will result for *li* or *wh* relatives like (27) (we omit some minor morphosyntactic features here).

(27) *Rajt* *lit-tifel* *li* */’l min j-af* *Pawlu*
Saw.1SG ACC.DEF-boy COMP /who 3SGM-know Paul
I saw the boy that Paul knows.

(28)
$$\left[\begin{array}{ll}
\text{PRED} & \text{‘BOY’} \\
\text{DEF} & + \\
\text{ADJ} & \left\{ \left[\begin{array}{ll}
\text{PRED} & \text{‘KNOW<(SUBJ) (OBJ)>’} \\
\text{COMPFORM} & \text{DECL} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{‘PAUL’} \\ \text{PERS} & 3 \\ \text{GEND} & \text{MASC} \\ \text{NUM} & \text{SG} \end{array}\right] \\
\text{TOPIC} & \left[\begin{array}{ll} \text{PRED} & \text{‘PRO/WHO’} \end{array}\right] \\
\text{OBJ} &
\end{array}\right] \right\}
\end{array}\right]$$

With this in place, we now turn to the analysis of the nature, occurrence and distribution of the resumptive pronoun in RRCs, and in particular to the questions (i) what is the correct analysis of the resumptive strategy and (ii) how is the above supplemented to account for RPs? We begin with a brief overview of key work in LFG on resumption.

3 Resumption in LFG

A key distinction is that made between true resumptives, which are grammatically licensed bound pronouns, and false resumptives, or intrusive pronouns, which are not grammatically licensed (but might arise in performance, sometimes due to processing constraints). A number of properties distinguish true resumptives from intrusive pronouns. Asudeh (2004) lists the following (drawing notably on Chao and Sells (1983) and using English for illustrative purposes although English in fact shows intrusive rather than resumptive behaviour): (i) true resumptives, but not intrusive pronouns, permit binding by a quantifier resisting an e-type interpretation (*every, each, no - I’d like to review every book that Mary couldn’t remember if she’d read RP/*IP before*); (ii) true resumptives, but not intrusives, support a list answer (*Which of the linguists do you think if Mary hires RP/*IP everyone will be happy? —- Chris, Daniel or Bill*); (iii) true resumptives, but not intrusives, support functional answers to questions.

As pronouns, RPs are subject to some interpretive restrictions. As noted by Doron (1982) they do not permit *de dicto* or non-specific readings, so that in *Dani* *will find the woman that he is looking for (RP)*, the RP would receive a *de dicto* reading; and they do not permit pair-list answers to wh-questions such as *Which woman did every man invite (RP)?* (Engdahl, 1980; Sharvit, 1999)

Asudeh (2004) develops an approach to true resumptives in LFG building on the twin insights that (i) they are syntactically pronouns and (ii) they are surplus resources which are ultimately removed from semantic composition. As syntactic pronouns, RPs are anaphorically bound elements. In his treatment of Irish, the complementisers themselves introduce the equations identifying the discourse functions involved in long distance dependencies: (29a) is the gap-binding complementiser *a* (which causes lenition of the following element) and (29b) is the (nasal mutating) *a* found in RP marked dependencies. (30) shows the manager resource which consumes a pronominal meaning and outputs an identity function on the antecedent.

(29) a. *aL*: $(\uparrow \text{UDF}) = (\uparrow \text{COMP UDF}) \mid (\uparrow \text{UDF} = (\uparrow \text{GF})$ (Irish)

b. *aN*: $(\uparrow \text{UDF})_\sigma = (\uparrow \text{GF}_\sigma\ \text{ANT})$ (Irish)

(30) $\lambda P \lambda y.y$: $[(\uparrow \text{UDF}_\sigma \multimap ((\uparrow \text{UDF})_\sigma \otimes (\uparrow \text{GF}^+)_\sigma)\ ] \multimap ((\uparrow \text{UDF})_\sigma \multimap (\uparrow \text{UDF})_\sigma)$

While Asudeh (2004) argues that (true) RPs are simply pronouns at f-structure, subject to anaphoric binding, an alternative view is taken in Falk (2002), namely that pronouns may lack a PRED value just in case they are functionally identified with a discourse function: functional identification is introduced lexically (by the pronoun itself) and mediated by reference to a ρ projection containing the referential elements in the discourse as shown in (31).

(31) $f \in \rho^1(\uparrow_\rho) \wedge (\text{DF}\ f) \Rightarrow \uparrow = f$

In subsequent work, and building on an insight of McCloskey (2006), Asudeh (2011, to appear) distinguishes two types of true resumptives, which he refers to as *syntactically active resumptives* (SARs) and *syntactically inactive resumptive* (SIRs). Both types of resumptive receive the same treatment in the syntax-semantics interface, that is, they are removed by a manager resource. SARs do not display gap-like properties in the syntax and are anaphorically bound pronouns in the syntax: the RPs of Hebrew and Irish are of this type. On the other hand, (SIRs) are syntactically gap-like (i.e. they are functionally controlled): the RP is treated as the bottom of a filler-gap dependency by restricting out the pronominal PRED value, as shown in footnote 7. Effectively, these RPs are aubible gaps. Asudeh (2011, to appear) takes the RPs of Swedish and Vata to be of this type.[7]

[7]The functional uncertainty statement for Swedish (with RPs only in SUBJ function), is as in (ii).

(ii) $(\uparrow \text{UDF}) \backslash \text{PRED} =$

$(\uparrow \text{CF}^*$	$\{$	$[\text{GF-SUBJ}]$	$\mid$	$\text{SUBJ} \backslash \text{PRED}$ $\})$
constraints		$(\rightarrow \text{PRED}) = (\uparrow \text{UDF PRED})$		$(\uparrow \text{UDF})_\sigma = (\rightarrow_\sigma\ \text{ANTEC})$

SAR and SIR pronouns are distinguished by their behaviour in relation to a number of syntactic diagnostics, summarised in (32). The most robust diagnostics are weak crossover (WCO) and behaviour in relation to syntactic islands; the remaining diagnostics are less robust because it is less clear that the relevant property is entirely syntactic.

(32)

	SIR	SAR
Island Sensitive	Yes	No
Subject to WCO	Yes	No
Reconstruction Licensed	Yes	No
ATB Extraction	Yes	No
Licenses PG	Yes	No

Asudeh (to appear)

4 Maltese Resumptives

In this section we consider the nature of the resumptive elements in Maltese relative clauses. We show first that these elements are indeed true resumptives and not intrusive pronouns, and then consider their status with respect to the SIR/SAR distinction. (33) shows that a resumptive may be bound by a quantifier resisting an e-type interpretation (Maltese *kull* 'every' is one such element). (34) shows that the pronoun in question supports a list answer (and so is a resumptive), and (35) demonstrates that it supports a functional answer to a wh question. Together, these examples then support the conclusion that Maltese has true resumptives rather than intrusive pronouns in these contexts.

(33) *Kull tifel li ħsib-t li kellim-t-(u) lbieraħ*
every boy COMP thought-1SG COMP spoke-1SG-(3SGM.ACC) yesterday
every boy that I thought I spoke to yesterday

(34) *Liem mil-lingwist-i t-(a)ħseb li jekk Marija*
Which from.DEF-linguist-PL 3SGF-think COMP if Mary
jirnexxie-l-ha t-ħaddm-u kulħadd i-kun kuntent?
succeed-DAT-3SGF 3SGF-employ-3SGM.ACC everyone 3-be.SGM happy
Which of the linguists do you think that if Mary succeeds in employing (him), everyone will be happy?
'l Mario, 'l John, jew 'l Salvu (= Mario, John or Salvu)

(35) *Liem hija l-mara li kull ragel j-af lil*
which COP.3SGF DEF-woman COMP every man 3-knows-SGM ACC
omm-(ha)*
mother-3SGF.ACC
Which is the woman whom every man knows her mother?
- *'l Marija* (= Marija)
- *'l martu* (= his wife)
- **Pawlu, 'l Marija u Ganni 'l Rita* (= Mario, Marija and Ganni, Rita)

Likewise, we can show that resumptives in Maltese *do* indeed show the interpretive properties typical of pronouns. The interpretation in (36) is that there is a specific woman that Daniel will find. As indicated above, (35) shows that a pronoun (unlike a gap) fails to permit a pair-list answer.

(36) *Daniel għad i-sib il-mara li Marija t-(a)ħseb*
Daniel will 3-find-SGM-find DEF-woman COMP Marija 3SGF-thinks
li il-u j-fittix-(ha)
COMP long time-3SGM 3SGM-search-3SGF.ACC

Daniel will find the woman that Maria thinks he has been looking for for a long time.

We conclude that Maltese has true resumptives in RRCs, and turn to the question of whether they are syntactically active or syntactically inactive pronouns. Recall that the most robust and clear-cut diagnostics are behaviour in relation to weak crossover, and in relation to syntactic islands. Consider (37) as a case of relativisation on the object: the dependency between the antecedent (*ir-raġel*) (or the TOPIC) and the RP 'crosses over' the possessive in *martu* ('his wife'), but the sentence is perfectly well-formed. By contrast, and although both gap and RP are generally available for relativisation on the OBJ, employing a version of (37) with a gap rather than a RP is ungrammatical. One might object that in (37) it is possible that the position relativised on is the SUBJ POSS (compare (11) for example). Note however that the POSS function is not accessible to relativisation by the wh-strategy, as shown by the example in footnote 4, and thus it is clear that (38) involves relativisation on the OBJ, and therefore constitutes a case of crossover. Crucially, (38) involves a RP and would be ungrammatical with a gap, despite the fact that, as demonstrated in section 1.2, RPs are normally excluded in wh-relatives.

(37) *Ir-raġel li n-af li ħallie-t-u mart-*(u)*
DEF-man COMP 1.SG-know COMP left-3SGF-3SGM.ACC wife-3SGM.ACC
baqa' ma hariġ-x mid-dar
left.3SGM NEG go out.3SGM-NEG from.DEF-house

The man who I know that his wife left him, has not left the house since.

(38) *Ir-raġel 'l min n-af li t-elq-it-u*
DEF-man ACC.who 1SG-know COMP left-3SGF-3SGM.ACC
l-mara/mart-(u)*
DEF-woman/woman-3SGM.ACC

the man who I know that his wife left him

The WCO data above indicate that Maltese RPs and gaps do not show the same syntactic behaviour, and support the conclusion that Maltese RPs in RRCs are SARs (and hence anaphorically bound pronouns in the syntax on the analysis proposed by Asudeh (to appear)). This conclusion is also supported by the island sensitivity diagnostic. For example, (39) illustrates the Complex Noun Phrase Constraint, with a (second) relative dependency into a CNP created by relativisation: although the relativised position is one which is normally accessible to the gap strategy, the resumptive is obligatory here as a gap would cause a syntactic constraint violation. The same occurs with other constraints such as the Adjunct Island Constraint and the Wh-Island Constraint, illustrated here with wh-relatives, which obligatorily involve RPs where a gap would violate a syntactic constraint (see (40) and (41)). These two diagnostics therefore provide strong evidence that Maltese RPs are syntactically active, that is, that they are pronouns (rather than gaps) in the syntax.

(39) *Raj-t ir-raġel li n-af mara li*
saw-1SG DEF-man COMP 1SG-know woman COMP
t-af-u u għid-t-l-u
3SGF-know-3SGM.ACC and told-1SG-DAT-3SGM
j-selli-l-i għali-ha
3SGM-send regards-DAT-1SG for-3SGF.ACC

I saw the man who I know a woman that knows him, and told him to send her my regards. CNPC

(40) *Il-mara 'l min int rid-t t-kun t-af min* $(hi)_i$
DEF-woman ACC.who you want-2SG 2SG-be 2SG-know who she
t(a)-ħseb li $ra\text{-}ha_i$
3SGF-think COMP saw.3SGM-3SGF.ACC

the woman who you wanted to know who she thinks that saw her WHIC

(41) *Il-mara 'l min lanqas kon-t għaraf-t għajr x'hin*
DEF-woman ACC.who NEG was-1SG recognised-1SG except what.time
qbiż-t-ha vera nbidl-(e)t
overtook-1SG-3SGF.ACC really changed-3SGF

The woman who I hadn't recognised except when I overtook her, has really changed. AIC

We turn now to the issue of parasitic gaps and show that Maltese gaps licence parasitic gaps while Maltese resumptives do not. As far as we are aware, there has been no previous discussion of this phenomenon in Maltese, so we first establish that gaps in Maltese may license parasitic gaps. A wh-relative clause with an obligatory gap (*'l min kull raġel sellem* __) licenses the use of either a gap or an RP within the following adjunct phrase (*bla m'għaraf-(ha)*), as in (42).

(42) *Il-mara 'l min kull raġel sellem bla m'*
DEF-woman ACC.who every man greeted-3SGM without COMP/NEG
għaraf-(ha)
recognised.3SGM-(3SGF.ACC)

the woman whom every man greeted without recognising

The set of licit continuations are as we would expect for a gap construction (43) shows identificational, functional and pair-list continuations for (42).

(43) *kien j-isim-ha Marija* (= was named Marija)
kien-et omm-u (= was his mother)
jiġifieri Peter, Marija, Tony, Rita, ... (= that is Peter, Marija, Tony, Rita, ...)

On the other hand, RPs do not license parasitic gaps. Consider now (44). Since RPs are not (normally) licensed in wh-relatives, a potentially controlling RP will only be possible in circumstances where a gap is excluded, for example, in an island. The RP *-ha* cannot control a parasitic gap, only a pronominal.

(44) *Kellim-t ’l mara ’l min n-(a)-ħseb li l-fatt li kull*
spoke-1SG ACC.woman ACC.who 1SG-think COMP DEF-fact COMP every
*raġel laqagħ-***ha** *f’dar-u mingħajr*
man welcomed.3SGM-3SGF.ACC in.house-3SGM.ACC without
m’għaraf-ha dejjaq-ha
N-COMP.recognised.3SGM-3SGF.ACC displeased.3SGM-3SGF.ACC

I spoke to the woman who I think that the fact that every man welcomed her in his house without recognising her, displeased her.

Turning now to *li* relatives, we see that the data here also supports the conclusion that RPs are syntactically active (and hence, do not share the ability to licence parasitic gaps that gaps exhibit). Similar to wh-relatives, in *li* relatives only gaps but not RPs may license parasitic gaps, as shown in examples (45) to (48).

(45) *Dawn huma l-kotba li Toni s-sellef*
these COP.3PL DEF-books COMP Tony PASS-borrowed.3SGM
bla/mingħajr ma ħallas
without N-COMP paid.3SGM

These are the books that Tony borrowed without paying (for). GAP - PGAP

(46) *Din hija l-libsa li Marija xtra-t bla/mingħajr*
this.SGF COP.3SGF DEF-dress COMP Mary bought-3SGF without
ma ġarrb-it-ha
N-COMP tried-3SGF-3SGF.ACC

This is the dress that Mary bought without trying (it) on. GAP - RP

(47) **Uri-ni l-libsa li raj-t-ha bla*
show.2SG-1SG.ACC DEF-dress COMP saw-1SG-3SGF.ACC without
ma xtraj-t
N-COMP bought-2SG

Show me the dress that you saw without buying. *RP - PGAP

(48) *Libsa li mor-t xtraj-t-ha bla ma*
dress COMP went-1SG bought-1SG-3SGF.ACC without COMP.NEG
ppruvaj-t-ha ma ġie-t-ni-x
tried-1SG-3SGF.ACC NEG came.3SGF-1SG.ACC-NEG
A dress that I went to buy without trying on did not fit me. RP - RP

We conclude, then, that the parasitic gap diagnostic is applicable in Maltese, and further supports the view that Maltese RPs are SARs, that is, are anaphoric pronouns at f-structure. Given this, we can extend the analysis of bare (*li*) relatives given above, replacing (20) above by (49) (the only change is the addition of an anaphoric dependency ($\uparrow$ TOPIC)$_\sigma$ = (($\uparrow$ RRPPATH$_\sigma$) ANTECEDENT) to allow for the use of a resumptive), and adding the resumptive path definition in (50).

(49) CP $\longrightarrow$ ϵ C$'$
($\uparrow$ TOPIC PRED) = 'PRO' $\uparrow = \downarrow$
(ADJ $\in \uparrow$)
($\uparrow$ COMPFORM $=_c +$)
($\uparrow$ TOPIC) = ($\uparrow$ RGAPPATH) |
($\uparrow$ TOPIC)$_\sigma$ = (($\uparrow$ RRPPATH$_\sigma$) ANTECEDENT) }

(50) RGAPPATH $\equiv$ { COMP } * DIRGF
Constraints
RRPPATH $\equiv$ { ARGF } * [ADJ $\in$]* GF
GF $\equiv$ { SUBJ, OBJ, OBJ$_{goal}$, POSS }
ARGF $\equiv$ { SUBJ, OBJ, OBL, COMP }

The general impossibility of using a resumptive in the highest subject position may be captured by an anti-locality condition (Asudeh, 2004, to appear).

(51) Anti-Locality Condition: (Asudeh, 2004)
($\uparrow_\sigma$ ANTECEDENT) $\neq$ (($\uparrow$ SUBJ) TOPIC)$_\sigma$

With the exception of the HSR and the highest OBJ condition, the set of environments within which the gap is permitted is a subset of those within which the RP is available. Because the distribution of gaps and RPs in *li* relatives overlap significantly, it is relatively straightforward to give an account along the lines outlined above. This closely follows the approach taken in Asudeh (2004) to Irish, Palestinian Arabic and Hebrew, languages which he argues fundamentally show non-complementarity of gaps and RPs.[8] But the distributional pattern for wh-relatives in Maltese is different: RPs are systematically excluded when gaps are permitted, essentially appearing only in cases of WCO, island violations and the like. The question which arises is how best to account in the grammar for the occurrence of

[8]Of course formulating all the constraints (such as WCO) would raise further non-trivial issues.

these RPs, for if we are correct in our claim that Maltese RPs in relative clause constructions are syntactically active, then they must be associated with an anaphoric binding constraint. Attempting to define a RWHRPPATH which would have the effect of permitting an RP just in case a gap were not possible does not seem a particularly attractive (or feasible) approach, and raises a number of interesting theoretical issues for future work, in particular about the analysis of RPs in languages which show both free variation and complementary distribution (in different constructions) (see Falk (2002) for some discussion in the context of Modern Hebrew). For the moment we are inclined to think that the observed pattern of distribution of the RP in wh-relatives does in fact result from the interaction of further constraints with a rather permissively defined anaphoric binding constraint permitting RPs in wh-relatives, along the lines sketched above for *li* relatives. Notice however that since POSS is excluded as the bottom of the dependency for wh-relatives, it is equally excluded in such dependencies mediated by RPs, suggesting that we might want just one generalisation for the dependency, defaulting to pronominal expression when the gap is otherwise excluded, which suggests we want just one distributional statement for wh-relatives. For now, we leave this issue on this somewhat speculative note and turn in the following section to some cases where it is perhaps less clear that the RP is a SAR.

5 Across The Board

In this section we look at the distribution of gaps and RPs in across-the-board constructions. Our expectation, based on the SAR/SIR diagnostics, would be that SARs should not mix with gaps in ATB constructions. We have shown above that Maltese has SARs. However, gap and RP *do* occur together in ATB constructions in both types of relative clause (even though RPs are generally systematically excluded from wh-RRCs). The following examples involve coordination of IPs (that is, the TOPIC is outside the coordination). (52) shows coordination under *li* with a gap in the first conjunct and an optional RP in the second conjunct.

(52)	*Il-ktieb*	*li*	*qra-t*	*Marija*	*u*	*kkritika-t-(u)*	*Doris*
	DEF-book	COMP	read-3SGF	Mary	and	criticised-3SGF-3SGM.ACC	Doris

the book that Mary read and Doris criticised

In similar fashion, in wh-relatives a gap is obligatory in the first conjunct but a RP appears optionally in the second conjunct.

(53)	*Ir-raġel*	*'l min*	*irrappurtaj-t*	*u*	*weħħil-t-(u)*	*multa,*
	DEF-man	ACC.who	reported-1SG	and	CAUSE.get-1SG-(3SGM.ACC)	fine,

fadal-l-u	*sal-aħħar*	*t-ax-xahar*	*biex*	*i-ħallas*
left.3SGM-DAT-3SGM	till.DEF-end	of-DEF-month	in order	3SGM-pay

The man who I reported and caused to get a fine has till the end of the month to pay. *wh* GAP GAP/RP

If the approach developed in Asudeh (to appear, 2011) is correct, then the data above might suggest that Maltese also has SIRs, that is, functionally controlled RPs or audible gaps. But if this is so, then the distribution is very different from Swedish and Vata, where they are limited to the SUBJ function. Further, while a SIR might be expected to control a parasitic gap, we see that the RP in an ATB construction appears not to be able to do so:

(54) *Il-libsa li raj-t fil-hanut u Marija*
DEF-dress COMP saw-1SG in.DEF-shop and Mary
xtra-t-ha bla ma ppruva-t-(ha)*
bought-3SGF-3SGF.ACC without NCOMP tried-3SGF-3SGF.ACC
the dress that I saw in the shop and Mary bought without trying

Of course if the RPs found in ATB constructions are SIRs then we would not expect them to occur in ATB constructions involving positions which are not accessible to gap dependencies, namely islands. (55), which involves the WHIC, shows that they do.

(55) *l-mara 'l min t-ħassib-t jekk kull raġel*
DEF-woman ACC.who RECIP-thought-1SG whether every man
*i-ħobb-***hie***-x u j-irrispetta-***hie***-x,*
3-loves.3SGM-3SGF.ACC-NEG and 3-respects.3SGM-3SGF.ACC-NEG
kien-et Marija.
be-3SGF Marija
The woman whom I wondered whether every man loves and respects her, was Mary.

In (55) the wh-dependency passes across-the-board into an island and involves an RP in each conjunct, as gaps are not permitted in island constructions. Further in (56) the RP in the second conjunct is bound by a quantified NP head that resists an e-type interpretation suggesting that this is a true RP rather than an intrusive pronoun.

(56) *Kull tifel li dik it-tifla t-af u n(a)-ħseb*
every boy COMP DEM.SGF DEF-girl 3SGF-knows and 1-think.SG
t(i)-xtieq t-kellm-(u) ma j-rid-x
3SGF-wishes 3SGF-speak-3SGM.ACC NEG 3-wants.SGM
i-kellim-ha
3-speak.SGM-3SGF.ACC
Every boy that this girl knows and I think wishes to speak to does not want to speak to her.

At the very least, these examples indicate that we cannot simply conclude that ATB constructions involve gap-like (SIR) resumptives *tout court*: such a analysis would create a number of difficulties. The alternative is that they are SARs, that is, f-structure pronouns subject to anaphoric control. However in this case too a difficulty arises: the approach to coordination (using distribution) in LFG and the disjunction of a functional control equation and an anaphoric binding equation such as that in (49), repeated here as (57), will not predict the observed behaviour.[9] An inbound functional uncertainty distributed into a coordinate structure must find *some* solution in each conjunct (guaranteeing across-the-board extraction) but is free to find different solutions in each conjunct (one can think of this as distributing the functionally uncertain path, and independently finding a solution in each conjunct). The crucial problem is that the required interpretation is one in which the disjunction takes narrow scope and thus itself distributes into each conjunct, permitting the combination of gap with RP.[10] But contrary to this, the disjunction receives wide scope in (57), predicting that only GAP/GAP and RP/RP are grammatical.[11]

(57) $\{(\uparrow \text{TOPIC}) = (\uparrow \text{RGAPPATH}) \mid$
$(\uparrow \text{TOPIC})_\sigma = ((\uparrow \text{RRPPATH}_\sigma) \text{ ANTECEDENT}) \}$

6 Reconstruction

The final data set which we will discuss concerns the phenomenon of reconstruction and the distribution of gaps and resumptives in reconstruction contexts. By reconstruction we refer to the phenomenon whereby a filler shows a range of (interpretive) behaviours appropriate for its *in situ* position or function. Of course, in LFG, because unbounded dependency constructions (with gaps) involve functional control, those "reconstruction" properties which are f-structure related are predicted as the 'filler' is associated with both the discourse function and the within-clause function. Two central types of reconstruction data are *binding reconstruction* (e.g. of reflexive pronouns) and *scope reconstruction*, that is, examples such as (58) in which a gap is under the scope of a quantifier.

(58) *Which book did every boy say . . . was too expensive?*

[9]The notion of distribution is defined by Dalrymple and Kaplan (2000):

(iii) For any *distributive* property P and set s, $P(s)$ iff $\forall f \in s.P(f)$.
For any *nondistributive* property P and set s, $P(s)$ iff P holds of s itself.

[10]Note that this alone would fail to exclude an RP from the first conjunct (for example in wh-relatives) — further conditions must constrain the occurrence of the RP. It is far beyond the scope of this paper to provide a full treatment of the Maltese ATB facts and we leave these concerns for future work.

[11]We speculate that it may be possible to re-express the functional uncertainties using local names to achieve narrow scope for the disjunction, to allow GAP/RP combinations, but we do not pursue this possibility here, not least because we have already raised some doubts above about the use of the disjunctive equation itself.

Recent work on reconstruction in RRCs in Arabic dialects includes Aoun et al. (2001), Choueiri (2002), Aoun and Li (2003) and Malkawi (2009). In the approach of Asudeh (to appear) reconstruction would be evidence for SIR status (to the extent to which reconstruction itself is an f-structure phenomenon distinguishing gaps from pronouns). Given the emerging understanding of reconstruction in (other) Arabic dialects, our major aim in this section is straightforwardly empirical, contributing a brief comparison of Maltese with its close Semitic neighbours.

Aoun et al. (2001) suggest that in Lebanese Arabic (LA), reconstruction status correlates with islandhood status. (59) illustrates reconstruction into the position of a RP in a non-island construction. On the other hand, the ungrammaticality of (60) indicates that an RP in an island resists reconstruction.

(59) *təlmiiz-a$_i$ l-kəsleen ma baddna nχabbir wala mʕallme$_i$ ʔənno huwwe*
student-her the-bad NEG want.1P tell.1P no teacher that he
zaʕbar b-l-faħṣ.
cheated.3SM in-the-exam

Her bad student, we don't want to tell any teacher that he cheated on the exam. (LA: Aoun et al 2001:381)

(60) **təlmiiz-a$_i$ l-kəsleen ma ħkiina maʕ wala mʕallme$_i$ ʔabl-ma huwwe*
student-her the-bad NEG talked-1P with no teacher before he
yuuṣal.
arrive.3SM

Her bad student, we didn't talk to any teacher before he arrived. (LA: Aoun et al 2001:381)

Subsequently, Choueiri (2002) and Aoun and Li (2003) show that definite and indefinite RRCs show different patterns in contexts in which there are no island violations. (61) involves a relative clause attached to a definite head (*SSuura* 'the picture') and allows reconstruction into the RP position as in (59) above. On the other hand, reconstruction is not possible in (62), which involves a relative clause attached to an indefinite head (*Suura* 'a picture').

(61) *chuft [SSuura tabaç bint-a$_1$]$_2$ yalli [kə]ll mwazzafe]$_1$ ʔaalit*
saw.1SG the-picture of daughter-her that every employee said.3SGF
*ʔanno badda tçallcʔ-**a**$_2$ bi-maktab-a*
that wanted.3SGF hang-3SGF in-office-her

I saw the photo of her daughter that every employee said she wanted to hang in her office. (LA: Malkawi 2009: 69)

(62) **chuft [Suura la-ʔibn-a*$_1$*]*$_2$ *[kə]ll mwazzafe]*$_1$ *ʔaalit ʔanno*
saw.1SG picture of-son-her every employee said.3SGF that
*badda tçallcʔ-***a**$_2$ *bi-maktab-a*
wanted.3SGF hang-3SGF in-office-her

I saw a photo of her son that every employee said she wanted to hang in her office. (LA: Malkawi 2009: 70)

This provides the more complex pattern of data concerning the availability of the RP in reconstruction environments which is summarised in (63).

(63)

Lebanese Arabic	Definite Relative	Indefinite Relative
Island	No Reconstruction	No Reconstruction
Non-Island	Reconstruction	No Reconstruction

In Jordanian Arabic (JA), however, a different pattern emerges. Malkawi (2009) shows that weak (inflectional or clitic) resumptives behave differently from strong pronoun resumptives in JA. Weak resumptive elements, as used in the examples below, show reconstruction effects *irrespective of the presence of an island* for both bound variable and reflexive binding tests, in relatives as well as in other dislocation structures.[12] (64)-(65) respectively contain a definite and indefinite head for the relative clause and in each case, reconstruction into the site of the (weak) resumptive is possible, giving the distributive reading, whereby each father saw a picture of his own daughter. A similar pattern is found for reflexive binding (examples omitted for lack of space).

(64) *chuft [Surit bint-uh*$_1$*]*$_2$ *illi kul ʔab*$_1$ *bi-hib-ha*$_2$ *(hi)*$_2$
saw.1SG picture daughter-his that every father IMPFV-love-3SGF (her)

I saw the picture of his daughter that every father loves. (JA: Malkawi 2009:62)

(65) *chuft [Surah la-bint-uh*$_1$*]*$_2$ *kul ʔab*$_1$ *bi-hib-ha*$_2$ *(hi)*$_2$
saw.1SG picture of-daughter-his every father IMPFV-love-3SGF (her)

I saw a picture of his daughter that every father loves. (JA: Malkawi 2009:62)

The examples in (66) and (67) involve RPs contained within islands, but here again we see reconstruction. Again, similar facts obtain with reflexives. (68) provides a summary.

(66) *chuft SSuura*$_2$ *tabaçat ʔibn-ha*$_1$ *illi zçiltu laʔannu kul*
saw.1SG the-photo of son-her that were.angry.2P because every
mwazzafah$_1$ *bidha tçalliʔ-ha*$_2$ *(hi)*$_2$ *bi-l-maktab*
employee.F wants.3SGF hang-3SGF (her) in-the-office

I have seen the photo of her son that you are angry because every employee wants to hang (it) in the office. (JA: Malkawi 2009: 63)

[12] Glosses and translations are given in French in the original. Some minor alterations and corrections have been made in translating these to English.

(67) *chuft Suura$_2$ la-ʔibn-ha$_1$ zçiltu laʔannu kul mwazzafah$_1$*
saw.1SG photo of-son.her were.angry.2P because every employee.F
bidha tçalliʔ-ha$_2$ (hi)$_2$ bi-l-maktab
wants.3SGF hang-3SGF (her) in-the-office

I have seen a photo of her son that you are angry because every employee wants to hang (it) in the office. (JA: Malkawi 2009: 64)

(68)

Jordanian Arabic	Definite Relative	Indefinite Relative
Island	Reconstruction	Reconstruction
Non-Island	Reconstruction	Reconstruction

Although it would be premature to draw any firm conclusions at this stage, our preliminary investigation appears to show that Maltese patterns with JA (as described by Malkawi). (69) and (70) illustrate reconstruction (into the site of a resumptive) in non-island contexts for definite and indefinite relatives respectively.[13]

(69) *Raj-t [ir-ritratt tat-tifla tagħ-ha$_i$]$_j$ li Pawlu j-(a)ħseb*
saw-1SG DEF-photo of.DEF-girl of-3SGF.ACC COMP Paul 3SGM-think
li [kull impjegat-a]$_i$ qal-et li t-rid
COMP every employee-SGF said-3SGF COMP 3SGF-want
id-dendl-u$_j$ fl-uffiċju tagħ-ha$_i$
3SGF-hang-3SGM.ACC in.DEF-office of-3SGF.ACC

I saw a photo of her daughter which Paul thinks that every employee wants to hang in her office.

(70) *Ta-w-ni [ritratt tat-tifla tagħ-ha$_i$]$_j$ li qal-u*
gave.3PL-1SG.ACC photo of.DEF-daughter of-3SGF.ACC COMP said.3-PL
li [kull waħda]$_i$ t-(i)xtieq id-dendl-u$_j$ fil-kamra
COMP every one.SGF 3SGF-wishes 3SGF-hang-3SGM.ACC in.DEF-room
tagħ-ha
of-3SGF.ACC

They gave me a photo of her daughter which they said that every woman/one wishes to hang in her room.

(71) *Sib-t [ir-ritratt tal-ID tiegħ-u$_i$]$_j$ li int n-(a)ħseb*
Found-1SG DEF-photo of.DEF-ID of-3SGM.ACC COMP you 1SG-think
t-ħassib-t jekk Pawlu$_i$ kien-x iddispjaċut li
RECIP-wondered-2SG whether Paul was.3SGM-NEG sad.SGM COMP
tilf-u$_j$
lost.3SGM-3SGM.ACC

I found the photo of his ID which I think you were wondering whether Paul was upset that he lost.

[13] Note that we use LDD examples to enable the use of an RP.

(72) *Iltqaj-t ma' [ħabib-a minn tiegħ-u$_i$]$_j$ li n-(a)ħseb Pawlu$_i$*
Met.1SG with friend-SGF from of-3SGM.ACC COMP 1SG-think Paul
kien ġa j-af-ha$_j$ qabel ma ħareg
was.3SGM already 3SGM-knows-3SGF.ACC before COMP go out.3SGM
magħ-ha$_j$
with-3SGF.ACC

I met a friend of his who I think Paul already knew before going out with (her).

(73)

Maltese	Definite Relative	Indefinite Relative
Island	Reconstruction	Reconstruction
Non-Island	Reconstruction	Reconstruction

What we see from these data is that it appears always to be possible to reconstruct into a resumptive in Maltese (more work is needed to establish whether we see the same pattern with reflexives). As noted above, if reconstruction is indicative of SIR status, then this data set is inconsistent with the results of other diagnostics, which support SAR status for Maltese resumptives. On the other hand, the status of the reconstruction diagnostic itself may be open to question.

7 Conclusion

This paper has provided a first description of Maltese RRCs showing that Maltese, unlike many Arabic dialects, has wh-relatives alongside non wh-relatives. Each type of RRCs permits a resumptive, but with a different distribution. On the basis of the major diagnostics concerning islandhood, weak crossover and control of parasitic gaps, we have argued that Maltese has syntactically active resumptives, that is, resumptives which are subject to anaphoric binding, captured by an anaphoric control equation. We have raised a number of issues concerning how the distribution of gap/RP is to be captured in the grammar. Our discussion of two further putative diagnostics raised some further questions. We argue that the interaction of RPs with ATB phenomena does not, on balance, suggest that Maltese has SIR as well as SAR (because the RP does not itself pass further SIR tests like PG) but does leave an analytic issue for further work. As for reconstruction we suggest that factors such as definiteness of the antecedent and whether or not the RP is in a SAR or a SIR- diagnosing position are not relevant to reconstruction in Maltese.

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CLITIC PLACEMENT, SYNTACTIC DISCONTINUITY AND INFORMATION STRUCTURE

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Abstract

The phenomenon of so-called second position clitics has received considerable attention in the linguistic literature, and some proposed analyses of the phenomenon have suggested major architectural changes to linguistic theories. In this paper, we look at second position clitics in New-Shtokavian, their syntactic and prosodic properties, and propose a purely syntactic clitic placement analysis. We show that the complex data can be accounted for by an analysis of split constituents and their resulting information structure differences with a simple prosody-syntax interface.

1 Introduction

The phenomenon of so-called second position clitics (2PC) in particular in Slavic languages has received considerable attention in the linguistic literature over the last decades. Some proposed analyses of the phenomenon have led to major architectural changes to linguistic theories, and new powerful mechanisms, which for many appeared unnecessary and unmotivated, leading to wrong predictions and over-generation. In this paper, we look at second position clitics in New-Shtokavian (NSh), their syntactic and prosodic properties, and propose a purely syntactic clitic placement analysis.

NSh in the *ije*-kavian variant currently represents the Croatian standard language, while the *i*- and *e*-kavian variants are spoken in e.g. Bosnia–Herzegovina and Serbia respectively. The examples discussed in the following are from the NSh variant spoken in Croatia.[1]

The problem we are concerned with in this paper is illustrated by the examples in (1). In NSh pronouns and auxiliaries can be realized in a (morphologically and/or phonologically) reduced form. We refer to these elements as clausal clitics, i.e. pronominalized verbal arguments or clausal auxiliary verbs. Such clausal clitics seem to be subject to a second position placement constraint, which apparently renders them obligatorily in either a position after a clause-initial syntactic constituent (1P-constructions), or after the initial phonological word (1W-constructions). This is illustrated in (1a,b) for a sentence initial subject NP, and in (1c,d) for an initial object NP.

(1)	a.	*Novi*	*auti*	***su***	*stigli*	*u*	*skladište.*
		new	cars	be.3pl	arrive	in	storage
		'New cars arrived at the storage.'					

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[1]We expect judgement difference between our data and data taken from work based on so called BSC (Bosnian, Serbian, Croatian) or Serbo-Croatian, which often focuses on particular variants, or ignores regional differences and variation.

b. *Novi* ***su*** *auti* *stigli* *u* *skladište.*
new be.3pl cars arrive in storage

c. *Novi* *auto* ***su*** *naši* *susjedi* *kupili.*
new car be.3pl our neighbors buy
'Our neighbors bought a new car.'

d. *Novi* ***su*** *auto* *naši* *susjedi* *kupili.*
new be.3pl car our neighbors buy

The analysis of clitic placement in (1a,c) as placement after the first syntactic phrase (a 1P-construction) appears to be straightforward. The placement of clitics in positions after the initial adjective as in (1b,d) (a 1W-construction) raises questions about the nature of the underlying constraints and mechanisms. The question, whether 1W-constructions are syntactic or phonological in nature, is the matter of many debates. In these 1W-constructions an item contributing information to the clause level is apparently embedded inside a fronted nominal phrase. Would this indeed be the most plausible analysis, it would induce problems for various syntactic theories, e.g. related to level autonomy, syntactic placement constraints, or to the fact that clitics contributing information to the sentence level appear to be inside a subconstituent of arbitrary complexity and embedding depth. An explanation of constructions as in (1b,d) was offered by approaches that suggest a complex prosody-syntax interface, see e.g. Halpern (1995) for a generative approach, and more recently Bögel et al. (2010) within the LFG framework.

In contrast to the prosodic analyses and suggested extensions of the prosody-syntax interface, we argue in this article for a purely syntactic explanation for both construction types, i.e. 1W- and 1P-constructions. We show that the apparent cases of phonological clitic placement in 1W-constructions can be analyzed as instances of split constituent constructions, and that the word order variation is related to information structure, implying scope differences in a hierarchical (syntactic) representation, rather than scope neutral phonological processes. As a consequence of our analysis, the prosody-syntax interface remains rather simple, and does not utilize complex word rearrangement mechanisms outside of syntax, or at the level of phonological representations.

The article is structured as follows. In section 2, we briefly outline previous analyses of the phenomenon and discuss some of their shortcomings. Sections 3 and 4 present the relevant data in more detail. We present evidence that apparent phonological clitic placement in fact involves split constituents in section 3. In section 4 we show that the word order variation is related to information structure. The outline of our analysis is given in section 5, and section 6 discusses how our analysis can account for some of the more complex examples. Section 7 concludes the discussion.

2 Previous analyses

There has been extensive work on second position clitics (2PC) in general, and in the recent years in particular, see e.g. Halpern and Zwicky (1996); van Riemsdijk (1999); Franks and King (2000); Anderson (2005). Assumptions and hypotheses related to 2PC in Bosnian, Croatian, and Serbian (or Serbo-Croatian) can be roughly divided into purely phonological, purely syntactic or mixed phonological-syntactic accounts.

Purely phonological accounts for 2PC placement in the respective languages and dialects such as e.g. Radanović-Kocić (1988, 1996) and O'Connor (2002) assume that clitic placement is not subject to syntactic constraints, but rather restricted by purely phonological processes and requirements. Thus, in phonological accounts clitics are either placed after the first phonological word or after the first phonological phrase. In such models the fact that the respective phonological categories usually overlap with syntactic ones is responsible for the specious analysis of purely syntactic clitic placement. Such assumptions require the formulation of a so far missing rich theory of phonological or prosodic representations, where word order and word placement restrictions can be formulated that make the appropriate predictions, and offer plausible explanations.

Diametrically opposed are accounts which suggest purely syntactic mechanisms and constraints for 2PC placement. Representative for a purely syntactic approach to 2PC placement are e.g. Cavar and Wilder (1992) and Progovac (1996). Here we draw on the observations and arguments therein, but we will extend the observations and arguments taking information structure into account. As far as we know, information structure has not been the focus of 2PC placement analyses so far, although some work has hinted at relevant implications (e.g. Diesing et al. 2009).

A third strand of analyses can be called mixed phonological-syntactic accounts. In these analyses it is assumed that 2PC are either placed after the first syntactic constituent, or after the first phonological word. Most of these accounts (e.g. Schütze 1994; Halpern 1995) relate to work presented in Zec and Inkelas (1990). Such proposals have in common that an architecture of a phonology-syntax interface is suggested which involves active movement or placement of elements like clitics at a phonological or prosodic level, or at the interface between these and the syntactic level. In this section, we discuss in more detail in particular Halpern's (1995) account of prosodic inversion, and its recent incorporation into LFG by Bögel et al. (2010).

In the prosodic inversion account proposed by Halpern (1995) and adopted by Bögel et al. (2010), enclitics are assumed to be placed in syntax either after the first syntactic constituent or sentence initially. There is no plausible explanation offered for this particular syntactic placement peculiarity. In constructions where 2PC are placed after a clause initial syntactic constituent, the stipulated prosodic requirement of enclitics requiring a prosodic host to their left is accounted for naturally. However, if 2PCs are placed sentence initially, the enclitics cannot attach prosodically to a host to their left. In these cases reordering at the prosodic level is suggested as the mechanism that renders the appropriate word order that satisfies the prosodic requirement of enclitics to attach to a preceding prosodic host. This mechanism is called Prosodic Inversion (PI), i.e. a local last resort inversion operation that affects a clause initial enclitic and the prosodic word that follows it, or clause final proclitics and the prosodic word that precedes it. In short, it is suggested that the last resort operation of PI reorders or moves words at the level of prosodic or phonological representation.

Halpern's (1995) concept of PI extends the previously assumed complexity of the phonology-syntax interface significantly. Figure 1 sketches this idea of the mapping between phonology and syntax, as adopted in Bögel et al. (2010). In the c-structure, 2PCs are assumed to be realized sentence-initially. This ensures that the pronominal clitics contribute their information to the sentence level. However, the second line displays the phonological spell out of the c-structure, in which the clitics have been moved to a position following the first phonological word. The interface mapping is assumed to be carried out by a complex rule which ensures that the clitics are only moved minimally and when necessary.

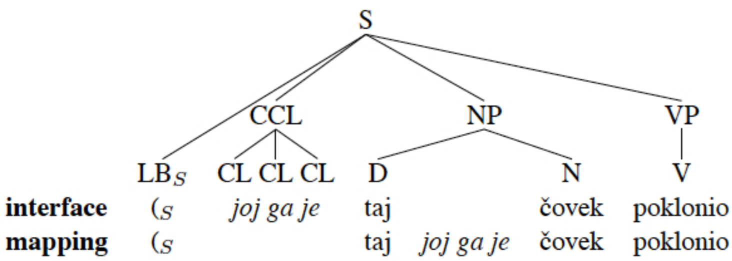

Figure 1: Complex prosody-syntax interface (Bögel et al., 2010)

The PI analysis for 2PC placement faces various problems, e.g. it involves a range of unmotivated conceptual stipulations. For example, it has to stipulate that 2PCs are realized syntactically in sentence initial position. This unmotivated stipulation serves as the main motivation for PI, rendering it conceptually necessary. However, there does not seem to exist any empirical data that supports the initial placement stipulation. Moreover, the motivation for assuming two different 2PC placement strategies in general seems unmotivated and lacks empirical support. In fact, there appear to be clear information structure differences between the two resulting surface constructions in the contrast in (1a,c) and (1b,d). These are not explained by the PI-account.

Further, the PI-account faces empirical problems. It over-generates, as the NSh-examples in (2) show:

(2) a. *Na* *nj(ega)* ***je*** *bacila* *pogled.*
on him/it be.3sg throw.ptc look
'She was looking at it.'

b.	**Na*	***je***	*njega*	*bacila*	*pogled.*
	on	be.3sg	him/it	throw.ptc	look

(2a) shows that preposition can function as host for an enclitic pronominal complement *nj*. It is possible to lengthen the prepositional nucleus and assign stress to the initial prepositional syllable, rendering them well-formed phonological words.[2] In the case of a stressed preposition, PI would also predict the inversion of an initial enclitic auxiliary and a following adjacent stressed preposition to be possible, contrary to the empirical facts, as (2b) shows.

The PI-account also under-generates. A PI-version that is restricted to inversion with an adjacent phonological word excludes NSh-examples in which 2PCs are placed after the second or third phonological word or syntactic constituent, as shown in (3). Such constructions and their analyses will be discussed in more detail in section 6.

(3)	a.	*Taj*	*naš*	*veliki*	***nam***	*prihod*	*neće*	*tako*	*puno*	*pomoći.*
		this	our	big	us	income	not-will.3sg	this	much	help.inf
		'This big income of ours will not help us that much.'								
	b.	*Takav*	*veliki*	*brzi*	***mi***	*auto*	*nije*	*posebno*	*potreban.*	
		such	big	fast	me	car	not-be.3sg	specially	necessary	
		'I don't need such a big fast car that much.'								

To sum up, besides purely phonological and syntactic accounts, we discussed in particular the shortcomings of the mixed account that introduces the last resort operation of PI. However, all these accounts have in common that they cannot motivate or explain the intra-linguistic variation, i.e. the alternations of the different constructions. In the following we shall argue that clitics are always placed after an initial syntactic constituent, and we shall present an alternative information theoretic approach that explains the intra-linguistic variation between the two core constructions presented in (1).

3 Split Constituents

In this section we argue that NSh licenses discontinuous rendering of constituents in syntax, as described in e.g. Progovac (1996), or Fanselow and Cavar (2001, 2002) and citations therein. The possibility of complex syntactic discontinuities leads to the specious analysis of prosodic 2PC placement.

Examples of discontinuous noun phrases are presented in the examples in (4) and (5). The examples (4a) and (5a) show that an enclitic auxiliary *su* or *je* can intervene between the two words of a subject or object noun phrase respectively. However, this is also true for non-clitic sentential adverbs, as the examples (4b) and (5b) show.

[2]See Cavar and Cavar (2011) for a detailed phonetic and phonological analysis of stressed prepositions and their status of being bi-moraic phonological words, capable of hosting clitics.

(4) a.

Novi	***su***	*auti*	*stigli*	*u*	*skladište.*
new	be.3pl	cars	arrive.ptc	in	storage

‘New cars arrived at the storage.’

b.

Novi	***su***	***danas***	*auti*	*stigli*	*u*	*skladište.*
new	be.3pl	today	cars	arrive.ptc	in	storage

(5) a.

Taj	***je***	*čovjek*	*nazvao.*
this	be.3sg	man	call.ptc

‘This man called.’

b.

Taj	***je***	***danas***	*čovjek*	*nazvao.*
this	be.3sg	today	man	call.ptc

There is in fact ample empirical evidence for the possibility to render complex NPs discontinuously without 2PCs being involved at all. It seems plausible to assume that syntactic discontinuity of complex phrases is responsible for the apparent splitting of these phrases by 2PCs. Well-know examples of discontinuities in interrogative contexts include the examples in (6), as discussed, for example, in Browne (1976).[3]

(6) a.

Ivan	***je***	*kupio*	*neki*	*plavi*	*auto.*
Ivan	be.3sg	buy.ptc	some	blue	car

‘Ivan bought some blue car.’

b.

Kakav	***je***	*Ivan*	*kupio*	*auto?*
what-kind-of	be.3sg	Ivan	buy.ptc	car

‘What kind of car did Ivan buy?’

c.

Kakav	***je***	*Ivan*	*auto*	*kupio?*
what-kind-of	be.3sg	Ivan	car	buy.ptc

The possibility of realizing complex phrases discontinuously is not restricted to NPs. For example, PPs can be split in interrogative contexts in the same way, as shown in the examples in (7).

(7) a.

Ivan	***je***	*živio*	*u*	*velikom*	*gradu.*
Ivan	be.3sg	live.ptc	in	big	city

‘Ivan lived in a big city.’

b.

U	*kakvom*	***je***	*Ivan*	*živio*	*gradu?*
in	what-kind-of	be.3sg	Ivan	live.ptc	city

‘What kind of car did Ivan buy?’

c.

U	*kakvom*	***je***	*Ivan*	*gradu*	*živio?*
in	what-kind-of	be.3sg	Ivan	city	live.ptc

[3] Such syntactic discontinuities are common in other Slavic and Non-Slavic languages, see e.g. Fanselow and Cavar (2001, 2002) and the references therein, Obenauer (1976) for French, or Nakanishi (2007) for Japanese.

There are fewer possibilities of rendering discontinuous PPs compared to NPs. While a complex PP can be discontinuously realized in a linearly stretched way, maintaining the underlying canonical word order as in (7), it is not possible to render the elements in a crossing manner, as in example (8). In terms of theories that rely on the concept of movement, example (8) shows that PPs are islands for extraction in NSh, which imposes serious problems for a movement-based explanation of the examples in (7b-c).

(8)	*$Gradu_i$*	*Ivan*	*živi*	*u*	*velikom*	$\_\_\__i$
	city	Ivan	live.3sg	in	big	

The examples in (9) show that 2PCs cannot occur in positions where a complex PP cannot be split. It is not possible for a subject NP to intervene between the preposition and the prepositional complement *nekom grad* in (9a), nor is it possible for an enclitic to intervene in this position (9b). This is true even in cases in which the preposition is clearly an independent phonological word (a bi-moraic and stressed unit) that can host an enclitic complement.

(9)	a.	**U*	*Ivan*	*nekom*	*gradu*	*živi.*	
		in	Ivan	some	city	live.3sg	
	b.	**U*	***je***	*nekom*	*gradu*	*Ivan*	*živio.*
		in	be.3sg	some	city	Ivan	live.ptc

Furthermore, we observe that in split contexts in NSh one split NP-part, for example the head-noun, can be pronominalized in interrogative (10b) and declarative (10c) contexts, while in non-split contexts (10d) this is impossible. This further supports the assumption that we are dealing with two distinct noun phrases in these constructions, as e.g. proposed in Fanselow and Cavar (2001, 2002).

(10)	a.	*Koliko*	*si*	*knjiga*	*pročitao?*	
		how-many	be.2sg	books	read.ptc	
		'How many books did you read?'				
	b.	*Koliko*	*si*	*ih*	*pročitao?*	
		how-many	be.2sg	them	read.ptc	
	c.	*Sve*	*sam*	*ih*	*pročitao.*	
		all	be.1sg	them	read.ptc	
		'I read all of them.'				
	d.	**Ivan*	*je*	*pročitao*	*pet*	*ih.*
		Ivan	be.3sg	read.ptc	five	them

As has been discussed in Cavar and Wilder (1999) and O'Connor (2002), 2PCs cannot split the head noun from its relative clause in sentence initial position.

(11) a.

Čovjek,	*koji*	*živi*	*u*	*Parizu,*	*sijeća*	***vas***	***se***.
man	who	live.3sg	in	Paris	remember.3sg	you.2pl.acc	refl

‘The man, who lives in Paris, remembers you.”

b.

**Čovjek*	***vas***	***se,***	*koji*	*živi*	*u*	*Parizu,*
man	you.2pl.acc	refl	who	live.3sg	in	Paris

sijeća.
remember.3sg

Given that the head-noun *čovjek* of the complex subject-NP represents a well-formed prosodic word, it would be expected that the 2PC cluster *vas se* can be generated in sentence initial position and invert with the NP-head in the PI approach. This, however, is not possible. There is a simple syntactic explanation for the ungrammaticality of (11b), i.e. the head noun cannot be split from its relative clause by any other element. The only option for a discontinuous realization of an NP with a relative clause would involve right-extraposition of the relative clause, similar to German and English.

In this section we have presented arguments for a syntactic analysis of split NPs and PPs, establishing a parallel between the syntactic splits and splits with the presence of 2PCs. In cases in which syntactic splits are excluded, splits by 2PCs are excluded as well. The fact that e.g. head nouns in split-NP constructions can be pronominalized supports the assumption that each resulting part of a split NP can function as an independent syntactic NP constituent.

4 Information structure

In this section, we argue that the different syntactic structures with 2PCs also differ with respect to their specific information theoretic properties. Semantic and pragmatic effects, however, are not expected, if the minimal word order difference involves clitic placement at the prosodic level.

The examples in (12) illustrate that 2PC split constructions are not possible in neutral contexts that form the answer to the question “What happened?”, as shown in (12a) for an oblique argument, and in (12b) for a subject NP.

(12) a.

??	*U*	*velikom*	***je***	*gradu*	*Petar*	*živio.*
	on	big	be.3sg	tree	Peter	climb.ptc

‘Peter climbed on a big tree.’

b.

??	*Taj*	*nepoznati*	***je***	*čovjek*	*nazvao*	*Mariju.*
	this	unknown	be.3sg	man	call.ptc	Maria

‘This unknown man called Maria.’

A further test involves quantifier scope variation in wh-questions with and without splits, as described by Obenauer (1976) for *combien*-split constructions in French, and by Nakanishi (2007) for split NPs in Japanese.[4]

In example (13), the 2PC unambiguously cliticizes to the fronted direct object phrase. The sentence has two readings, i.e. the collective and the distributive reading. In contrast, in questions involving split NPs as in (14) only the collective reading remains.

(13)	*Koliko*	*članaka*	*su*	*svi*	*ti*	*studenti*	*pročitali?*
	how-many	articles	be.3pl	all	these	students	read.ptc

$?n: \exists nx \text{ article}(x) \,\&\, \forall y\, [\text{ student}(y) \rightarrow \text{read}(y,x)\,]$
How many articles exist, such that all students read them?

$?n: \forall y\, [\text{ student}(y) \rightarrow \exists nx \text{ article}(x) \,\&\, \text{read}(y,x)\,]$
What is the number, such that all students read that number of papers?

(14)	*Koliko*	*su*	*svi*	*ti*	*studenti*	*pročitali*	*članaka?*
	how-many	be.3pl	all	these	students	read.ptc	articles

* $?n: \exists nx \text{ article}(x) \,\&\, \forall y\, [\text{ student}(y) \rightarrow \text{read}(y,x)\,]$

$?n: \forall y\, [\text{ student}(y) \rightarrow \exists nx \text{ article}(x) \,\&\, \text{read}(y,x)\,]$

The observation in (14) can be explained as being the result of a syntactic split in a wh-question, as discussed above. Similarly, the same disambiguation effect seems to occur in constructions with an apparent prosodic NP-split, as shown in (15), where only the collective reading is available.

(15)	<u>*Koliko*</u>	***su***	<u>*članaka*</u>	*svi*	*ti*	*studenti*	*pročitali?*
	how-many	be.3pl	articles	all	these	students	read.ptc

* $?n: \exists nx \text{ article}(x) \,\&\, \forall y\, [\text{ student}(y) \rightarrow \text{read}(y,x)\,]$

$?n: \forall y\, [\text{ student}(y) \rightarrow \exists nx \text{ article}(x) \,\&\, \text{read}(y,x)\,]$

As shown above, the different word order with 2PCs, after the initial word in split constructions, or after the initial constituent, has consequences with respect to the contribution to the sentence information structure. This is not expected if a purely phonological placement were responsible for the 1W-placement. The observations support a syntactic placement of clitics in the 1W-constructions.

5 Basic Analysis

Our analysis has to account for the fact that clitics can be realized in 1P- and 1W-constructions, as discussed above. However, clitics can also be realized in

[4]Thanks to Maribel Romero for the relevant hints and a fruitful discussion of the semantic and pragmatic properties of related split constructions.

third or fourth position (prosodically, and syntactically, see e.g. Cavar and Wilder (1999)). Examples of such a deeper placement are presented in (17) and discussed below. It is important, however, that our analysis is also compatible with these facts. Similarly, our analysis has to explain why clitics cannot be realized after the first prosodic word in embedded contexts, and that there is a strict string adjacency condition between complementizers and clitics.

Any adequate analysis of the relevant construction has to be complex, because it involves the interaction of various linguistic levels, such as syntactic, information, and prosodic structure, as well as semantic properties.

We will not discuss details of relevant prosodic constraints and requirements for the 1W- and 1P-constructions, nor their specific intonation contours. We are confident that our approach is compatible with various recent proposals of prosodic structure within LFG such as Bögel et al. (2010); O'Connor (2004); Mycock (2005); Mycock and Dalrymple (2011).

We also have to skip a detailed discussion of the semantic properties of the relevant constructions. However, we are certain that an appropriate model of the semantic structure can be incorporated in our approach, e.g. along the lines of Dalrymple and Nikolaeva (2011).

The data discussed in sections 3 and 4 showed that the basic levels needed to analyze the data are syntactic structure and information structure. In our analysis, the clitic cluster always follows a syntactic phrase, i.e. 1W-constructions are cases of syntactic structures with discontinuous syntactic phrases. Following work on i(nformation)-structure in LFG (e.g. Bresnan 2001; Choi 1999; King 1997), we assume that certain c-structure positions can be associated with information structure functions. Thus, while the 1W- and 1P-constructions might have the same f-structure, their c- and i-structure might differ.

Figure 2 shows the basic c-structure template assumed for all sentences, i.e. for syntactically discontinuous 1W-constructions, or the continuous 1P-constructions. The 2PCs or the clitic cluster mark the boundaries between TOP(ic) and FOC(us), i.e. the elements following the clitic cluster are in the default focus domain (e.g. VP), associated with the FOC(us) role. The elements before the clitic cluster can be interrogative XPs, TOP(ic) or C(ontrastive) FOC(us) elements.

In the sentential template, the position preceding the clitic cluster is marked as either a topic or a contrastive focus position. This may seem complicated at first sight. However, the similarity between topic and contrastive focus has been noted in various works before (e.g. King 1995; Choi 1999; Mchombo et al. 2005; Cook and Payne 2006). Applying, e.g. Choi's (1999) features "Prom[inent]" and "New" to encode the basic information structure roles (see table 1), topic and contrastive focus share the feature [+Prom]. Thus, the Spec-CP position can be associated with the feature [+Prom], i.e. it would require that all syntactic objects in this position play a prominent role in the information structure.

Specific focus background structures are associated with all split constructions. These are additionally also prosodically marked. These constructions require the initial split subconstituent to be stressed. Thus, without going into details of the

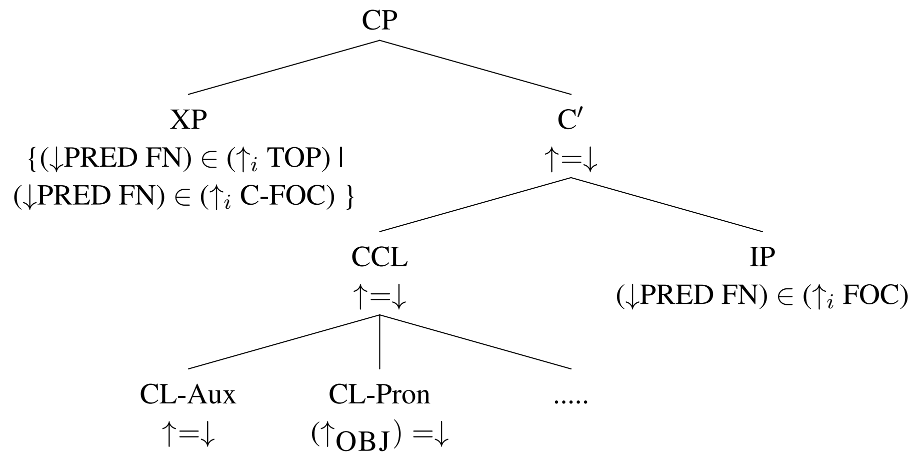

Figure 2: Basic c-structure template including a clitic cluster (CCL)

	– New	**+ New**
– Prom	Tail	Completive Focus
+Prom	Topic	Contrastive Focus

Table 1: Information structure features (Choi, 1999)

prosodic structure, stressing the first subconstituent might contribute the information [+New]. This is required to put contrastive focus on the split constituent. Without this stress, the split constituent would be analyzed as the topic, which would be information-structurally odd.

How the template is applied in the different analyses for the two basic constructions is illustrated by using the well-known examples in (16).

(16) a. *Taj čovjek* ***joj ga je*** *poklonio.*
this man her it be.3sg present.ptc
'This man presented it to her.'

b. *Taj* ***joj ga je*** *čovjek poklonio.*
this her it be.3sg man present.ptc

Figure 3 shows the analysis for (16a), in which the clitic attaches after the initial syntactic phrase, i.e. the subject NP. The subject does not necessarily receive stress. NSh is a pro-drop language such that any overt subject is actually interpreted as prominent. Thus we analyze this construction with an initial subject NP as an instance in which the initial phrase is representing a topic. The clitic cluster consists of three clitics in this case, the object$_\theta$, the object and the auxiliary. The focus is solely projected by the verb.

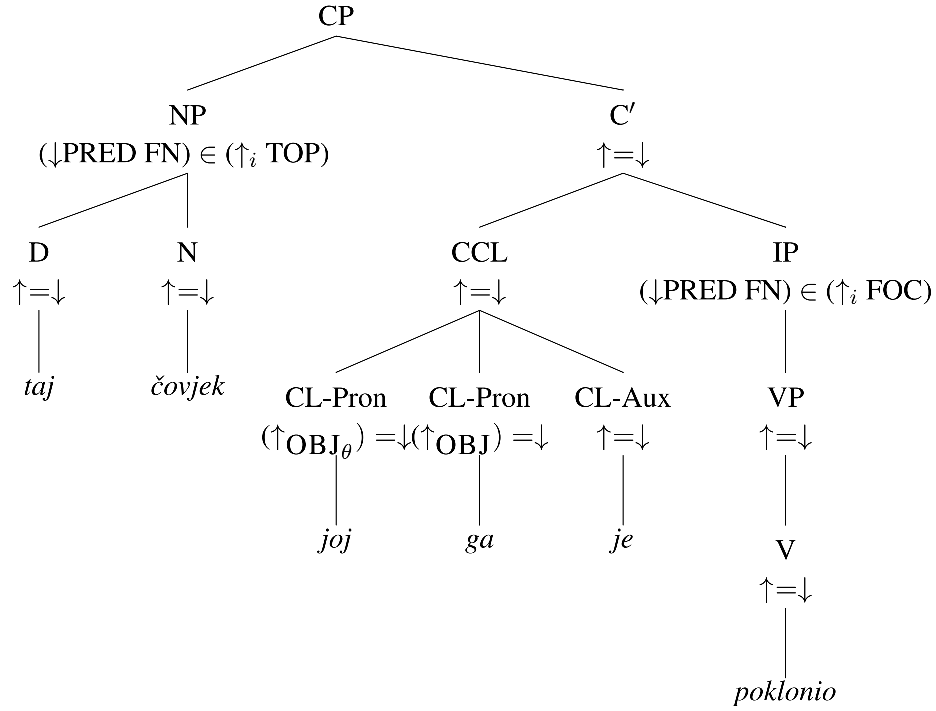

Figure 3: C-structure analysis for (16a): Clitics after the first phrase

In contrast, figure 4 displays the basic analysis for (16b), i.e. the 1W-construction that involves a split constituent in our analysis. The initial constituent in this construction just consists of the sentence initial demonstrative. This construction is only well-formed with a specific intonation contour, i.e. the sentence initial demonstrative receives stress. Thus, in this case the demonstrative is contrastively focused, while the head noun of the subject, *čovjek* 'man' is not contributing new information to the sentence, but it might be thematic. The default focus domain is projected by the verb, but it might also include the head noun of the subject.

A full account of the split constructions that includes a discussion of the syntactic structure cannot be provided here because of restrictions of space. Nevertheless, we shall sketch a possible analysis in the following.

The challenges discontinuous constituents pose for syntactic analysis are twofold. Firstly, an analysis needs to define possible phrase structure rules which define which parts of a constituent can function as phrases on their own. For NSh, for example, a determiner is a possible single constituent of a noun phrase, but a preposition cannot represent a full PP by itself.

Secondly, the analysis has to explain how the single phrases in the c-structure

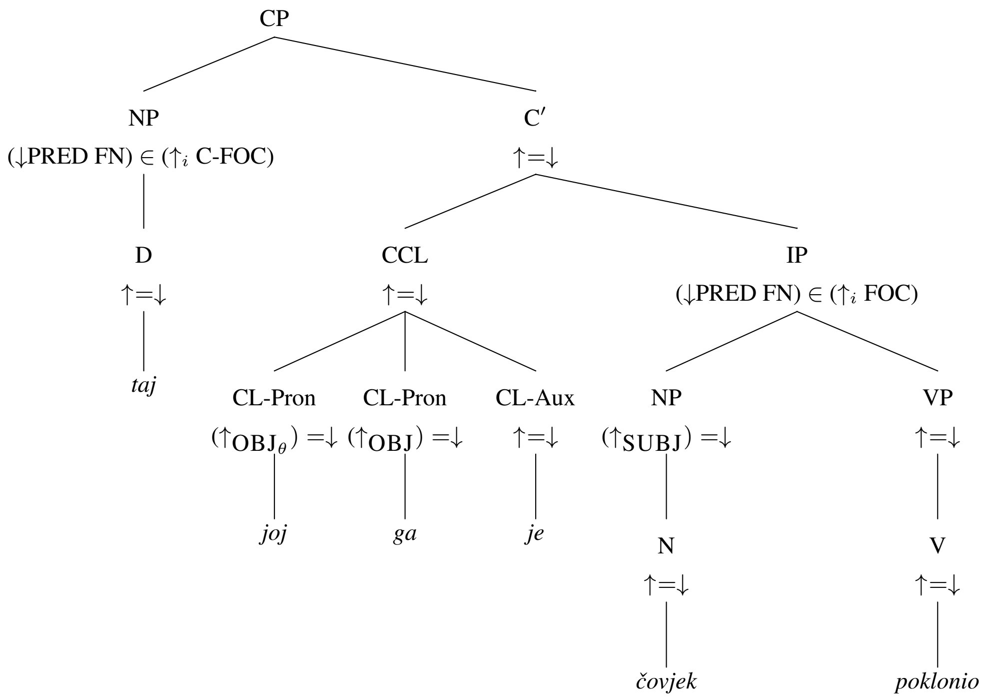

Figure 4: C-structure analysis for (16b): Clitics after the first word

can unify without PRED-value clashes in the f-structure. This question has been addressed within LFG e.g. by Nordlinger (1998) for Australian languages or by Kuhn (1999) for German. Unfortunately, the empirical basis is different in our case.

For the Australian languages discussed by Nordlinger (1998), no distinction exists between nouns and adjectives. Thus, every nominal item can either be used attributively or as a head noun. As a consequence, there are no restrictions on the phrase structure rules of discontinuous constituents.

In German, in contrast, as has been discussed by Kuhn (1999), discontinuous constituents are highly restricted. Only the head noun, or the head noun and its modifier(s) can be preposed in German. This differs from the data in NSh in which the demonstrative or the demonstrative and the nominal modifiers can be preposed. Consequently, Kuhn's (1999) analysis of the German split construction involving elliptical NPs cannot be applied to NSh.

Thus, we propose for the NSh data an alternative analysis in which we treat split-off adjectives and/or demonstratives as headless NP constructions, which in a way resemble nominalizations, but lack the *pro*-PRED-value they would have when otherwise used alone. This way, we can account for the fact that the individual parts of the split NPs can function as independent NPs while avoiding PRED value clashes in the f-structure.

Reconsidering the examples involving relative clauses in (11), we might add that in our account, (11a) is grammatical because the whole subject NP is in Topic position, whereas in (11b) only the head noun is in topic or contrastive focus position, and the relative clause would have to be assumed to be in the focus domain. This, however, would be information structurally rather odd. Alternatively, if the head noun is in topic position, the relative clause has to be right extra-posed, outside of the topic or focus domain.

Summing up, we propose a purely syntactic analysis for 2PC placement. The clitic cluster always attaches after the first syntactic constituent, which may be a topic or a contrastive focus information-structurally. The first syntactic constituent may either be a complete syntactic phrase, or a split-off part of a syntactic constituent, which then triggers a contrastive focus reading and consequently requires a specific intonational contour. In the next section we turn to even more complex cases and show how the basic analysis laid out here can account for these.

6 Further Data and Analyses

In this section we shall discuss more relevant data, which has proven to be difficult for other analyses, in particular the PI-based approaches, and show how our analysis can account for it naturally.

6.1 Clitic Third, Fourth ...

The so called sentential or second position clitics do not always have to be realized in second position in the clause (see also (3) for an example of a complex split NP). In (North-)Western NSh variants in Croatia there is a tendency for Clitic-Third (or -Fourth). Syntactic sequences like "XP V CCL ..." are very frequent in these variants. In contrast, (South-)Eastern NSh seems to show a stricter tendency for Clitic-Second, i.e. full phrases seem to be more common in NSh-variants in Dalmatia and West-Herzegovina, while 1W-constructions seem to be more frequently used in the Eastern variants.

The examples in (17) taken from the Croatian Language Corpus (CLC)[5] show constructions in which 2PCs are located in the third or fourth position in the clause. This shows that the topic constituent preceding the clitic cluster can be quite complex.

(17) a. CP V.ptc CCL ...

[5] `http://riznica.ihjj.hr`

[*Da održi koncert*] [*pozvao*] ***ga je*** *Katolički*
that hold concert call-on.ptc him be.3sg catholic
pokret za žene
organization of women

'He was invited by the catholic society for women to arrange a concert.'

b. X NP V.ptc CCL . . .

[*Oduše,*] [*hrvatski igrač*] [*isprovocirao*] ***ga je***
honestly Croatian player needle.ptc him be.3sg
startom s leđa
initially from back

'Honestly, the Croatian player was initially needling him from the back.'

c. C NP NP C NP NP AUX CCL . . .

[*Ali ni jedan ni drugi,*] [*dakle ni govoreni ni*
but not one not other, that not spoken not
pisani jezik] [*nisu*] ***mu*** *mogli biti korisni*
written language not-be.3pl him could be helpful
neposredno.
directly

'but not the one nor the other, that is not the spoken nor the written language, could have been directly useful for him'

d. C NP NEG V.imp CCL . . .

[*ali pune glave*] [*ne dadoše*] ***mu*** *mira*
but full heads not give.imp him piece

'but the full heads did not give him peace'

As suggested in Cavar and Wilder (1992), constructions like (17a) involve a fronted phrase and a participle head in C preceding the clitic cluster, i.e. so called Long Head Movement constructions. Similarly, the construction in (17b) involves an initial phrase and participle head preceding the clitic cluster, however being preceded by a pragmatic or a discourse element like *Oduše*. The constructions in (17c-d) might involve further positions preceding the clause, which we might assume to be typed as free hanging topics and extra-sentential elements.

As for our arguments and analysis, these examples show that the stipulation of second position clitic placement is problematic. The placement position involves constraints imposed by the possibility of realizing various types of topic and focus elements in the left periphery of the sentence, which again is a syntactic domain, rather than prosodic in nature.

6.2 Breakable Clitic Cluster

In this final section we present additional data on clitic clusters which supports the complex syntactic nature view of 2PC placement constraints.

It is often claimed that the clitic cluster is unbreakable in NSh. However, evidence suggests that the clitic cluster is breakable at least in certain syntactic and information theoretic contexts. A detailed analysis of this data, however, is beyond the scope of this paper.

As discussed in the previous sections, clitics usually occur in a syntactic position following contrastively focused or topicalized elements. With respect to various previous examples we mentioned the clitic cluster in NSh, referring to a group of clitics that appear together in the second position in the clause. Numerous clitics can cluster together, and their relative order seems to be subject to placement constraints. The grouping regularities in NSh are described in the slot-model in (18). This seems to be a tendency, not necessarily a strict grammatical constrained, as discussed in Cavar (1999).[6]

(18) *li* – Aux. – Dat.Pron. – Acc.Pron. – Refl.Pron. / *je* (Aux.3sg)

In complex sentences multiple clitic clusters are possible, suggesting that each clause provides a designated structural clitic cluster position, as shown in the example in (19):

(19)

Ivan	***mu***	***je***	*rekao*	*da*	***mu***	***ga***	*neće*	*dati.*
Ivan	him	be.3sg	say.ptc	that	him	it	not-want.3sg	give.inf

'Ivan told him that he will not give it to him.'

A PI-based approach would have to assume some special handling of multiple-clitic-cluster constructions, and a clause-based application of placement and inversion constraints.

The common assumption is that a clitic cluster cannot be split. The ungrammaticality of examples such as (20b) seems to support this assumption:

(20) a.

Neko	*dijete*	***mi***	***ga***	***je***	*donjelo.*
some	child	me	it	be.3sg	bring.ptc

'Some child has brought it to me.'

b.

**Neko*	***mi***	*dijete*	***ga***	***je***	*donjelo.*
some	me	child	it	be.3sg	bring.ptc

On the one hand, it seems that a placement stipulation as formulated in the context of PI would have to always uniformly apply to all 2PCs at once in the same way, rather than to individual such clitics. Thus, if one 2PC is placed after the initial syntactic constituent, all of them have to be placed there, i.e. it is not possible to

[6]Note that clitic clusters with more than two such clitics are very rare in language use data and corpora, e.g. in the Croatian Language Corpus.

place only one clitic in sentence initial position, and the others in a position after the initial syntactic constituent, otherwise (20b) should be well-formed.

In some contexts like e.g. VP-topicalization constructions, it seems to be possible to split the clitic cluster. In (21b), for example, the two clitics are separated by *auto* 'car'. This seems to be only possible when a complex ditransitive predicate or verb phrase is topicalized.

(21) a.

Ivan	***mu***	***je***	*kupio*	*auto,*	*a*	*ne*	*Stipe.*
Ivan	him	be.3sg	buy.ptc	car	and	not	S.

'Ivan has bought him a car, and not Stipe.'

b.

Kupio	***mu***	*auto*	***je***	*Ivan,*	*a*	*ne*	*Stipe.*
buy.ptc	him	car	be.3sg	Ivan	and	not	Stipe.

It seems that the pronominal verbal argument that is realized as a sentential clitic can be located in its complete syntactic and functional complex, i.e. its VP, independent of the other clitic elements. Such an observation is at least problematic for any prosodic 2PC placement model. As mentioned above, on the one hand, in a PI-based approach one would be forced to assume a uniform placement decision for all 2PCs to explain the clustering constraints and the ungrammaticality of examples like (20b). On the other hand, for examples like (21b) one would have to allow for a disjoint initial placement for the 2PCs.

Even more complex problems for PI-based approaches are illustrated by the data on clitic clusters in sentences with infinitival complements. As (22) shows, the clitics that belong to the matrix clause and to the embedded clause can be realized in all possible clitic cluster spots. The direct object clitic of the embedded clause can be realized in the matrix clause as in (22b) or in the embedded clause as in (22c). This could be seen as an instance of optional "clitic raising". In (22d), the complete embedded clause appears to be topicalized, resulting in two spots for clitic clusters as in the VP-topicalization examples above.

(22) a.

Ivan	***je***	*želio*	*čitati*	*knjigu*	*u*	*parku.*
Ivan	be.3sg	wish.ptc	read.inf	book	in	park

'Ivan wanted to read a book in the park.'

b.

Ivan	***ju***	***je***	*želio*	*čitati*	*u*	*parku.*
Ivan	it	be.3sg	wish.ptc	read.inf	in	park

'Ivan wanted to read it in the park.'

c.

Ivan	***je***	*želio*	*čitati*	***ju***	*u*	*parku.*
Ivan	be.3sg	wish.ptc	read.inf	it	in	park

d.

Čitati	***ju***	*u*	*parku*	***je***	*Ivan*	*želio.*
read.inf	it	in	park	be.3sg	Ivan	wish.ptc

Leaving a detailed explanation and discussion of these constructions to a later time, we might conclude that it appears that, what may find a straightforward syntactic explanation, imposes serious issues and problems for PI-based approaches.

7 Conclusion

We have discussed numerous arguments from the literature in favor of a prosodic analysis of 2PC placement in NSh. Given the numerous counterexamples and empirical counter evidence, we can conclude that the concept of prosodic inversion lacks empirical evidence. Thus the proposed extension of theoretical concepts at the prosodic and syntactic level is not motivated.

On the basis of the current empirical evidence we can retain the assumption that clitic placement in the relevant language(s) is syntactic in nature. The fact that some complex phrases can be realized discontinuously, imposes serious theoretical problems in various theories, but also supports the syntactic analysis of 2PC placement.

Due to space restrictions, we were only able to present a brief discussion of the empirical facts, and just sketch a theory of clitic placement and split constructions in NSh. We hope to be able to present an extended and more detailed version in the near future.

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A VERY LONG-DISTANCE ANAPHOR?

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Abstract

Yąg Dii (Niger-Congo/Adamawa-Ubangi, Cameroon; also called Duru) has a complicated pronominal system, originally described by Bohnhoff (1986), with four series of pronouns whose distribution is determined by their grammatical function and the type of clause in which they appear. One series seems to exhibit an otherwise unattested form of non-locality: at least one clause must intervene between the pronoun and its antecedent, and the presence or absence of coreferent phrases in the intervening clause does not affect its appearance or distribution. The nature of the relation between this very long-distance pronoun and its antecedent seems to violate otherwise well-established notions of locality of anaphoric relations and, indeed, of grammatical dependencies more generally. We present an analysis of the binding requirements of this anaphor that relies on features associated with different parts of its binding domain, and compare our analysis to alternatives which involve the specification of extended paths.

1 Locality in grammar

It is generally assumed that languages do not have grammatical dependencies that are exclusively nonlocal – there are no grammatical dependencies that operate at a minimal distance of two clauses away, for example (Fitzpatrick 2002, Sag 2008, among many others). In the context of anaphoric binding patterns, this assumption amounts to the claim that anaphors never ignore their local context. This is the *Locality Condition* of Dalrymple (1993), stated as: "binding constraints ... always refer to local elements, never exclusively to nonlocal ones", and the *subset principle* of Manzini and Wexler (1987) for anaphoric binding domains, stating that smaller potential binding domains are always properly contained in larger ones.

Anaphoric binding patterns in Yąg Dii appear to run counter to these standardly accepted generalisations. There are several series of pronouns in Yąg Dii, one of which, glossed 2LD in the following, requires a very long-distance binder. In example (1), 2LD appears as the subject of a subordinate clause (*he repay the IOU*) which is itself contained within a subordinate clause (*his friend asked him that he repay the IOU*); 2LD must be bound by the main clause subject, two clauses away:[1]

[†]I am grateful to Lee Bohnhoff (personal communication, October 1991) for providing corrections to mistakes in transcriptions and indices for the examples taken from Bohnhoff (1986), additional examples, and helpful comments on the patterns discussed here. For comments on this paper, I am grateful to Ash Asudeh, Miriam Butt, Tracy Holloway King, Jean-Marie Marandin, the audience at "Ling Lunch" Paris Diderot, June 2011, and the audience at LFG11, particularly Louisa Sadler and Doug Arnold.

[1]The form glossed CM is a clause-final particle.

(1) Nán ba’ad ∅ ’ǫ̀ [moo ’ȩ̀ǹ dà bì tóó bà ka vì bi
man work (he$_i$) say for what friend his.LD$_i$ other that sb-he$_j$ ask him.LD$_i$
[bà ’ìi sʉ́ʉ́wʉ ’ʉ́lá]]?
that he.2LD$_i$ repay.him$_j$ CM-Q
‘The worker$_i$ asked why his.LD$_i$ friend asked him.LD$_i$ that he.2LD$_i$ repay the IOU.’ (corrected version of Bohnhoff, 1986, 119)

(2)
$$\left[\begin{array}{ll} \text{PRED} & \text{say} \\ \text{SUBJ} & [\text{worker}]_i \\ \text{COMP} & \left[\begin{array}{ll} \text{PRED} & \text{ask} \\ \text{SUBJ} & [\text{his.LD}_i \text{ friend}] \\ \text{OBJ} & [\text{LD}]_i \\ \text{COMP} & \left[\begin{array}{ll} \text{PRED} & \text{repay} \\ \text{SUBJ} & [\text{2LD}]_i \end{array}\right] \end{array}\right] \end{array}\right]$$

The 2LD pronoun can be used whether or not there is a coreferential pronoun in the intervening clause. As in (1), there is a coreferential subject in the immediately higher clause in example (3), but not in the equally acceptable example in (4):

(3) Bà’á ∅ gàà [[sèỳ ìi làà tée] bà bíń hǫ̀ hẹn
Papa$_i$, (he$_i$) knows time he.2LD$_i$ goes when, that he.LD$_i$.will see thing
Múúsà wòò]
Moses his
‘Papa$_i$ knows that when he.2LD$_i$ goes, he.LD$_i$’ll see Moses’s thing.’
(L. Bohnhoff, p.c.)

(4) Bà’á ∅ gàà [[kóó ìi lúu ní sį̀’] bà míń hǫ̀ hẹn
Papa$_i$, (he$_i$) knows time he.2LD$_i$ leave NEG even, that I.will see thing
Múúsà wòò]
Moses his
‘Papa$_i$ knows that even if he.2LD$_i$ doesn’t leave, I’ll see Moses’s thing.’
(L. Bohnhoff, p.c.)

(5)
$$\left[\begin{array}{ll} \text{PRED} & \text{know} \\ \text{SUBJ} & [\text{Papa}]_i \\ \text{COMP} & \left[\begin{array}{ll} \text{PRED} & \text{see} \\ \text{SUBJ} & [\text{he.LD}_i/\text{I}] \\ \text{OBJ} & [\text{thing}] \\ \text{ADJ} & \left\{\left[\begin{array}{ll} \text{PRED} & \text{leave} \\ \text{SUBJ} & [\text{2LD}]_i \end{array}\right]\right\} \end{array}\right] \end{array}\right]$$

Thus, the 2LD pronoun is an exceptionally long-distance anaphor, and seems to exemplify an exclusively nonlocal dependency: it must corefer with a subject at least two clauses distant, and its distribution is not affected by the presence or absence of intervening potential binders.

Binding patterns for the 2LD pronoun may appear similar to familiar patterns of switch reference, where clauses are marked to indicate coreference between arguments, often subjects, of two different clauses. Haiman and Munro (1983) provide example (6) from Pima, citing Langdon and Munro (1979) and personal communication from Etheleen Rosero. The morpheme glossed SS enforces coreference between the subject of *cry* and the subject of *hit*, while the DS morpheme indicates that the subjects of the two verbs are not coreferent:

(6) a. Hegai 'uuvi 'a-t 'am ṣohñi hegai ceoj c 'am ṣoṣa.
that woman 3-perf hit that man SS cry
'The woman$_i$ hit the man and she$_i$ cried.'

b. Hegai 'uuvi 'a-t 'am ṣohñi hegai ceoj ku-t (hegai ceoj) 'am ṣoṣa.
that woman 3-perf hit that man DS that man cry
'The woman hit the man$_i$ and he$_i$ (the man) cried.'
(Pima; Haiman and Munro, 1983, x)

Like other anaphoric processes, however, and unlike 2LD, switch-reference always operates locally: according to Haiman and Munro (1983, xiii), "there seem to be no languages ... in which switch-reference is marked *exclusively* between non-adjacent clauses. Thus, if a language has switch-reference marking between non-adjacent clauses, it will also mark switch-reference between adjacent clauses."

2 PRON and SUBORD pronouns

Yag̨ Dii has four distinct series of pronouns, each with a different distribution. First, there is a basic series of subject, object, and possessive pronouns, which we will gloss as PRON; Bohnhoff calls this the *mí* series, after the first person subject and object forms. Second, there is a series of SUBORD pronouns for use in subject position of certain main clauses as well as many subordinate clauses. The PRON and SUBORD pronoun paradigms are given in Table 1. The discontinuous 1incl.pl form *ba...ví* can be interrupted by the verbal complex (the verb or series of serial verbs and any object pronouns). Besides these forms, subject forms in the PRON series (but not the SUBORD series) can appear with suffixes indicating future or nonfuture tense. There are also emphatic forms corresponding to each member of the subject PRON, future subject PRON, and SUBORD series, and there is a separate series of possessive affixes for use with kinship terms; see Bohnhoff (1986) for further discussion of these forms. For present purposes, it will be sufficient to distinguish the members of the PRON and SUBORD series that are listed in Table 1.

The choice of PRON vs. SUBORD subject pronoun form depends only on the syntactic environment, and is not determined by requirements of coreference

	PRON subject	PRON object	PRON possessive	SUBORD subject
1.sg	-n/mí	-n/mí	míí	’àǹ
1incl.dual	ba	ba	bàà	ba
2.sg	-m/mɔ́	-m/mɔ́	móó	’àm̀
3.sg	∅	-wʉ	wòò	’à
1excl.pl	vɔ́	vɔ́	vóó	’òo
1incl.pl	ba...ví	ba ví	bàà ví	ba...ví
2.pl	ví	ví	víí	’ì
3.pl	vʉ	vʉ	vòò	’ʉ̀u

Table 1: PRON and SUBORD pronouns, from Bohnhoff (1986, 107,109,110).

	main clauses	subordinate clauses
PRON:	imperfective-factative, perfective-factative	indirect quotation, comparison clauses, causal adjuncts (“because...”) introduced by *moo*, ‘until’ adjuncts
SUBORD:	imperfective-hortative	indirect order, relative clause, temporal/locative/conditional clause, purpose clause, concessive clause, causal adjunct introduced by *ka* or *bà*

Table 2: Distribution of PRON and SUBORD subject pronouns, from Bohnhoff (1986, 107-108).

or noncoreference with an element of the main clause. The subject PRON and SUBORD pronouns are in complementary distribution, as detailed in Table 2. In examples (7)–(10), the basic PRON subject, object, and possessive pronouns are used:

(7) Imperfective-factative:
Mɔ́ làà kaalɨ́
you.PRON go to.town
‘You go to town.’ (Bohnhoff, 1986, 107)

(8) Indirect quotation:
... bà mɔ́ làà kaalɨ́
that you.PRON go town.to
‘... that you go to town.’ (Bohnhoff, 1986, 107)

(9) Mí hǫ̀ ví ’ú
I.PRON see you.Pl.PRON CM
‘I see you.’ (Bohnhoff, 1986, 110)

(10) Mí hǫ̀ lig móó sʉ́’ʉ́
I.PRON see house your.Sg.PRON already
‘I saw your house already.’ (Bohnhoff, 1986, 110)

Examples (11) and (12) require the SUBORD subject form. We will refer to the domain in which the SUBORD form is used as the SUBORD domain:

(11) Imperfective-hortative:
’Àm̀ làà kaalɨ́
you.SUBORD.must go town.to
‘Go to town!’ (Bohnhoff, 1986, 108)

(12) Temporal/locative/conditional:
Tòẁ/sè’èy/ya ’àm̀ làà kaalɨ́ tée
if/when/where you.SUBORD go town.to demonstrative
‘If/when/where you go to town...’ (Bohnhoff, 1986, 108)

SUBORD pronouns are found only in subject position; there is no separate SUBORD series of nonsubject pronouns.

The choice between PRON and SUBORD subject pronouns is not governed by requirements of coreference or noncoreference with an element of the main clause. Though the SUBORD domain is often a subordinate clause, a SUBORD pronoun is required as the main clause subject in examples (11) and (13):

(13) ’Àǹ làà kaaláa?
must.I.SUBORD go town.to.Q
‘Must I go to town?’ (Bohnhoff, 1986, 107)

In (14), the SUBORD pronoun appears within the complex clausal complement of the main verb *say*. It does not corefer with any argument in the immediately higher clause, though it is coreferent with an argument in the main clause:

(14) Nà’á ∅ ’ǫ̀d bà’á [[sè’èy bà ’à fíí ya
Mother$_i$ (she$_i$) says.to Father$_j$ time that he.SUBORD$_j$ returns comes
babbɨ́ tée] bà bíń dəə̀ dʉbbɨ̀]
field.from then] that she.LOG$_i$ cook yam.CM
‘Mother$_i$ says to Father$_j$ that when he$_j$ returns from the field, she$_i$ will cook the yams.’ (corrected version of Bohnhoff, 1986, 122)

(15)
$$\left[\begin{array}{ll}
\textsc{pred} & \text{say} \\
\textsc{subj} & [\text{mother}]_i \\
\textsc{obj} & [\text{father}]_j \\
\textsc{comp} & \textit{ld}\left[\begin{array}{ll}
\textsc{pred} & \text{cook} \\
\textsc{subj} & [\text{LD}]_i \\
\textsc{obj} & [\text{yams}] \\
\textsc{adj} & \left\{ \textit{subord}\left[\begin{array}{ll} \textsc{pred} & \text{return} \\ \textsc{subj} & [\text{SUBORD}]_j \end{array}\right] \right\}
\end{array}\right]
\end{array}\right]$$

Example (16) is structurally similar to (14), but it contains two SUBORD pronouns. The SUBORD pronoun subject of *return* corefers with the SUBORD pronoun subject of *cook* in the immediately higher clause as well as with a nonsubject in the main clause:

(16)

Nà'á	∅	'ǫ̀d	bà'á	[[sè'èy	bà	'à	fíí	ya
Mother$_i$	(she$_i$)	says.to	Father$_j$	time	that	he.SUBORD$_j$	returns	comes

babbɨ́	tée]	bà	'à	də̀ə̀	dʉbbɨ̀]
field.from	then]	that	he.SUBORD$_j$	cook	yam.CM

'Mother$_i$ says to Father$_j$ that when he$_j$ returns from the field, he$_j$ should cook the yams.' (corrected version of Bohnhoff, 1986, 122)

(17)
$$\left[\begin{array}{ll}
\textsc{pred} & \text{say} \\
\textsc{subj} & [\text{mother}]_i \\
\textsc{obj} & [\text{father}]_j \\
\textsc{comp} & \textit{ld}\left[\begin{array}{ll}
\textsc{pred} & \text{cook} \\
\textsc{subj} & [\text{SUBORD}]_j \\
\textsc{obj} & [\text{yams}] \\
\textsc{adj} & \left\{ \textit{subord}\left[\begin{array}{ll} \textsc{pred} & \text{return} \\ \textsc{subj} & [\text{SUBORD}]_j \end{array}\right] \right\}
\end{array}\right]
\end{array}\right]$$

Thus, the choice of PRON or SUBORD pronoun forms is determined in purely structural terms: clauses of particular types require the SUBORD form of the subject pronoun rather than the PRON form.

3 LD pronouns

Besides the PRON and SUBORD series, Yąg Dii has a third series of bound pronouns which are used only in certain subordinate domains to corefer with a subject in a higher clause. We will gloss these pronouns with the label LD. Table 3 augments the patterns in Table 1 with the nonemphatic subject, object, and possessive LD forms. As with the PRON forms, LD forms can appear with suffixes for future and nonfuture tense, and there is a separate series of possessive forms for use with kinship terms; see Bohnhoff (1986) for the complete paradigms.

According to what Bohnhoff (1986, 112) calls the *reference condition*, the LD pronoun appears in a restricted set of subordinate clauses which we will call the LD

	PRON subject	PRON object	PRON possessive	SUBORD subject	LD subject	LD object	LD possessive
1.sg	-n/mí	-n/mí	míí	’àǹ	bi	-n/mí	míí
1incl.dual	ba	ba	bàà	ba	bi	ba	bàà
2.sg	-m/mɔ́	-m/mɔ́	móó	’àm̀	bi	bi	bìì
3.sg	∅	-wʉ	wòò	’à	bi	bi	bìì
1excl.pl	vɔ́	vɔ́	vóó	’òo	bi	vɔ́	vóó
1incl.pl	ba...ví	ba ví	bàà ví	ba...ví	bi	ba ví	bàà ví
2.pl	ví	ví	víí	’ì	bi	bi	bìì
3.pl	vʉ	vʉ	vòò	’ʉ̀u	bi	bi	bìì

Table 3: Pronouns including LD forms, from Bohnhoff (1986, 107,109,110,113).

	main clauses	subordinate clauses
SUBORD only:	imperfective-hortative	relative clause, concessive clause, temporal/locative/conditional clause
LD only:		indirect quotation, subordinate desiderative
both SUBORD and LD allowed:		indirect order, purpose clause, causal adjunct introduced by *ka* or *bà*

Table 4: Distribution of LD and SUBORD subject pronouns.

domain, and must be bound by the grammatical subject of the clause immediately containing the LD domain, which we will call the LD antecedent. In (18), the LD domain is the subordinate clause *they go to town*, and the LD antecedent is the subject of the matrix verb *want*:

(18) Vʉ hį́į [bi làà kaalɨ́]
they.PRON$_i$ want they.LD$_i$ go town.to
‘They want to go to town.’ (corrected version of Bohnhoff, 1986, 113)

Bohnhoff (1986, 112) shows that the LD domain consists of indirect quotations, subordinate desiderative clauses, indirect orders, purpose clauses, and causal adjuncts introduced by *ka* or *bà*. As shown in Table 4, there is some overlap between the LD domain and the SUBORD domain. Where either pronoun can be used, the LD pronoun is used when coreference with the LD antecedent is intended; when noncoreference is intended, the SUBORD form must be used. In contrast with example (18), the SUBORD form is used in example (19), since the pronoun appears in subordinate subject position and the subordinate clause is an indirect order, one of the environments in which the LD domain and the SUBORD domain overlap.

(19) Vʉ hį́į [’ʉ̀ʉ làà kaalɨ́]
they.PRON$_i$ want they.SUBORD$_{*i,j}$ go town.to
‘They want others to go to town.’ (Bohnhoff, 1986, 114)

Bohnhoff provides example (20) to show that the LD pronoun must be bound by the *closest* LD antecedent. The verbs *say* and *tell* both introduce an LD domain, since their complements are indirect quotations. However, example (20) is not ambiguous; the antecedent of the LD pronoun must be Moses, the closest eligible LD antecedent, and not Mother:

(20) Nà’á ∅ ’ọ̀d bà’á [Múúsa bà ∅ ’ọ̀ [bà biǹ hį́į̧
Mother$_i$ (she$_i$) says.to Father Moses$_j$ that (he$_j$) says that he.LD$_{j,*i}$ wants
lààlɨ́ kaalɨ́]]
to.go to.town
‘Mother$_i$ tells Father that Moses$_j$ says that *she$_i$/he$_j$ wants to go to town.’
(Bohnhoff, 1986, 118)

Unlike the SUBORD pronoun, whose appearance is restricted to subject position, the LD pronoun may appear as a subject, object, or possessor within the LD domain. In example (21), the object of the subordinate verb *refuses* is a LD pronoun whose antecedent is the subject of the matrix verb *attack*:

(21) Yọ̀ọb vʉ kɔ́ ’à’á [bà hą́ŋ́ bi
ancestor.spirits$_i$ they.PRON$_i$ attack grandmother because.she refuses them.LD$_i$
nannè]
food
‘Ancestor spirits$_i$, they$_i$ attack grandmother because she refuses them$_i$ food.’
(Bohnhoff, 1986, 115)

In example (22), both the subordinate subject and the possessor of the object are LD pronouns:

(22) vʉ hį́į̧ [bi mbàà kan yúú bìì nu]
they.PRON$_i$ want they.LD$_i$ sit with head their.LD$_i$ CM
‘They$_i$ want to sit with their$_i$ head.’ (= ‘They want to be independent.’)
(Bohnhoff, 1986, 116)

The LD domain is not defined by properties typically associated with logophoricity, though its roots are likely based in an earlier logophoric system: Bohnhoff (1986, 112) observes that clauses constituting the LD domain “all may have been derived from underlying quotes”. Culy (1997) discusses the extension of logophoric marking from typical logophoric domains such as reported speech, thought, or perception to adjuncts such as purpose clauses and causal clauses, and proposes that this is the result of grammaticisation of an original logophoric system; this seems to be the case for Yą̧g Dii. As Bohnhoff (1986, 113) notes, the LD domain “does not seem to be limited to contexts containing a performative verb, nor to a desiderative context, nor do such pragmatic/semantic notions as source/receiver of the information seem to govern the use of the series”. Nonsubject antecedents of LD pronouns are not permitted. Further, constructions that seem to have very similar meanings vary as to whether they introduce a LD domain: for example, causal constructions introduced by *ka*/*bà* constitute a LD domain (example 21), while causal constructions with *moo*, as in example (23), do not:

(23) Cause with *moo*:
Vʉ yaa bi mà”ǫ lùù ’ú, [moo vʉ ’ǫ̀
they.PRON$_i$ come, they.LD$_i$ grab.him leave CM, because they.PRON$_i$ say
bà yą̀ŋŋè]
that.he crazy.CM
‘They$_i$ came to take him away, because they$_i$ said that he’s crazy.’
(Bohnhoff, 1986, 115-116)

The PRON pronoun is used as the subject of the subordinate clause *because they say that he’s crazy* because this is neither a LD domain nor a SUBORD domain: only causal constructions with *ka*/*bà* allow LD or SUBORD pronouns, not causal constructions with *moo*.

Morphosyntactically, the LD domain is usually marked either by the subordinator/complementiser *bà* or by the presence of a particular lexical predicate in the immediately higher clause; Culy (1997) discusses the importance of marking by particular complementisers in defining the logophoric domain in many languages. Subordinate purpose clauses seem to constitute an exception to this generalisation, since they do not contain special marking to indicate the LD domain, and need not appear with a particular predicate in the immediately higher clause; it may be that these are positionally encoded:

(24) Subordinate purpose clause:
Bà’á ∅ nə’əy hághá [bi hǫ̀ pʉ́ggɨ̀]
Father$_i$ (he$_i$) bends down he.LD$_i$ sees animal.CM
‘Father bends down to see the animal.’
(corrected version of Bohnhoff, 1986, 114)

Example (18) contains a subordinate desiderative clause, signalled by the presence of the verb ‘want’ in the matrix clause. Example (21) contains a causal adjunct with the subordinator/complementiser *bà*. Indirect quotations are also introduced by *bà*:

(25) Indirect quotation:
Bà’á ∅ ’ǫ̀ [bà bíń láá kɔ̀ddɨ̋]
Father$_i$ (he$_i$) says that he.LD$_i$.will go forest.to
‘Father$_i$ says that he$_i$ will go to the forest.’
(corrected version of Bohnhoff, 1986, 114)

In fact, indirect discourse may consist of a number of clauses, as in (26):

(26) ... vʉ ọd Yésù: “Bà’á, ɨ́ nii vóó ∅ bà’ vɔ́ ya, moo òo
they say-to Jesus: Sir, the.one elder$_i$ our (he$_i$) send us come, so we
ọd ví biǹ màan bà vín dɔ́n kíi bììlí né.
say.to you that.he.LD$_i$ is.worthy that you enter house his.LD$_i$.in NEG.

Mo wòò nɔ mà, biǹ yaan kan fǫ́ǫ́ bìì ní yę̀ nɔ.
for that CM then that.he.LD$_i$ come.NEG with body his.LD$_i$ NEG here CM

Ą̀máa bà ì ǫ̀ moo yǫŋ dágá sį̀’, nán bìì yę̀ bàn zą̀ą̀ ǫ́.
but that you say word cheek one only man his.LD$_i$ this that.he heals CM

Moo bi ą́ḿ, bà biǹ kìd ɨ́ nii bìì vʉ tɔ́ggʉ́,
for he.LD$_i$ too that he.LD$_i$ hear.to the.one elder his.LD$_i$ plural ear.CM
bà biǹ dɨ kan sǫ́ǫ́ze bìì bà kʉʉ kìd bi tɔ́g máa vʉ
that he.LD$_i$ is.there with soldier his.LD$_i$ that they hear him.LD$_i$ ear this pl
ą́ḿ.
too

Bà ìi ọd dágá: “Ą̀m̀ làà ʉ́” tée, bàn làà.
that if.he.2LD$_i$ say-to one: You go CM if, that.he go

Bà ìi ọd tóó: “Ą̀m yaa ʉ́” tée, bàn yaa.
that if.he.2LD$_i$ say-to another: You come CM if, that.he come

Bà ìi ọd nán ba’ad bìì: “Ą̀m̀ kɔ́ hẹn yę̀ nɔ” tée
that if.he.2LD$_i$ say-to man work his.LD$_i$: You do thing this CM, then
bàn kɔ́ ʉ́.
that.he do CM

‘...they say to Jesus: “Sir, our elder$_i$ has sent us to you, to say to you that he$_i$ isn’t worthy for you to enter his$_i$ house. That’s why he$_i$ hasn’t come here himself$_i$. But even if you simply say a single word, his$_i$ worker will be healed. For he$_i$ too says that he$_i$ takes orders from his$_i$ superiors; that he$_i$ has his$_i$ soldiers that take orders from him$_i$, too. That if he$_i$ says to one: “Go!”, then he will go. That if he$_i$ says to another: “Come!”, he will come. That if he$_i$ says to his$_i$ worker, “Do this!”, he will do it.’ (L. Bohnhoff, p.c.)

Each clause in these multi-clause indirect discourse segments is marked with the subordinator/complementiser *bà*. We analyse these examples as subordination to an unpronounced main clause predicate, with only the subordinate LD domain realised. An alternative analysis might treat these in terms of a morphologically marked main-clause LD domain interpreted as indirect discourse (see Dimmendaal 2001 for more discussion). Under the second analysis, indirect discourse clauses as in (25) and (26) would differ from the other LD domains in that no syntactic relation would be required between the LD antecedent (which would not be syntactically present in the clause) and the LD pronoun; instead, indirect discourse would have to be analysed specially, as true logophoricity, different from the other syntactically defined instances of the LD domain. For uniformity, and in the absence of evidence that the conditions governing these multi-clause examples are different from the other examples, we assume that subordination is involved, with an unpronounced main-clause predicate.

An orthogonal issue related to determination of the LD antecedent is raised by Bohnhoff's claim that the LD antecedent must be the *pronoun* subject of the immediately higher clause, which, on his analysis, is always present but sometimes unpronounced. This would make Yąg Dii a pronoun-incorporating language in the sense of Jelinek (1984): on this view, the subject of every clause is a (possibly unpronounced) pronominal, and what appears to be a full non-pronominal subject is treated as a dislocated topic or apposition to the pronoun. In fact, it is likely that full non-pronominal subject phrases are best treated as subjects and not topics or appositions, with unpronounced pronominal subjects posited only when there is no overt subject phrase (see Austin and Bresnan 1996 for a thorough discussion of differences between these two analyses and arguments against the Jelinek view). The choice between the two analyses does not affect the analysis of overt pronouns in the language, and so for clarity and consistency with Bohnhoff's presentation of examples, we include unpronounced pronouns (represented as $\emptyset$) in some examples, though we do not intend this as a claim that unpronounced pronominal forms are actually present in the structure.

4 Subordinate clause LD pronouns: 2LD

Our primary interest is a fourth series of pronouns which we will label 2LD, characterised above as the "very long-distance" series, as shown in Table 5. Like the LD series, 2LD pronouns appear in the LD domain and must corefer with the LD antecedent. Like the SUBORD series, they are used only in subject position of certain subordinate clauses within the LD domain. There are no 2LD object or possessive pronouns. As shown in examples (3) and (4), the 2LD pronoun neither requires nor disallows a coreferential pronoun in the intervening clause in the LD domain. 2LD is, then, an exceptionally long-distance anaphor, whose binding conditions seem to be exclusively nonlocal: it must appear as the subject of an embedded clause within the LD domain, and it must corefer with a subject outside the LD domain, at least two clauses distant, without imposing any binding requirements in the intervening clause.

There are clear morphological parallels between the 2LD series and the SUBORD series, as is evident from inspection of the paradigms in Table 5. Their distribution is also closely related; indeed, Bohnhoff (1986, 123) states that "in the same way that *'àǹ* [SUBORD] subjects are used instead of *mì* [PRON] subjects in certain clauses, so *'ìi* [2LD] subjects occur instead of *bi* [LD] subjects in (some of) those same grammatical contexts". In fact, in light of additional data unavailable to Bohnhoff at the time the article was written, constraints on the distribution of 2LD seem to be very close or identical to those for the SUBORD subject pronoun: 2LD

	PRON	SUBORD	LD	2LD
1.sg	-n/mí	’àǹ	bi	’àǹ
1incl.dual	ba	ba	bi	’aa
2.sg	-m/mɔ́	’àm̀	bi	’ìi
3.sg	∅	’à	bi	’ìi
1excl.pl	vɔ́	’òo	bi	’òo
1incl.pl	ba...ví	ba...ví	bi	’aa...ví
2.pl	ví	’ì	bi	’ìi
3.pl	vʉ	’ʉ̀u	bi	’ìi

Table 5: Subject pronouns of all four pronoun types, from Bohnhoff (1986, 107,113,120).

appears as the subject of a relative clause, temporal/locative/conditional clause, concessive clause, indirect order, purpose clause, or causal adjunct (though there are no available data that allow a determination of whether 2LD is limited to causal adjuncts introduced by *ka* or *bà*, as in the case of the SUBORD pronoun series). Bohnhoff does not provide examples of 2LD as the subject of a purpose clause or a causal adjunct, though he states that it can appear there. In fact, however, he notes (p. 121) that in some clauses, either the LD or the 2LD pronoun may appear: “Initial concessive and cause clauses for many speakers simply retain the *bi* [LD] forms, although some examples of *’ii* [2LD] may also be heard.” Example (27) shows 2LD as the subject of a relative clause within the LD domain:

(27) ... ví ọd í kíi àgà: “Àkàw ∅ ọ̀ [lig [bà ìi
you say.to the.one house self: “Teacher$_i$ (he$_i$) say house that he.2LD$_i$
lá hẹn lálɨ́ páska kan waa duulí bìì vʉ wʉlɨ́ máa] bà
eat thing eating Easter with child following his.LD$_i$ plural there when, that.it
dɨ tɛ́lá?]”
is.there where?”
‘... you’ll ask the house owner: “The teacher asks, where is the house in which he.2LD will eat the Easter meal with his disciples?”’ (L. Bohnhoff, p.c.)

In (28), 2LD is the subject of a temporal adjunct clause in initial position within the LD domain:

(28) ∅ ’ọ̀ [[sè’èy bà ’ìi là fíí ya babbɨ́ tée] bà
(she$_i$) says time that she.2LD$_i$ goes returns comes field.from when, that
bíń dә̀ә̀ gbɔkìì]
she.LD$_i$.will cook pigeon
‘She$_i$ said that when she.2LD$_i$ returned from the field, she.LD$_i$ would cook the pigeon.’
(Bohnhoff, 1986, 121)

Another example of a temporal/locative/conditional clauses with 2LD is given in (3), a concessive clause with 2LD subject is given in (4), and an indirect order with 2LD subject is given in (1).

5 Standard binding theory and 2LD

The following generalisations govern the distribution of the four Ya̧g Dii pronoun series:

(29) **PRON:** can bear any grammatical function, except for subject in SUBORD domain; noncoreferent with LD antecedent if in LD domain

SUBORD: must appear as subject in SUBORD domain; noncoreferent with LD antecedent if in LD domain

LD: must appear in LD domain; can bear any grammatical function (except for subject in SUBORD domain within LD domain); coreferent with LD antecedent

2LD: must appear as subject in SUBORD domain within LD domain; coreferent with LD antecedent

The status of the parenthesised portion of the condition on LD reflects the uncertainty discussed at the end of the previous section: in at least some SUBORD clauses within the LD domain, either LD or 2LD can appear, but it is not clear whether the LD and 2LD pronouns are in free variation in all SUBORD domains.

It is not possible to capture the very long-distance nature of the binding constraints on the 2LD pronouns by means of standard binding-theoretic constraints. 2LD does not behave like a standard pronominal, in that it does not obey only a negative binding condition such as Binding Condition B (a pronominal must be free in its governing category: Chomsky 1981). 2LD pronouns require an antecedent in the same sentence, unlike pronominals, and cannot appear without an antecedent (setting aside the extended indirect discourse examples, which must be marked with *bà* and which we have proposed to treat as involving an unpronounced main clause subject and predicate). Of course, 2LD does not behave like a standard anaphor either, since it is not locally bound. To ensure the presence of a nonlocal antecedent, we might attempt to state the binding requirements for 2LD as a combination of a local noncoreference requirement (as we expect to find with pronominals) and a nonlocal coreference requirement (as we find with long-distance reflexives): that is, 2LD would be an overt pronominal anaphor, which must be locally free but bound in a larger domain, as originally suggested for Malayalam *t̲aan* by Mohanan (1981) (see also Dalrymple 1993 and Kiparsky 2002). Mohanan (1981) provides examples (30a) and (30b) to show that *t̲aan* must be bound, and example (30c) to show that the binder of *t̲aan* may not be a coargument of the same predicate – that is, *t̲aan* must be bound within the sentence in which it appears, but may not be locally bound:

(30) a. *ṯaan aanaye n̲uḷḷi
self.NOM elephant.ACC pinched
'Self pinched the elephant.' (Malayalam; Mohanan, 1981, 13)

b. [ṯaan aanaye n̲uḷḷi en̲n̲ə] kuṭṭi r̄aajaawinooṭə mar̄an̄n̄u
self.NOM elephant.ACC pinched that child king.DAT said
'The child$_i$ told the king that self$_i$ pinched the elephant.'
(Mohanan, 1981, 17)

c. *moohan ṯaane aar̄aad̲hik'k'un̲n̲u
Mohan self.ACC worships
'Mohan$_i$ worships himself$_i$.' (Mohanan, 1981, 15)

Such an approach will not produce the right result for 2LD, however. We cannot ensure that the antecedent of 2LD appears at least two clauses removed by requiring 2LD to be free in the LD domain but bound in a larger domain, since 2LD can appear whether or not there is a potential binder in the LD domain, as shown in (3) and (4).

6 The LD requirement

LFG binding requirements are generally stated in terms of binding equations as shown in (31), where $\uparrow$ is the f-structure of the pronoun, and $\uparrow_\sigma$ is the semantic structure corresponding to $\uparrow$:

(31) $$(\uparrow_\sigma\ \text{ANTECEDENT}) = ((\underset{\substack{\text{DELIMITS}\\ \text{BINDING}\\ \text{DOMAIN}}}{\text{GF}^*}\quad \underset{\substack{\text{GRAMMATICAL}\\ \text{FUNCTION OF}\\ \text{PRONOUN}}}{\text{GF}_{\text{pro}}}\quad \uparrow)\quad \underset{\substack{\text{GRAMMATICAL}\\ \text{FUNCTION OF}\\ \text{ANTECEDENT}}}{\text{GF}_{\text{ant}}}\ )_\sigma$$

This constraint requires the pronoun $\uparrow$ to appear at the end of the binding path $\text{GF}^*\ \text{GF}_{\text{pro}}$. The antecedent of the pronoun bears the grammatical function GF_{ant}.

(32) $$\begin{bmatrix} \text{GF}_{\text{ant}} & [\text{ANTECEDENT}] \\ \ldots\ \text{GF}^*\ \ldots & \text{GF}_{\text{pro}}\ \ [\text{PRONOUN}] \end{bmatrix}$$

The binding equations can be further specialised to encode particular binding requirements. For example, the binding equation in (33) uses the off-path constraint $\neg(\rightarrow \text{TENSE})$ to require the pronoun to find its antecedent in the minimal finite domain containing the pronoun; the off-path constraint prevents the path through the binding domain from passing through an f-structure with the attribute TENSE:

(33) $$(\uparrow_\sigma\ \text{ANTECEDENT}) = ((\underset{\neg(\rightarrow\ \text{TENSE})}{\text{GF}^*}\quad \text{GF}_{\text{pro}}\ \uparrow)\quad \text{GF}_{\text{ant}})_\sigma$$

(34) $\left[\begin{array}{llll} \text{GF}_{ant} & [\text{ANTECEDENT}] & & \\ \ldots & \text{GF}^{*} & \ldots & \text{GF}_{pro}\ [\text{PRONOUN}] \\ & \text{DOES NOT PASS THROUGH AN F-STRUCTURE WITH A TENSE ATTRIBUTE} & & \end{array}\right]$

For more discussion of LFG's binding theory, see Dalrymple (1993), Bresnan (2001), and Asudeh (2004).

For the Yąg Dii LD pronouns, we propose that the clause that contains the LD domain and the LD antecedent – the **binding domain** for the LD pronoun – is marked with the attribute-value pair ⟨LD-ANT,+⟩. This marking is enforced by the predicate or construction which defines the subordinate domain as an LD domain (the main clause predicate whose complement is an indirect quotation, subordinate desiderative, or indirect order; the *ka* or *ba* marking on causal adjuncts; or the c-structure rule marking a subordinate clause as a purpose clause):

(35) $\left[\begin{array}{ll} \text{SUBJ} & [\text{LD antecedent}] \\ \text{LD-ANT} & + \\ \text{COMP} & [\ldots\text{LD pronoun} \ldots] \end{array}\right]$

It is important to note that the LD-ANT domain is not what we have been calling the LD domain; instead, it is the clause containing both the LD domain and the LD antecedent. We can now state the requirements for the LD pronouns with some minimal modifications to the form of the standard binding equations:

(36) $(\uparrow_{\sigma}\ \text{ANTECEDENT}) = ((\underset{\substack{\neg(\rightarrow\ \text{LD-ANT})\\ 1}}{\text{GF}^{*}}\quad \underset{\substack{\neg(\leftarrow\ \text{LD-ANT})\\ 2}}{\text{GF}_{pro}}\ \uparrow)\quad \underset{\substack{(\leftarrow\ \text{LD-ANT})\\ 3}}{\text{SUBJ}}\ )_{\sigma}$

1. the clause containing the LD antecedent is the **smallest** clause marked with LD-ANT that also contains the pronoun (the path through the binding domain to the LD pronoun may not pass through a clause with LD-ANT marking);

2. the clause containing the LD pronoun cannot have LD-ANT marking (LD pronouns are not bound by a clausemate);

3. the ANTECEDENT of the pronoun is the SUBJ of a clause with LD-ANT marking.

This combination of constraints encodes the binding requirements for the LD pronoun, and enforces an appropriate degree of nonlocality. The antecedent of the LD pronoun is not a clausemate (since the antecedent must appear in an LD-ANT-marked clause, and the LD pronoun may not appear in an LD-ANT-marked clause): the antecedent must be the subject of the LD-ANT-marked clause which properly contains the LD domain in which the LD pronoun appears.

7 The SUBORD requirement

We propose that the SUBORD domain is marked as $\langle$SUBORD,$+\rangle$.

(37) $\begin{bmatrix} \text{SUBJ} & [\text{SUBORD PRONOUN}] \\ \text{SUBORD} & + \end{bmatrix}$

SUBORD pronouns require the presence of that feature, while PRON pronouns are incompatible with that feature. As with the LD feature, this marking is enforced by the main clause predicate or construction defining the domain as a SUBORD domain. We can then enforce the requirement for SUBORD pronouns to appear as subjects of SUBORD-marked clauses with the existential constraint in (38):

(38) $((\text{SUBJ} \uparrow)\ \text{SUBORD})$

8 Constraints on 2LD

We now turn to the question of the binding requirements of 2LD. It is tempting to analyse 2LD as just the LD version of SUBORD: we have seen that 2LD pronouns appear in subject position of SUBORD clauses, just like SUBORD pronouns, and are bound by the LD antecedent, just like LD pronouns. However, more needs to be said in cases of overlap between the SUBORD and LD domains. Some clauses are both SUBORD and LD:

(39)	Vʉ	hį́į́	[’ʉ̀ʉ	làà	kaalɨ́]
	they.PRON$_i$	want	they.SUBORD$_j$	go	town.to

‘They want others to go to town.’ (Bohnhoff, 1986, 114)

(40)	Vʉ	hį́į́	[bi	làà	kaalɨ́]
	they.PRON$_i$	want	they.LD$_i$	go	town.to

‘They want to go to town.’ (corrected version of Bohnhoff, 1986, 113)

The complement of the verb *want* is an indirect order, which is in the overlap between the SUBORD and LD domains. Both SUBORD pronouns (ex. 39) and LD pronouns (ex. 40) are allowed in this domain. This means that the subordinate clause subject position in these examples is SUBORD-marked, and the antecedent is in an LD-ANT-marked clause. If 2LD were simply required to appear in a SUBORD domain and to be bound by the LD antecedent, we would expect the 2LD pronoun to appear in (40). This is not possible, however: the LD pronoun and not the 2LD pronoun appears here.

It might appear that we could get around this problem by claiming that a clause cannot be LD and SUBORD at the same time, but this would lead to the incorrect prediction that LD and SUBORD pronouns cannot appear in the same clause. We do find LD and SUBORD pronouns in the same clause, however; an example is given in (41).

(41) Bàbą̀ąm ∅ vì [moo ’ę̀ǹ pę́ń vʉǹ tid waa bìì gbɔ
Rabbit$_i$ (he$_i$) asks for what first they.PRON$_j$ hold child his.LD$_i$ leave
mammé máalá?] [’ɨ́ yę̀ máa, bà vʉǹ sóó ’ʉ́] [bà
water.in Q? this here focus that they.PRON$_j$ fake CM, that
’ʉ̀ʉ sòò waa bìì pʉ́ bi dɔ̀g ’yą̀’ą yɛ̀
they.SUBORD$_j$.must look.for child his.LD$_i$ give him.LD$_i$ go.up now here
no.]
CM
‘Rabbit$_i$ asks why they (Boar) held his$_i$ child and let it fall in the water? (He says) that they faked it, that **they.SUBORD must look for his.LD$_i$ child and give it to him.LD$_i$ now**!’ (Bohnhoff, 1986, 118-119)

The generalisation seems to be that there is an ‘exclusion zone’ for 2LD in the topmost clause in the LD domain. 2LD is an exclusively long-distance anaphor, and its antecedent must appear at least 2 clauses away.

We propose to introduce an additional feature marking the top clause of the LD domain as an ‘exclusion zone’ for 2LD, and constrain the 2LD pronoun so as to prevent it from appearing there. We will use the feature LD-DOMAIN to mark the exclusion zone for 2LD in the LD domain:

(42)
$$\left[\begin{array}{ll} \textsc{subj} & [\textsc{ld}\ \text{antecedent}] \\ \textsc{ld-ant} & + \\ \textsc{comp} & \textit{ld} \left[\begin{array}{ll} \textsc{subj} & ... \\ \textsc{ld-domain} & + \\ \textsc{comp} & \textit{subord} \left[\begin{array}{ll} \textsc{subj} & [\text{2LD}] \\ \textsc{subord} & + \end{array}\right] \end{array}\right] \end{array}\right]$$

Notice that this marking is still purely local to the predicate or construction defining the LD domain: the matrix clause containing the LD domain is marked with LD-ANT, and the LD domain itself is marked with LD-DOMAIN. No marking of more deeply embedded clauses or constraints involving purely nonlocal relations are required. We can now state the binding constraints for 2LD as follows:

(43) Binding constraints for 2LD:

$$(\uparrow_\sigma \textsc{antecedent}) = ((\begin{array}{c} \textsc{gf}^* \\ \neg(\rightarrow \textsc{ld-ant}) \\ 1 \end{array} \quad \begin{array}{c} \textsc{subj} \\ \neg(\leftarrow \textsc{ld-domain}) \\ (\leftarrow \textsc{subord}) \\ \neg(\leftarrow \textsc{ld-ant}) \\ 2 \end{array} \quad \uparrow) \quad \begin{array}{c} \textsc{subj} \\ (\leftarrow \textsc{ld-ant}) \\ 3 \end{array})_\sigma$$

1. As with LD, the clause containing the 2LD antecedent is the **smallest** clause marked with LD-ANT that also contains the pronoun.

2. • Like the LD pronoun, the clause containing the 2LD pronoun cannot have LD-ANT marking (2LD pronouns are not bound by a clausemate).

- Like SUBORD pronouns, 2LD must appear as the SUBJ of a clause with SUBORD-marking.
- To enforce the nonlocal relation between 2LD and its antecedent, the 2LD pronoun cannot appear in a clause with LD-DOMAIN marking (i.e., it cannot appear in the highest clause in the LD domain).

3. Like the LD pronoun, the ANTECEDENT of the 2LD pronoun is the SUBJ of a clause with LD-ANT marking.

On this analysis, the nonlocal nature of 2LD's binding requirements fall out from a combination of purely locally specified features.

9 An alternative analysis

As suggested by Louisa Sadler (p.c.), an alternative way of analysing the binding requirements of 2LD is to directly encode the nonlocal nature of the binding relation. On this analysis, the binding equation associated with 2LD would be:

(44) Alternative binding equation for 2LD (to be rejected):

$$(\uparrow_\sigma \ \mathrm{ANTECEDENT})=$$

$$\Bigg(\Bigg(\begin{array}{c} \mathrm{GF}^* \\ \neg(\rightarrow \mathrm{LD\text{-}ANT}) \\ 1 \end{array} \quad \begin{array}{c} \mathrm{GF} \\ \neg(\rightarrow \mathrm{LD\text{-}ANT}) \\ 2 \end{array} \quad \begin{array}{c} \mathrm{GF} \\ 3 \\ \end{array} \quad \begin{array}{c} \mathrm{SUBJ} \\ \neg(\leftarrow \mathrm{LD\text{-}ANT}) \\ (\leftarrow \mathrm{SUBORD}) \\ 4 \end{array} \quad \uparrow\Bigg) \quad \begin{array}{c} \mathrm{SUBJ} \\ (\leftarrow \mathrm{LD\text{-}ANT}) \\ 5 \end{array} \Bigg)_\sigma$$

This constraint resembles the requirements for LD, except that the path delimiting the binding domain must contain at least three grammatical functions (GF GF SUBJ): this directly reflects the fact that there must be at least one clause intervening between 2LD and its antecedent. The 2LD pronoun is required by this constraint to appear in the following environment:

(45)
$$f1\begin{bmatrix} \mathrm{SUBJ} & [\mathrm{LD\ antecedent}] \\ \mathrm{LD\text{-}ANT} & + \\ ...\mathrm{GF}_1^*... & f2\begin{bmatrix} \mathrm{GF}_2 & f3\begin{bmatrix} \mathrm{GF}_3 & f4\begin{bmatrix} \mathrm{SUBJ} & [\mathrm{2LD}] \\ \mathrm{SUBORD} & + \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

The Kleene star in the portion of the path marked 1 means that that portion can be empty, so it will often be the case that the f-structure labelled $f1$ and the f-structure labelled $f2$ will be the same, with only one clause (the exclusion zone $f3$) separating 2LD from its antecedent. We can explicate the binding constraints in (44) as follows:

1. As with LD, the clause containing the 2LD antecedent is the **smallest** clause marked with LD-ANT that also contains the pronoun. This is enforced for the f-structure labelled $f2$ by the constraint on the portion of the path marked 1.

2. The f-structure labelled $f3$ may not be LD-ANT-marked. This is enforced by the constraint on the portion of the path marked 2. This component of the path is obligatory.

3. The portion of the path marked 3 is also obligatory.

4. The 2LD pronoun must bear the grammatical function SUBJ. The f-structure marked $f4$ may not have LD-ANT-marking, and it must have SUBORD marking. This is enforced by the portion of the path marked 4.

5. As with the LD pronoun, the LD antecedent must be a SUBJ, and it must be in a clause with LD-ANT-marking.

This analysis has the advantage of requiring fewer features: only LD-ANT marking and SUBORD marking are required, and we do not need to appeal to additional features such as LD-DOMAIN. However, this advantage comes at the cost of allowing a nonlocal path with a minimal length of three grammatical functions. Given that this construction provides the only evidence we know of for grammatical nonlocality, we would prefer not to go down this slippery slope. Instead, we propose that nonlocality of this nature is forbidden in grammatical description, and that functional uncertainty paths are constrained by a general Locality Principle:

(46) **Locality Principle**: Paths in functional uncertainty expressions are of length zero or more (Kleene star) or of length one or more (Kleene plus); no other options are available in grammatical description.

Given this Locality Principle, the alternative binding constraint for 2LD presented in (44) is disallowed.

10 Conclusion

Yag̦ Dii presents a complicated picture for theories of anaphoric binding. The distributions of the PRON, SUBORD, and LD pronouns are not unexpected, given the general form of binding equations and the ability to mark domains with information about their syntactic properties. We have proposed that the distribution of the 2LD pronoun can be stated in local terms, by introducing additional features controlling the appearance of 2LD vs. LD at multiple levels of structure – governing a nonlocal relation by introducing a combination of local features to create a local ‘exclusion zone’ for 2LD. Our analysis obeys the Locality Principle, which we propose as a general principle for functional uncertainty paths in grammatical dependencies.

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THE PROSODY-SEMANTICS INTERFACE

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Abstract
In recent years, the relationship between prosody and syntax has been the subject of a considerable amount of work while the prosody-semantics interface has received less attention in the literature. However, any complete analysis of spoken language must account for those contributions to meaning which intonation and other aspects of prosody can make. In this paper, we focus on two such phenomena in English, the prosody-only indication of polar interrogativity in declarative questions and the so-called 'comma intonation' associated with non-restrictive relative clauses. Based on standard theoretical assumptions augmented with a more fine-grained view of the contents of the lexicon, we propose a formal treatment of the interactions between prosody, syntax and semantics, motivated by a strong commitment to modular specificity, that is consistent with LFG's co-description architecture. The revised architecture we posit situates the string at the heart of interface phenomena and offers a new perspective within the LFG framework not only on the interface between prosody and semantics, but also on the prosody-syntax interface.

1 Introduction[1]

The interaction between prosody and other aspects of linguistic structure has received an increasing amount of attention over the last 30 years (e.g. Nespor & Vogel 2007; Selkirk 1984). This work has overwhelmingly focused on the relationship between prosody and syntax, and has primarily been concerned with identifying and defining prosodic units and their relationship to syntactic units. Formalizations of the prosody-syntax interface exist in a variety of theoretical frameworks (e.g. Szendrői 2003, Minimalism; Klein 2000, HPSG), including LFG (e.g. Butt & King 1998; O'Connor 2006; Mycock 2006), most recently by Bögel et al. (2009, 2010). However, any analysis of prosody's place in the grammar is incomplete without a formal characterization of how it interacts with other aspects of linguistic structure in addition to syntax, given that prosody alone can indicate information structure status (as in a case of prosodic focusing such as *ANNA was studying at the university*, where capitals indicate prosodic prominence) and make semantic contributions (e.g. in a declarative question such as *Anna was studying at the university?*). In this paper, we will confine ourselves to discussing two such interface phenomena: the prosody-only indication of polar interrogativity found in declarative questions such as *Anna was studying at the university?* and the so-called 'comma intonation' associated with non-restrictive relative clauses exemplified by the sentence *Anna, who Bill met, was yawning*. In order to account for these phenomena, we propose to augment existing standard theoretical assumptions with (i) a more fine-grained view of the contents of the lexicon, and (ii) a formal treatment of interactions involving prosody, syntax, and semantics.

The proposed analysis is based on a view of modularity and domain specificity rooted in the fundamental differences that have been shown to exist between different aspects of linguistic structure. We take it to be a fact

[1] We would like to thank Doug Arnold, Joan Bresnan, Dag Haug, Aditi Lahiri, John Lowe, and Louisa Sadler for helpful comments and discussion.

about the nature of language that, for instance, syntax interprets only syntactic units and structure, while phonology interprets only phonological units and structure. However, it is clear that syntax and phonology, as integral parts of any string, are related to one another in a non-trivial way. If syntax and phonology are to interact, it is clear that certain syntactic information should be available to the phonology, and as a consequence phonological structure or processes may (or may not) correlate with syntactic structure. This interaction is crucial when one comes to consider the semantic contributions that can be made by prosody within an LFG approach because, under standard assumptions about the architecture of the grammar, semantic structure is projected from f-structure, i.e. from the syntax. In this paper, we explore the prosody-semantics interface in terms of an architecture in which the two are mediated by syntax (c-structure, f-structure) and which places the string itself at the heart of any account of the relevant interface phenomena.

We begin in Section 2 by describing the two interface phenomena to be analysed. In Section 3, we outline our approach to the lexicon, lexical entries and the string. Crucial assumptions about prosody and prosodic structure are summarized in Section 4. We then present our proposals for modelling the prosody-syntax interface (Section 5) and the prosody-semantics interface (Section 6) within the LFG framework, with specific reference to the analysis of declarative questions (6.1) and comma intonation (6.2) in English. Section 7 offers a comparison to other approaches.

2 The two phenomena: declarative questions, comma intonation

The two phenomena through which we will explore the prosody-semantics interface are declarative questions and the comma intonation associated with non-restrictive relative clauses. In both cases, prosody makes a crucial semantic contribution. In this section, we outline key features of the relevant English data.

The morphosyntax of a declarative question is identical to that of its non-interrogative counterpart. The two are distinct only in terms of their intonation: specifically, a declarative question has a sentence-final rise in intonation, represented as a Low (L) to High (H) pitch movement in (1).[2] (In writing, this is usually indicated by punctuation.)

(1) Declarative question: declarative syntax, final rise in intonation
Anna was studying at the university?
'æ.nə.wəz.'stʌ.di.ɪŋ.ət.ðə.ju.nə.'vɜː.sə.ti
L H

In contrast to a polar interrogative involving subject-auxiliary inversion such as *Was Anna studying at the university?*, there is nothing in the syntax of a declarative question such as (1) to indicate that it is an interrogative. Rather, the appropriate interrogative interpretation is communicated by this

[2] Throughout, we represent spoken utterances using IPA symbols. Syllables are separated by full stops; stress is marked on the relevant syllables by a superscript mark (primary stress) or a subscript mark (secondary stress). Following widely accepted convention, we represent pitch patterns as annotations on specific syllables. We assume two tones (pitch targets): High (H) and Low (L).

sentence's intonation pattern, namely the interrogative tune with which it is pronounced. Thus, prosody makes a meaning contribution in a declarative question.

The interrogative tune shown in (1) consists of a L tone followed by a H tone. Each of these tones (or pitch targets) is linked to a specific syllable; phonetically they are rendered simultaneously with the relevant syllable. We make the basic assumption, following much work on intonational phonology, that a tune minimally consists of a nuclear tone and a boundary tone. In a tune, the nuclear tone is the pitch target which represents the main stress in a major prosodic constituent known as the Intonational Phrase, while boundary tones appear at one edge or both edges of that Intonational Phrase. A left boundary tone is therefore associated with the first syllable in the Intonational Phrase (IntP) and a right boundary tone with its final syllable. We can therefore characterize the interrogative tune in (1) as consisting of a right boundary tone which is High (H) and a nuclear tone which is Low (L). This nuclear tone is associated with the stressed syllable of a specific prosodic constituent, smaller than IntP, to be defined in Section 3. At this stage, it suffices to say that the interrogative tune consists of a final L H pitch movement, i.e. a rise.

As well as indicating clause type, prosody may make other kinds of semantic contribution. The second phenomenon that we will analyse in this paper is so-called 'comma intonation' (Emonds 1976; Potts 2005), a specific pattern of prosodic phrasing associated with non-restrictive relative clauses. A claim repeatedly made in the literature is that a non-restrictive relative clause is separated from the rest of the utterance in which it appears by a pause on either side of it, indicated in (2) by double forward slashes.

(2) Comma intonation
Anna, who Bill met, was yawning.
'æ.nə.//ˌhu.'bɪl.mɛt.//ˌwəz.'jɔː.nɪŋ

In terms of its prosodic structure, the non-restrictive relative clause forms a separate prosodic constituent; it is an IntP. While comma intonation is regularly characterized as involving a pause on either side of the non-restrictive relative clause, this is not necessarily the case – there may instead be other prosodic indications of its status as a separate IntP, such as pitch reset at its left edge and at the start of the following IntP.

As a first step towards analysing these two interface phenomena, it is necessary to outline our approach to the lexicon, which we contend to be crucial in capturing the appropriate relations between prosody, syntax and semantics.

3 The lexicon, lexical entries, and the string

The starting point for our analysis is a more fine-grained view of the contents of the lexicon and the string.[3] This approach is motivated by a strong commitment to modularity and domain specificity. In this, we agree with

[3] We take the lexicon to be a theory of the structure of words, albeit a theory which must be complex, as demonstrated by Seiss (2011).

Scheer (2011: 347) when he states that "modules are domain specific and encapsulated … they are unable [to] understand, or even parse, what is going on in other modules". Thus, syntax, for example can manipulate and interpret only syntactic objects and structure – it is 'blind' to phonological objects. These facts about the syntactic and phonological levels of linguistic structure are reflected in our conception of the lexicon's contents. We propose that each lexical entry defines a relation between the s(yntactic)-form of a word and its p(honological)-form, as shown in (3) for the lexical items which appear in example sentence (1). This represents a move away from the standard LFG approach, which conflates these aspects of a lexical entry into a single form consistent with only the associated syntactic unit.

(3) Lexical entries

s-form	Anna	was	studying
f-descrip	N (↑PRED) = 'Anna'	I	V (↑PRED) = 'study⟨SUBJ⟩'
p-form	/æ$_{S}$.nʌ$_{W}$/	/wɒz/	/stʌ$_{S}$.di$_{W}$.ɪŋ$_{W}$/

at	the	university
P (↑PRED) = 'at⟨OBJ⟩'	D (↑SPEC) = 'the'	N (↑PRED) = 'university'
/æt/	/ði/	/ju$_{W}$.nɪ$_{W}$.vɜː$_{S}$.sɪ$_{W}$ .ti$_{W}$/

A lexical entry's s-form, shown on the top line inside each box in (3), together with its f-description contains information which is of relevance to the syntax of any sentence in which this lexical item appears. The lexical entry's p-form, which appears below the dashed line in (3), contains phonologically relevant information such as the item's syllable structure, the vowel and consonant sounds of which it consists, and its stress pattern. We distinguish the p-form from the s-form by presenting the former as a broad IPA transcription, with syllables specified as strong (S), weak (W) or unspecified for the purposes of stress placement.

By defining p-form and s-form, a lexical entry includes form specifications appropriate to the relevant macromodules, viz. syntax and phonology. That is not to say that these two forms are independent: they are after all always related by virtue of being part of the same lexical entry. However, the s-form and the p-form of a lexical entry are subject to different structural principles because they belong by definition to different macromodules of the grammar. This distinction is captured when we recognize and build into the architecture the fact that the string, like each lexical entry, has two separate but related aspects: the s-string, based on the s-forms of each lexical item, and the p-string, based on their p-forms. Setting aside prosody for the time being, these two aspects of the sentence *Anna was studying at the university* are shown in (4).

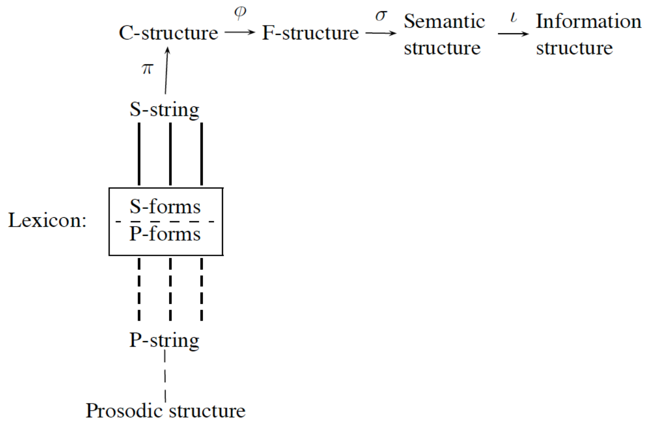
(4) *s-string*: Anna was studying at the university

p-string: 'æ.nə.wəz.'stʌ.di.ɪŋ.ət.ðə.ju.nə.'vɜː.sə.ti

In each case, the string's features are module specific: the s-string is composed of syntactic units and information relevant at the levels of syntactic structure including syntactic category, whereas the p-string is composed of phonological units and phonologically relevant information such as stress placement and syllable structure. Note that nothing in this approach sets up the expectation that there will be a one-to-one correspondence between syntactic units and phonological units.

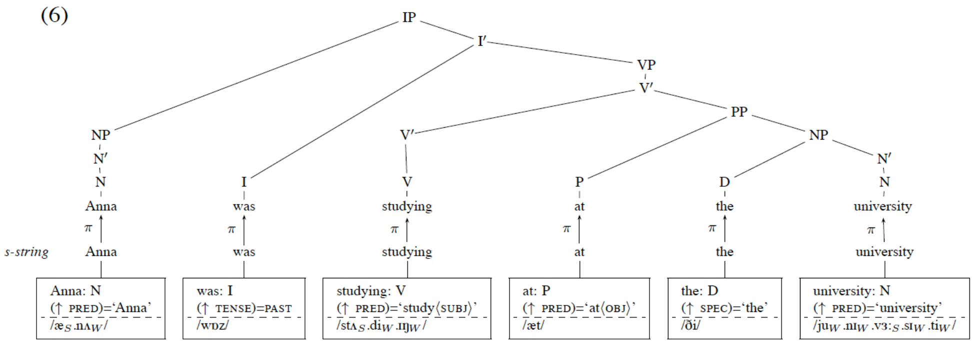
The diagram in (5) shows how the p-string and s-string fit into the overall architecture of the grammar which we propose.

(5)



The organization of modules along the top of the diagram in (5) is standard (constituent-structure maps to functional-structure maps to semantic-structure), with the additional assumption that information-structure is projected from semantic-structure (Dalrymple & Nikolaeva 2011). Moving downwards in (5), c-structure and the s-string are related by the π projection function (Kaplan 1987, Asudeh 2006), and each unit of the s-string is related to a lexical entry, specifically to its s-form which consists of syntactically relevant information. In this manner, we formally distinguish s-string units from the contents of c-structure terminal nodes and from the syntactic information (s-form) that is part of a lexical entry. These relations are shown in (6), which represents an analysis of the syntax of *Anna was studying at the university*.

(6)



Differentiating between s-forms and units in the s-string may seem unnecessary because it will overwhelmingly be the case that the relationship between the two will be one of identity, as in (6), but in fact this is an important distinction to make because the s-string cannot simply constitute a sequence of s-forms. If it did, in a sentence such as *Anna studies law and Ben studies art*, which contains two instances of the same word, there would have to be two separate s-forms of *studying* with each one necessarily being part of a distinct lexical entry. To avoid such duplication, we posit a mapping between s-forms and units of the s-string, in addition to the π projection function which maps between units in the s-string and terminal nodes at c-structure (Kaplan 1987, Asudeh 2006).[4]

Returning to the diagram in (5), we also propose that p-forms provide information which is used to construct the p-string (cf. the relation between s-forms and the s-string). The units of the p-string, i.e. syllables,[5] which Nespor (1999: 119) notes are “purely phonological in nature”, are related to p-structure terminal nodes. The dashed lines in (5) represent the phonological relations between p-forms, the p-string and p-structure. These appear to be considerably more complex than the equivalent mapping between s-forms and c-structure because they involve the application of phonological rules. For instance, the phonological rule which reduces an unstressed vowel in English applies between p-form and p-string, while a phonological rule whose domain is a prosodic unit, e.g. pitch reset at the beginning of IntP, is part of the relation between p-string and p-structure.

According to our version of the architecture in (5), there is no direct mapping between c-structure and p-structure (cf. Butt & King 1998), but rather the lexicon, along with other interface principles, mediates between s-string and p-string. We posit that the lexicon plays a crucial part in determining which syntactic, prosodic and semantic information is potentially available at the interface between the syntax and phonology. This assumption of an absolute distinction between syntax and phonology prompts the question: what of prosody?

4 Prosody and prosodic structure

A large body of work has shown that prosody has its own primitives and organizing principles which cannot be reduced to those of syntax or phonology. Here, we follow Selkirk (1986) in assuming the hierarchy of prosodic units in (7). This hierarchy results in structural configurations which are much flatter than syntactic ones; for instance, phrases are not maximal projections of heads.[6] Given the hierarchy in (7), we can now define the interrogative tune in (1) more accurately by specifying the default location of the nuclear tone. As stated previously, the right boundary tone, which is H, is associated with the last syllable in the IntP. The other component of the interrogative tune is a nuclear tone L, which is associated with the stressed

[4] The π projection function may be relevant in the analysis of clitics. See Section 7.

[5] We assume that the basic unit of the p-string is the syllable, but p-structure may refer to smaller units in some circumstances.

[6] Whether there is recursion in prosodic structure is a topic of much current debate, but one which falls outside the scope of this paper.

syllable of the first prosodic word (PW) of the final phonological phrase (PhP) in the IntP. We return to the issue of intonation in Section 6. In the remainder of Section 4 and in Section 5, the focus will be on prosodic phrasing and our proposals for the formal characterization of the prosody-syntax interface, an issue which it is necessary to address before an analysis of the phenomena introduced in Section 2 can be provided.

(7) The Prosodic Hierarchy

Utterance (Utt)
|
Intonational Phrase (IntP)
|
Phonological Phrase (PhP)
|
Prosodic Word (PW)

The issue of how prosody should be integrated into the LFG architecture has received increasing attention in recent years. Butt & King (1998) were the first to propose that prosody should be regarded as a distinct level of structure in the LFG architecture. In a sense though, prosodic structure straddles the boundary between syntax and phonology: it is clear that phonological processes can make reference to units of prosody, e.g. Nespor & Vogel (2007) claim that the PhP is the domain of application for the phonological rule of Iambic Reversal in English as in *thir'teen 'men* ⟶ *'thirteen 'men*, and that prosodic structure can be closely related to constituent structure, e.g. prosodic phrasing can disambiguate in cases of syntactic ambiguity such as (*old men*) (*and women*) where a pause serves to indicate that the adjective modifies only the first N conjunct.[7] Prosodic structure thus appears in at least some cases to have a relatively close relationship to constituent structure. It must be stressed though that alignment of constituents at these two different levels of linguistic structure is only partial: data clearly show that constituent structure and prosodic structure are not isomorphic. Indeed, Lahiri & Plank (2010) argue, citing work dating back to Steele (1775/1779), that in Germanic languages phonological phrasing is by default determined on the basis of rhythm, and thus non-isomorphism between syntax and prosody is to be expected, even to the extent that morphological word integrity is not necessarily respected. This is the case even in a simple sentence uttered at a normal speech rate such as (8).

(8) c-structure:
[$_{\text{IP}}$ [$_{\text{NP}}$ Anna] was [$_{\text{VP}}$ studying [$_{\text{PP}}$ at [$_{\text{NP}}$ the university]]]]

p-structure (default prosodic phrasing):

($_{\text{IntP}}$ ($_{\text{PhP}}$ ($_{\text{PW}}$ 'æ.nə.wəz.)) ($_{\text{PhP}}$ ($_{\text{PW}}$ 'stʌ.di.ɪŋ.ət.ðə.ju.nə.)) ($_{\text{PhP}}$ ($_{\text{PW}}$ 'vɜː.sə.ti)))

In the p-structure in (8), prosodic units are constructed on the basis of rhythmic principles, forming trochaic groups. The result is a massive

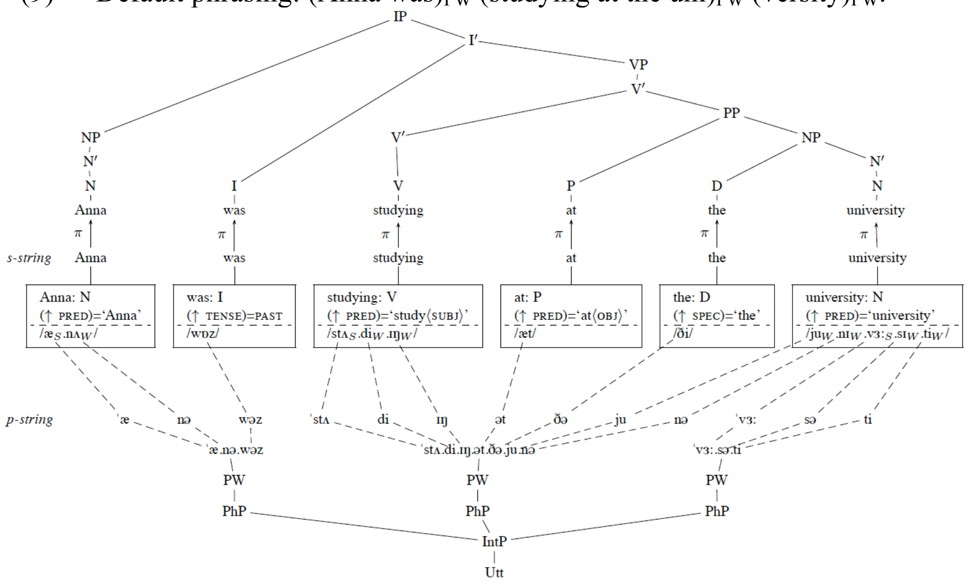
[7] We follow the widely adopted convention of indicating prosodic phrasing with rounded brackets. Square brackets are used to represent syntactic constituency.

disparity between c(onstituent)-structure and p(rosodic)-structure, right down to the number of basic units (six and three, respectively). Morphological word integrity is not respected: the final unit of this sentence's p-structure does not constitute a unit at c-structure. Any analysis must capture the non-isomorphic nature of the relationship between syntax and prosody, exemplified by (8).

5 Modelling the prosody-syntax interface

Following Lahiri & Plank (2010), we assume that in the case of a spoken sentence such as (8), the smallest prosodic unit (the prosodic word, PW) is constructed on the basis of rhythmic principles. Trochaic groups are formed with the consequence that there are significant mismatches between c-structure and p-structure, as shown in (9). (This is the same as example (6), but (9) includes this sentence's p-string and p(rosodic-)structure.) Note that the p-structure terminal nodes, which appear in the lower tree, are prosodic words. These prosodic words are related to syllables in the p-string as indicated.

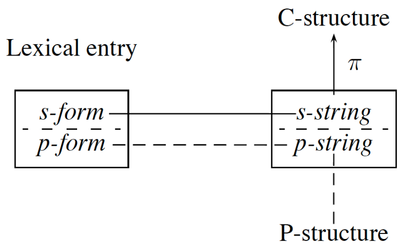
(9) Default phrasing: (Anna was)$_{PW}$ (studying at the uni)$_{PW}$ (versity)$_{PW}$.



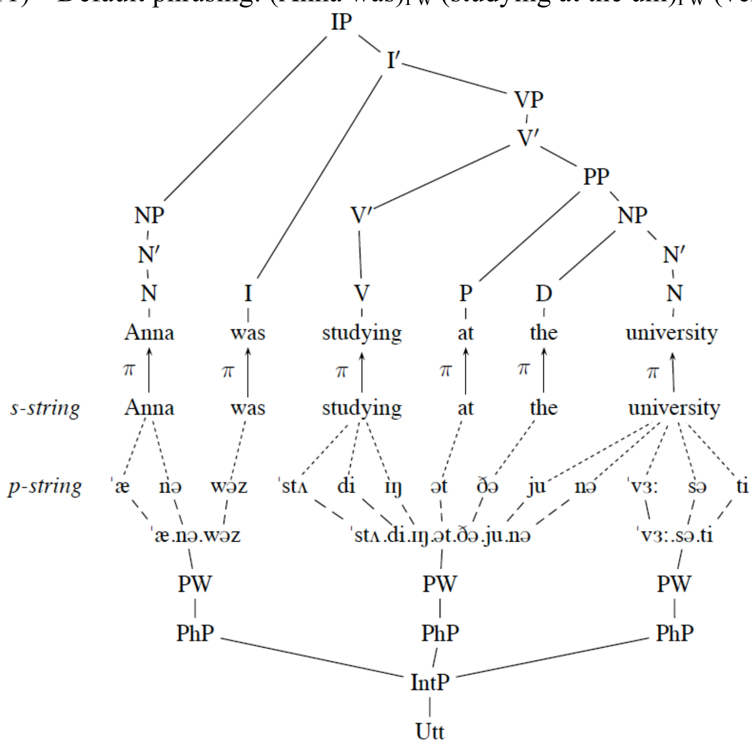
As noted previously, the extensive misalignment which Lahiri & Plank (2010) highlight extends as far as the number of basic units in this sentence: there are six terminal c-structure nodes, but only three terminal p-structure nodes. In (9), *Anna was* maps to a single terminal node at p-structure but to two terminal nodes at c-structure, and *university* maps to two separate terminal nodes at p-structure but to a single c-structure terminal node.

The diagram in (9) serves to illustrate the most important features of our approach to the interface between syntax and prosody. We relate c-structure and p-structure through those aspects of the string (the s-string and the p-string, respectively) which are constructed on the basis of the s-form and p-form values that are necessarily part of any lexical entry. The connection between a word's s-form and p-form is made in the lexicon, meaning that the lexicon is at the heart of the prosody-syntax interface. The excerpt of the architecture given in (10) shows how a lexical entry, the string and c- and p-structures are related to one another.

(10)



(11) Default phrasing: (Anna was)$_{PW}$ (studying at the uni)$_{PW}$ (versity)$_{PW}$.

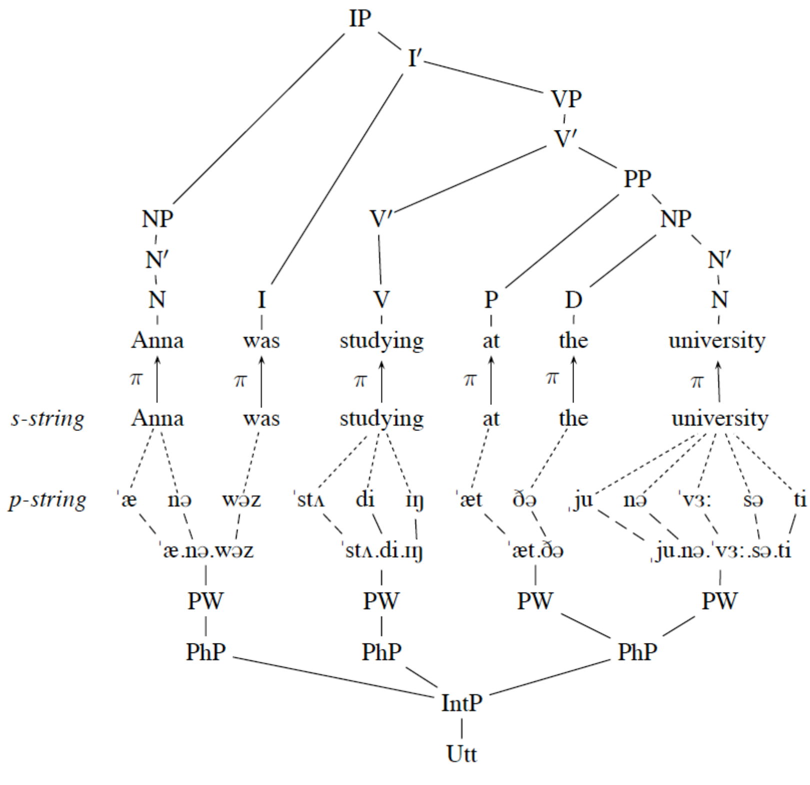


For the purposes of clarity and because it is perhaps more intuitive to do so, we henceforth represent the interface between syntax and phonology in terms of the relationship between the s-string and the p-string, and omit the details of lexical entries from all diagrams. The relationship established between s-string and p-string units via lexical entries is instead represented by dotted lines, as in (11). (The information expressed in (11) is the same as in (9), only without the lexical entries.)

Example (11) represents a sentence uttered at a regular tempo, with prosodic phrasing established according to the rhythmic principles which

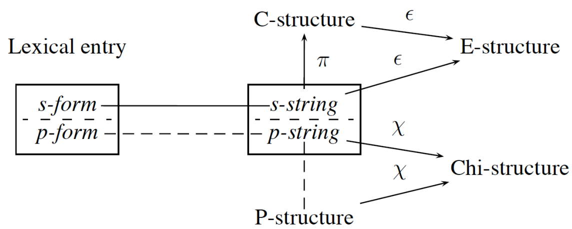
Lahiri and Plank (2010) identify as applying in the default case. The extent to which rhythmic principles determine prosodic phrasing varies though, and syntactic structure may be reflected in a sentence's prosodic structure to different degrees depending on a number of factors including speech tempo. For instance, when spoken more slowly and carefully our example sentence would have a different prosodic structure, such as the one shown in (12). The most striking difference between this example of careful speech and the default case shown in (11) is that the syntactic and prosodic constituents in (12) align to a greater degree. For instance, in (12) *university* occupies a single terminal node at both c-structure and p-structure, in contrast to (11) where *university* illustrates the point that morphological word integrity need not be respected at the level of p-structure. However, even in (12) there is still not complete isomorphism. For example, *Anna* and *was* map to two separate terminal nodes at c-structure but only one at p-structure, as in (11). To summarize, there appears to be a greater degree of alignment between c-structure and p-structure constituents in careful speech than there is in the default cases discussed by Lahiri & Plank (2010).

(12) 'careful speech': (Anna was)$_{PW}$ (studying)$_{PW}$ (at the)$_{PW}$ (university)$_{PW}$.



Facts about (non)isomorphism must be captured by any analysis of the prosody-syntax interface. In order to achieve this goal while at the same time respecting strict modularity, we contend that it is necessary for information about prosodic structure that is relevant for syntax and information about syntactic structure that is relevant for prosody to be simultaneously available for the purposes of alignment within LFG's co-description architecture. We propose to augment the existing LFG framework with two new structural levels: chi-structure, projected from p-structure and the p-string by the χ function, and e(psilon)-structure, projected from c-structure and the s-string by the ε function. Chi-structure contains information about prosodic structure, while epsilon-structure contains information about syntactic structure. (13) is a version of (10) revised to include chi-structure and e-structure.

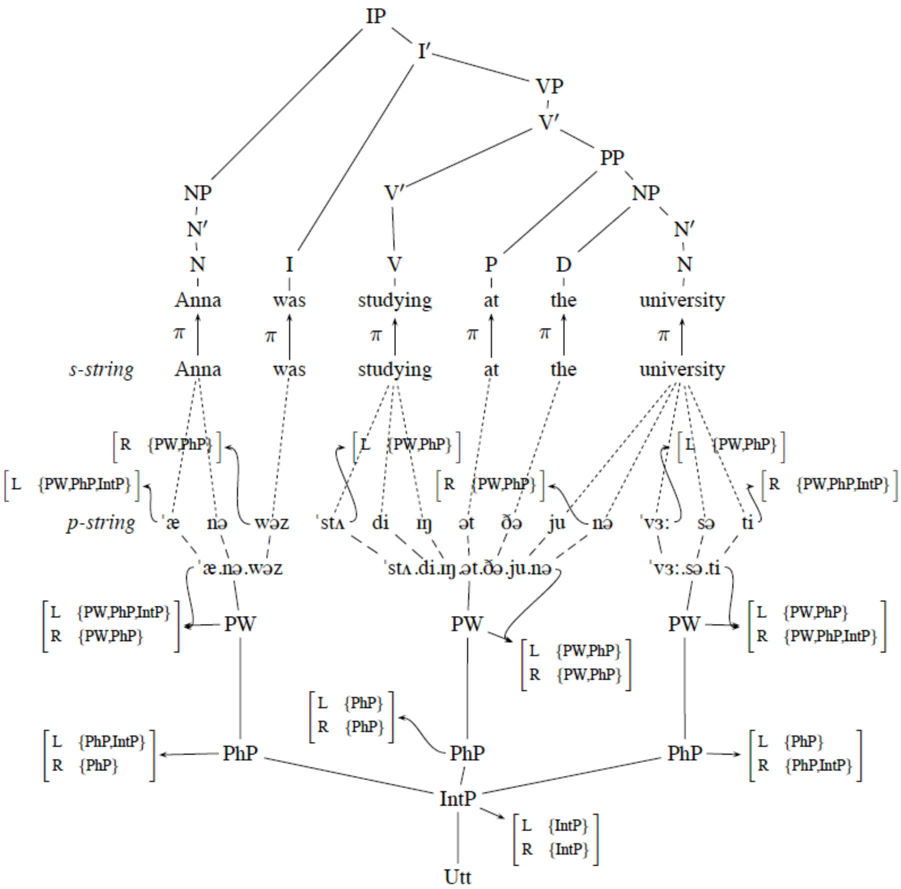
(13)



Chi-structure and e-structure contain information which is potentially relevant to the interaction between syntax, prosody and semantics, for instance for the purposes of alignment. In this paper, two types of such information are of particular concern: (i) prosodic constituent boundaries (or edges), and (ii) information about the presence of a semantically contentful tune such as the interrogative tune. Crucial for the former is that chi-structure contains information about prosodic constituent boundaries which is passed through p-structure and into the p-string, where the location of these boundaries is available to be aligned with the location of c-structure boundaries according to relevant interface principles (i.e. depending on factors such as speech tempo). The p-string and the chi-structure with which it is associated thus represent an important aspect of the interface between prosody and syntax, along with the lexicon and additional interface principles, such as those that determine the degree of alignment between prosodic and syntactic boundaries. In order for any alignment to occur though, similar information about syntactic constituent boundaries must also be available at the interface. This information is part of e-structure, which serves to pass it through c-structure and into the s-string, where the location of these boundaries is available to be aligned with the location of p-structure boundaries (cf. the relationship between p-structure and chi-structure). The relevant interface principles are thus able to apply. They determine the appropriate degree of isomorphism and enforce this on the basis of information about syntactic and prosodic structure contained within e-structure and chi-structure, respectively.

To give an example, we can begin by augmenting (11) – our analysis of *Anna was studying at the university* with default prosodic phrasing – with chi-structures which contain the information about prosodic structure that is available at the interface for the purposes of alignment. Chi-structures are associated with nodes at p-structure, as well as with units of the p-string (i.e. syllables). In formal terms, this involves the addition of rules containing information about the mapping between p-structure and p-string units and chi-structure (see Appendix). These rules ensure that a prosodic constituent inherits the relevant edge information from its mother via the associated chi-structure. In this way, information about the edges of prosodic constituents is passed through the p-structure tree, and is ultimately associated via chi-structure with the relevant syllables in the p-string. For example, the final syllable of the sentence, */ti/*, represents the right edge of a PW, a PhP, and the IntP. We represent chi-structures as attribute value matrices containing attributes L(eft) and R(ight). These attributes' values are sets consisting of members that indicate with which constituent edge(s) the relevant unit is associated, e.g. [L {PW}] denotes 'left edge of a Prosodic Word', [R {IntP}] denotes 'right edge of an Intonational Phrase'. The revised version of (11) is (14).

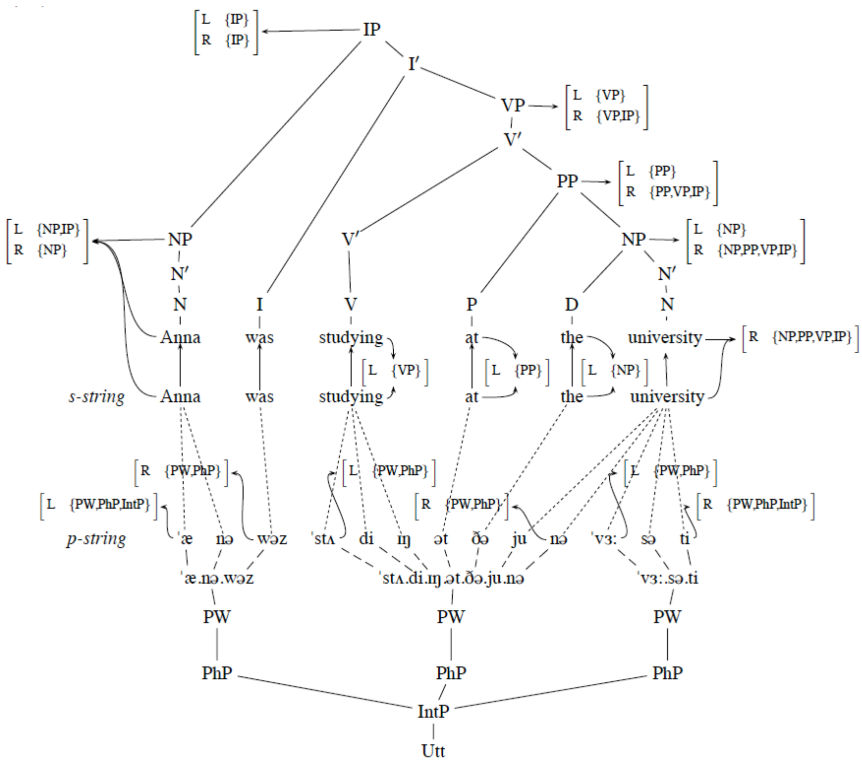
(14) (Anna was)$_{\mathrm{PW}}$ (studying at the uni)$_{\mathrm{PW}}$ (versity)$_{\mathrm{PW}}$.



The next step is to add e-structures to (14) according to a set of rules that map c-structure and s-string units to e-structure (see Appendix). These rules ensure that a syntactic constituent inherits all relevant information about the edges of syntactic constituents via the associated e-structures, and that this information is passed through the c-structure tree and into the s-string, where it is associated with one of its units, as shown in (15).

Passing information about the edges of all major constituents into the p-string and the s-string, as in (15), may seem excessive. Certainly, very little of this information seems to be relevant in the default case as there is extensive misalignment of syntactic and prosodic constituents (see Section 4). However, as the ‘careful speech’ example in (12) illustrates, in some utterances there is a greater degree of alignment between syntactic and prosodic constituents than we find in (15). Therefore, information about constituent boundaries must be available at the interface in order that the relevant alignment principles can apply to give phrasing which reflects the appropriate degree of increased isomorphism. Thus, at this stage, we elect to represent all potentially significant information about syntactic and prosodic structure in the relevant e- and chi-structures. This does not mean that we necessarily expect all of this information to emerge as being relevant at the interface. In fact, it is an important feature of this architecture that it enables us to explore the question of precisely which aspects of prosodic and syntactic structure are important at the interface and to investigate why this should be, both cross-linguistically and on a language-by-language basis.

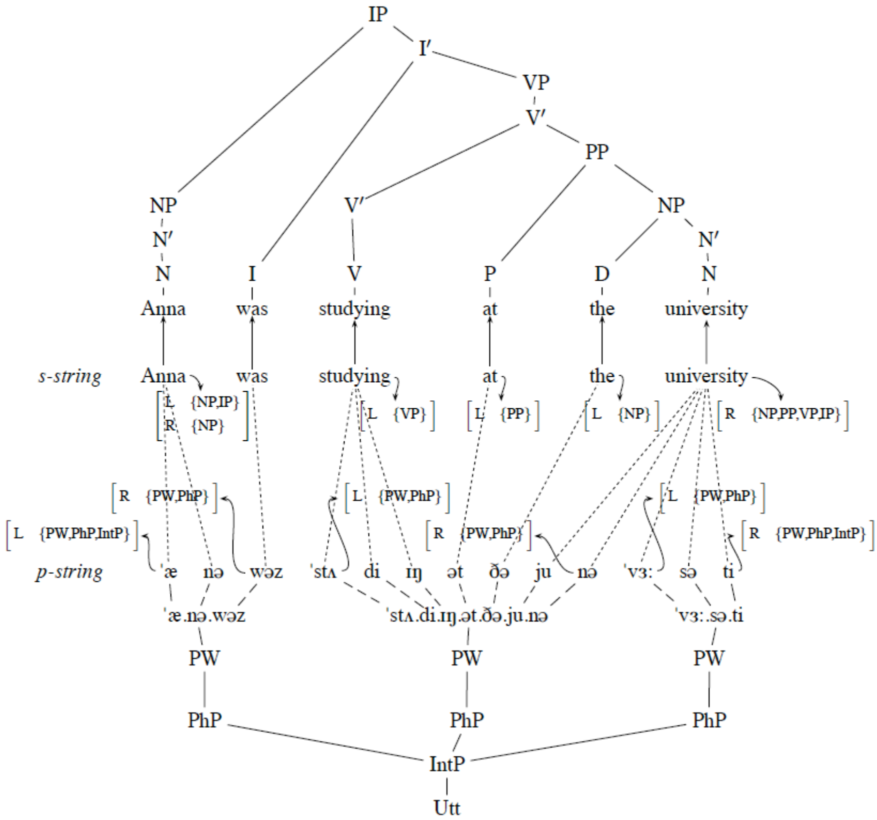
(15)



For clarity of exposition, we can strip the nodes in the p- and c-structure trees of their chi- and e-structures, leaving only the information available at the interface that is contained in and associated with the p-string and the s-string. If we trim the trees in (15) in this way, the result is (16).

We now have a formalization of the interface between the syntax and phonology macromodules which is consistent with modularity and domain specificity. Thus far, the chi- and e-structures presented have only contained information about constituent edges. However, this is not the only type of information which these two types of structure may contain; they may also contain information about semantics.

(16)



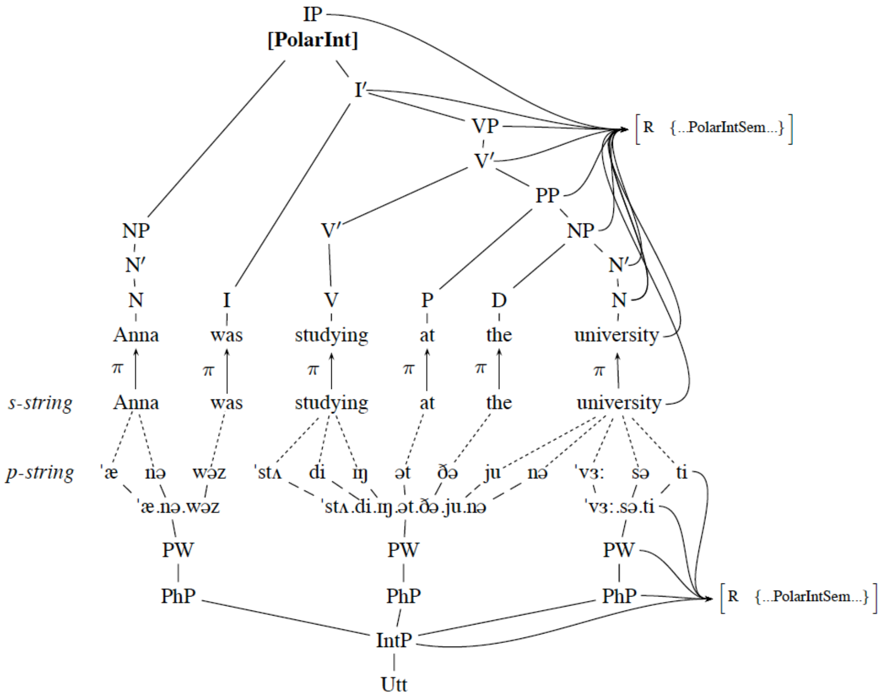
6 The prosody-semantics interface

As stated in Section 1, according to standard assumptions, semantic structure is projected from f-structure in LFG, i.e. from the syntax. We retain this view of the architecture and do not propose a direct relationship between prosody and semantics, in contrast to, for example, Butt & King (1998). Instead, we propose to capture facts about the meaning contributions that prosody can make by requiring 'semantic harmony' to hold at the interface between syntax and prosody. Under this approach, information about a meaning constructor annotated on a c-structure node is also included in the chi-structure projected from the node in question, i.e. this information is associated with one or both edges of the relevant constituent and will thus be a member of the appropriate attribute-value set. At the interface, principles of semantic harmony require a meaning contribution that represents an attribute-value set member at e-structure to be a member of the corresponding chi-structure as well. Of course, this chi-structure information is associated with a unit of the p-string and certain dominating p-structure nodes. If a chi-structure contains information about a meaning contribution, this must be reflected in the prosody of the relevant p-structure constituent. In this way, the meaning contribution of a prosodic configuration is related to the c-structure, from which f-structure and ultimately s-structure are projected. We exemplify this approach to the prosody-semantics interface by providing analyses of a declarative question in Section 6.1 and comma intonation in Section 6.2.

6.1 Declarative questions

In the case of a declarative question such as (17), it is the interrogative tune which the sentence bears that is crucial to its interpretation. For this interpretation to hold, since information about clause-type relates to the entire sentence and assuming that c-structure maps to f-structure which maps to s-structure, the c-structure root node (IP) must introduce the relevant meaning constructor [**PolarInt**], i.e. the semantics of a polar (yes/no) interrogative, defined as *λP.Ques(P)*: $\downarrow_\sigma \multimap \downarrow_\sigma$. This interrogative meaning contribution is associated with the right edge of the root IP. Given the general form of the relevant c-structure rules and the relation they establish with the epsilon projection (see Appendix), this R(ight) edge attribute-value information is also included in the e-structures projected from certain nodes which dominate this final word, i.e. the nodes along the right edge of the c-structure tree.

(17) Anna was studying at the university?



In formal terms, *PolarIntSem* is a member of the set that is the value of the attribute R(ight) in the appropriate e-structures. Thus, via e-structure, this information about interrogativity is passed along the c-structure tree's right side and into the s-string, where it is part of the e-structure associated with the final syntactic unit in the s-string, namely *university*. At the interface between s-string and p-string, principles of semantic harmony require that, if *PolarIntSem* is part of the value of an e-structure, it must also be a value in the corresponding chi-structure. In (17), that chi-structure is associated with the final syllable */ti/* in the p-string (i.e. the final syllable of the final IntP). As with c-structure, the relevant rules (see Appendix) mean that R(ight) edge attribute-value information is also included in the chi-structures projected from nodes along the right edge of the p-structure tree which dominate this final word. Each chi-structure, up to and including the one associated with IntP in (17), contains the attribute-value pair *R { ... PolarIntSem ...}*. The IntP constituent must exhibit prosodic features consistent with this information about meaning, so this IntP is the domain for the interrogative tune and ends with a final rise in intonation. Under this approach, information about a meaning constructor introduced at c-structure is also included at the levels of e-structure and chi-structure, the latter being associated with p-structure and the p-string. The prosody-syntax interface is therefore integral to our proposal for modelling the interaction between prosody and semantics.

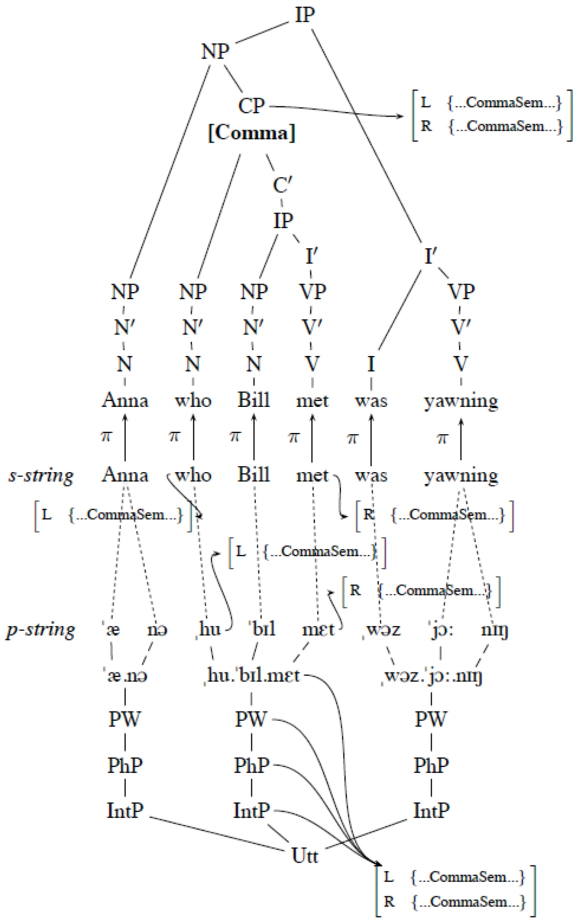
6.2 Comma intonation

Our analysis of the comma intonation associated with non-restrictive relative clauses also relies on chi-structure, e-structure and the information about meaning which they may both contain. Based on the insights of Potts (2005) and Arnold & Sadler (2010), we assume that the c-structure configuration which characterizes comma intonation introduces the meaning constructor [**Comma**] which is associated with *CommaSem*. As was the case with interrogativity and the declarative question in (17), information about this contribution to meaning is included in the e-structure projected from the relevant c-structure node, which in (18) is the CP. Specifically, *CommaSem* is a member of the set that is the value of the relevant CP's L and R attributes. This information is inherited by the smaller constituents which represent the edges of the CP, as shown in (18). Thus, in the s-string *who* is associated with an e-structure whose L attribute-value set contains a member *CommaSem*, and *CommaSem* is a member of the R attribute-value set in the e-structure associated with *met*.

At the interface between p-string and s-string, principles of semantic harmony require *CommaSem* to also be a member of the L attribute-value set in the chi-structure associated with the corresponding prosodic unit (established via the relation between s-form and p-form in the lexicon), i.e. */hu/*. Similarly, the chi-structure associated with */mɛt/* has a R attribute-value set member *CommaSem*. This information, associated with L and R attributes (left and right edges) at chi-structure, is also associated with all of the dominating prosodic constituents up to and including the middle IntP, a node whose chi-structure indicates that it represents both the left and right edges of the 'comma' configuration and which will exhibit the appropriate prosodic features (comma intonation).

As in the case of declarative questions, under this approach the semantic contribution made by comma intonation is analysed in terms of the prosody-syntax and syntax-semantics interfaces, based on the proposal that semantic information contained in e-structures must also be part of the related chi-structures, and vice versa. In this way, p-string and s-string and p-structure and c-structure (and s-structure) are related to one another.

(18) Anna, who Bill met, was yawning.



7 Comparison to other approaches

In recent work, Bögel et al. (2009, 2010) outline an approach to the prosody-syntax interface within the LFG framework which differs in significant respects from the one presented in this paper. Given that the two overlap with respect to some of the phenomena for which they seek to account, we offer a brief discussion of their key aspects for the purposes of comparison.

In common with the approach we have outlined in this paper, Bögel et al.'s (2009) work is in large part motivated by a desire to capture the extensive mismatches in syntactic and prosodic constituency highlighted by Lahiri & Plank (2010). Bögel et al. (2009) successfully account for many of these mismatches in their 'pipeline architecture' by inserting prosodic boundaries in the string, which is assumed to comprise syntactic units, i.e. c-structure words. However, it is not clear how their analysis could be extended to cover violations of morphological word integrity, such as that found in example (9), in which a prosodic boundary appears in the middle of a c-structure word.

We believe that our approach is more consistent with LFG's co-description architecture than the pipeline approach of Bögel et al. because it respects strict modularity: primitives from the phonology are not introduced into the syntax, nor vice versa. Furthermore, we contend that this new approach can be used to analyse the same phenomena as the pipeline one. For example, Bögel et al. (2010) propose using prosodic inversion (Halpern 1995) to analyse clitic placement within the LFG framework. Distinguishing the s-string from the terminal nodes of the c-structure and relating them via the π projection function (Kaplan 1987, Asudeh 2006) allows for the possibility of units in the s-string to have a different linear order from the terminal nodes at c-structure. This may be relevant to an analysis of clitic placement which incorporates prosodic inversion (Halpern 1995; see Bögel et al. 2010 and Lowe 2011 for LFG), though under the approach outlined the inversion would take place in the syntax rather than the prosody. Limits of time and space mean that the treatment of clitics at the interface and a more detailed assessment of the relative merits of these approaches must await further research.

Finally, in addition to an approach to the prosody-syntax interface, this paper offers a theory of the prosody-semantics interface and therefore goes beyond the scope of Bögel et al.

It is hoped that the formal LFG approach to the interaction between prosody, syntax and semantics presented in this paper will provide a framework for further research that will in turn increase our understanding of interface phenomena.

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Appendix

Passing information about the edges of prosodic constituents within p-structure

Prosodic-structure rules with chi-structure annotations about prosodic edges:

(19)
$$
\begin{array}{llll}
\text{IntP} & \rightarrow & & [\ \underset{\text{IntP} = (\downarrow_\chi \text{L})}{\text{PhP}} \quad \text{PhP*}\ ] \\
& & \& & [\ \text{PhP*} \quad \underset{\text{IntP} \in (\downarrow_\chi \text{R})}{\text{PhP}}\ ]
\end{array}
$$

(20)
$$
\begin{array}{llll}
\text{PhP} & \rightarrow & & [\ \underset{\substack{(\uparrow_\chi \text{L}) \sqsubseteq (\downarrow_\chi \text{L}) \\ \text{PhP} \in (\downarrow_\chi \text{L})}}{\text{PW}} \quad \text{PW*}\ ] \\
& & \& & [\ \text{PW*} \quad \underset{\substack{(\uparrow_\chi \text{R}) \sqsubseteq (\downarrow_\chi \text{R}) \\ \text{PhP} \in (\downarrow_\chi \text{R})}}{\text{PW}}\ ]
\end{array}
$$

(21)
$$
\begin{array}{lll}
\text{PW} & \rightarrow & \underset{\substack{\uparrow_\chi \sqsubseteq \downarrow_\chi \\ \text{PW} \in (\downarrow_\chi \text{L}) \\ \text{PW} \in (\downarrow_\chi \text{L})}}{\text{Syll}^{+}}
\end{array}
$$

These specifications hold of all prosodic-structure rules.

Passing information about the edges of syntactic constituents within c-structure
All XP-level rules are of the following form:

(22)

$$\begin{array}{lllll}
\mathrm{XP} & \rightarrow & & [\ \begin{array}{c}\Sigma\\ (\uparrow_{\varepsilon}\ \mathrm{L}) \sqsubseteq (\downarrow_{\varepsilon}\ \mathrm{L})\\ \mathrm{XP} \in (\downarrow_{\varepsilon}\ \mathrm{L})\end{array} & \Sigma^{*}] \\
 & & \& & [\Sigma^{*} & \begin{array}{c}\Sigma\\ (\uparrow_{\varepsilon}\ \mathrm{R}) \sqsubseteq (\downarrow_{\varepsilon}\ \mathrm{R})\\ \mathrm{XP} \in (\downarrow_{\varepsilon}\ \mathrm{R})\end{array}\ ]
\end{array}$$

All other rules simply pass information:

(23)

$$\begin{array}{lllll}
\mathrm{Cat} & \rightarrow & & [\ \begin{array}{c}\Sigma\\ (\uparrow_{\varepsilon}\ \mathrm{L}) \sqsubseteq (\downarrow_{\varepsilon}\ \mathrm{L})\end{array} & \Sigma^{*}] \\
 & & \& & [\Sigma^{*} & \begin{array}{c}\Sigma\\ (\uparrow_{\varepsilon}\ \mathrm{R}) \sqsubseteq (\downarrow_{\varepsilon}\ \mathrm{R})\end{array}\ ]
\end{array}$$

Prosodic tune specification
General form of prosodic-structure rules specifying intonational tunes:

(24)

$$\begin{array}{llllll}
\mathrm{IntP} & \rightarrow & & [& \begin{array}{c}\mathrm{PhP}\\ (\uparrow \mathrm{LBOUNDARY}) = (\downarrow \mathrm{LBOUNDARY})\end{array} & \mathrm{PhP}^{*}] \\
 & & \& & [\mathrm{PhP}^{*} & \begin{array}{c}\mathrm{PhP}\\ (\uparrow \mathrm{NUCLEAR}) = (\downarrow \mathrm{NUCLEAR})\end{array} & \mathrm{PhP}^{*}] \\
 & & \& & [\mathrm{PhP}^{*} & \begin{array}{c}\mathrm{PhP}\\ (\uparrow \mathrm{RBOUNDARY}) = (\downarrow \mathrm{RBOUNDARY})\end{array} &]
\end{array}$$

Introducing the interrogative tune at the IntP level.

(25)

$$\begin{array}{llll}
\mathrm{IntP} & \rightarrow & \mathrm{PhP}^{*} & \begin{array}{c}\mathrm{PhP}\\ (\downarrow \mathrm{NUCLEAR}) = \mathrm{L}\\ (\downarrow \mathrm{RBOUNDARY}) = \mathrm{H}\\ \mathrm{PolarIntSem} \in (\downarrow_{\chi}\ \mathrm{R})\end{array}
\end{array}$$

(26)

$$\begin{array}{llllll}
\mathrm{PhP} & \rightarrow & & [& \begin{array}{c}\mathrm{PW}\\ (\uparrow \mathrm{LBOUNDARY}) = (\downarrow \mathrm{LBOUNDARY})\\ (\uparrow \mathrm{NUCLEAR}) = (\downarrow \mathrm{NUCLEAR})\end{array} & \mathrm{PW}^{*}] \\
 & & \& & [\mathrm{PW}^{*} & \begin{array}{c}\mathrm{PW}\\ (\uparrow \mathrm{RBOUNDARY}) = (\downarrow \mathrm{RBOUNDARY})\end{array} &]
\end{array}$$

(27)

$$\begin{array}{llllll}
\mathrm{PW} & \rightarrow & & [& \begin{array}{c}\mathrm{Syll}\\ (\uparrow \mathrm{LBOUNDARY}) = (\downarrow \mathrm{LBOUNDARY})\end{array} & \mathrm{Syll}^{*}] \\
 & & \& & [\mathrm{Syll}\ ^{*} & \begin{array}{c}\mathrm{Syll}\\ (\uparrow \mathrm{RBOUNDARY}) = (\downarrow \mathrm{RBOUNDARY})\end{array} &] \\
 & & \& & [\mathrm{Syll}^{*} & \begin{array}{c}\mathrm{Syll}\\ (\uparrow \mathrm{NUCLEAR}) \Rightarrow\\ (\downarrow \mathrm{SYLLSTRESS}) =_{c} \mathrm{PRIMARY}\\ (\uparrow \mathrm{NUCLEAR}) = (\downarrow \mathrm{NUCLEAR})\end{array} & \mathrm{Syll}\ ^{*}]
\end{array}$$

MULTIPLE-GAP CONSTRUCTIONS

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“Parasitic” gap constructions are constructions in which one filler corresponds to more than one gap. In LFG, there is nothing particularly strange about this, as there is no reason to expect a one-to-one relationship. The anti-c-command constraint is not really based on c-command. Instead, there are two constraints, one disallowing gaps in reflexive environments, and the other disallowing the function SUBJ as an f-commanding structure-sharing function. Parasitic gaps in adjuncts are the result of the islandhood of adjuncts not being realized when a discourse-prominent element is shared with the body of the clause, while those in subjects are a loophole to circumvent the joint effect of subject islandhood and weak crossover.

1. Multiple Gap Constructions

1.1. Overview

Much attention has been paid over the years to long-distance dependency (LDD) constructions in which more than one gap corresponds to the same element.[1] Some examples of such sentences (drawn from Engdahl 1983, Chomsky 1986) are:

(1) a. Which articles did John file _ without reading _?
b. This is the kind of food you must cook _ before you eat _.
c. Which boy did Mary’s talking to _ bother _ most?

(2) a. Which men did the police warn _ that they were about to arrest _?
b. Who did you tell _ that you would visit _?
c. Which girl did you send a picture of _ to _?

These constructions are often referred to as “parasitic gap” constructions, a term which is more appropriate to (1) than to (2). In (1), one of the gaps cannot stand alone without the other gap, and in this sense it is parasitic on the other gap.

(3) a. *What/Which articles did John file the book without reading _?
b. What/Which articles did John file _ without reading the book?

However, in (2) each gap can stand on its own.

(4) a. Who/Which friend did you tell _ that you would visit your brother?
b. Who/Which friend did you tell your brother that you would visit _?

For this reason, despite terminology dating back to the seminal paper by

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Engdahl (1983) I will use the term "multiple-gap" construction[2] to refer to the totality of the phenomenon, and restrict the term "parasitic gap" to those cases where one of the gaps is ungrammatical alone. Parasitic gaps will be marked with a subscripted *p*.

My basic analysis of multiple-gap constructions will be presented in §2. In §3, I will discuss constraints on multiple-gap constructions, in particular what has come to be known as the anti-c-command constraint. In §§4 and 5, I will turn to the specifically parasitic varieties of the construction and speculate on what makes them possible, first those in adjuncts, and then those in subjects.

1.2. Assumptions about LDD Constructions

The version of LFG I will be assuming is one in which both inside-out and outside-in licensing exist: fronted elements which bear the SUBJ function are licensed outside-in while non-SUBJ elements are licensed inside out from a c-structure gap. This position is proposed by Falk (2006) as part of a theory of subjecthood, and confirmed by Falk (2007), where it is demonstrated that c-structure gaps are present for non-subjects but not for subjects.[3]

(5) a. $(\uparrow \text{DF}) = (\uparrow \text{GF* SUBJ})$
b. $\uparrow = ((\text{GF*} \uparrow)\ \text{DF})$

((5b) does not explicitly state that the lower GF cannot be SUBJ; I will return to this later.) The restriction of (5a) to SUBJ completely parallels the fact that functional controlees are limited to SUBJ:

(6) $(\uparrow \text{SUBJ/OBJ}) = (\uparrow \text{XCOMP SUBJ})$

The other thing that needs to be mentioned is the *wh*-path. In the first place, some languages have special marking (morphology, word order, tone changes) on the *wh*-path (Zaenen 1983). For this reason, it has been hypothesized that there is a special feature (variously referred to in the literature as BND, LDD, and WHPATH) in f-structures along the path. Given the variety of markings, it is proposed by Falk (2009) that the WHPATH feature distinguishes between the top of the *wh* path (with the value [+T]) and the rest of the path ([−T]). A well-formed *wh*-path has the feature [WHPATH [+T]] at its topmost layer and [WHPATH [−T]] elsewhere.

The other reason for the importance of the *wh*-path is that constraints on the path are responsible for island phenomena. According to the approach of Falk (2009), islands are essentially the result of extrasyntactic properties, such as a requirement that fronted elements be pragmatically prominent. In

[2]Although almost all examples that have appeared in the literature involve two gaps, it is possible to have more. The term "multiple-gap construction" is also used by Alsina (2008).

[3]In this paper, I will mark gaps for subjects as well for readability, even though technically there is no empty category in the subject position.

some cases, the syntax enforces the pragmatic requirement, resulting in an inviolable (or at least less easily violable) island constraint. For example, Complex NP Constraint violations are possible (in English) under certain pragmatic conditions when the NP-internal clause is a complement but not when it is a relative clause; this is attributed to the relative clause island, but not the complement island, being enforced syntactically. The syntax enforces such islands by not allowing the *wh* path to pass through a particular element (such as a relative clause). Formally, this is achieved through the WHPATH feature: disallowing a particular layer of f-structure from bearing the feature [WHPATH [−T]] renders it an island.

In LDD constructions of the familiar type, the multifunctional element is realized in the canonical position of the high function (the discourse function); however, there is nothing in principle requiring this. Realization of the multifunctional element in the canonical position of the lower function results in such constructions as in-situ questions and internally-headed relative clauses. (On relative clauses, see Falk 2010.) In most cases, such constructions are also subject to islands, although there appear to be no cases of marking of the path.

It is also possible for what appear to be in-situ questions or internally-headed relative clauses to not have the properties of LDD constructions. For example, English in-situ questions do not obey island constraints, and Choctaw internally-headed relative clauses are not islands for LDD constructions (Broadwell 1985a, Broadwell 1985b).[4] In such cases, the most natural conclusion is that despite their superficial similarity to LDD constructions, they are formally not LDDs. There are no syntactic FOCUS or TOPIC functions in such constructions, no long-distance dependencies, and no *wh*-path.

2. The Basics of Multiple-Gap Constructions

What makes multiple-gap constructions interesting is the fact that under fairly standard transformational approaches to the syntax of LDD constructions their existence is unexpected.

In LFG, the situation is somewhat more complex. From the representational point of view, there is no reason a single element could not have three functions instead of two. There is therefore no representational bar to multiple-gap constructions. However, the direction of licensing needs to also be considered. If the licensing is inside-out, there can be no restriction on number of gaps associated with a single fronted element; since each gap is generated independently, there is no bar to more than one gap. On the other hand, if the licensing is outside-in, only one gap can be licensed by the licensing equation. An alternative approach proposed by Alsina (2008) allows free association of

[4]Choctaw internally headed relative clauses also show signs of being bare CPs, rather than CPs embedded in nominal phrases; in particular, they use switch-reference markers and lack the nominal marking that is typical of internally-headed relative clause constructions.

an element bearing a grammaticized discourse function with another grammatical function: this approach also allows multiple gaps. As noted above, I am assuming a hybrid system in which subject LDD constructions are licensed outside-in, and others inside-out. Under this view, multiple gap constructions should be possible as long as there is no more than one SUBJ gap. As will be seen in §3.1, multiple SUBJ gaps are indeed impossible.

Ignoring subjects, then, multiple-gap constructions are unremarkable under my assumptions. The example (2b), for example, has the c-structure represented by the bracketing in (7a) and f-structure (7b), in which the fronted *who* is both OBJ of *tell* and OBJ of *visit*.

(7) a. [$_{\text{CP}}$ who did [$_{\text{S}}$ you [$_{\text{VP}}$ tell *e* [$_{\text{CP}}$ that [$_{\text{IP}}$ you would [$_{\text{VP}}$ visit *e*]]]]]]

b.
$$\begin{bmatrix} \text{FOCUS} & f \\ \text{SUBJ} & [\text{“you”}] \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{‘tell}\left\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})(\uparrow \text{COMP})\right\rangle\text{’} \\ \text{OBJ} & f \\ \text{COMP} & \begin{bmatrix} \text{SUBJ} & [\text{“you”}] \\ \text{TENSE} & \text{CONDIT} \\ \text{PRED} & \text{‘visit}\left\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\right\rangle\text{’} \\ \text{OBJ} & f \end{bmatrix} \end{bmatrix}$$

$f = [\text{“who”}]$

Of course, there are constraints on these constructions, and the interaction with islandhood (resulting in truly parasitic gaps) needs to be considered, but the basic multiple-gap construction is formally unproblematic.

There is, however, another consideration: processing. It has been well known for a long time (at least as early as Wanner and Maratsos 1978) that LDD constructions impose a burden on processing. It is plausible, therefore, that the parser would disprefer multiple gaps, happy to retire a fronted element as soon as it has found one gap in which to place it. This point is reinforced by theories of filler-driven parsing, in which the parser attempts to place the filler as early as possible in the parse (Frazier and Flores d'Arcais 1989). Thus, while the grammar might allow multiple-gap constructions, they might be harder to process and thus be more marginal in actual language use. This, in fact, seems to be the correct status of multiple-gap constructions. As has often been reported, speakers disagree on how acceptable multiple-gap constructions are, some being more tolerant than others. A theory in which they are essentially grammatical but difficult to process seems to be a solid basis for the kind of uncertainty one finds in the literature.

3. Constraints on Multiple Gap Constructions

3.1. Anti-C-Command

As originally proposed by Engdahl (1983), it is generally believed that one of the gaps in a multiple-gap construction cannot c-command the other. This is taken by Culicover (2001) to be one of the "current consensus positions" on multiple-gap constructions.[5] Some examples follow:

(8) a. *Who did you tell _ about _?
b. *Who did the story remind _ of _?
c. *Who _ read a book about _?

(9) a. *Who did you say _ convinced you [_ should pass the course]?
b. *Which articles _ got filed without you reading $\_\_{p}$?
c. *This is the kind of food that _ must be cooked before you eat $\_\_{p}$.
d. *Who did you say _ claimed that you should exempt _ from Introduction to Linguistics?

In each of these cases, the first gap c-commands the second gap; this is alleged to explain their ungrammaticality.

An anti-c-command constraint would be unexpected in LFG. However, as has been noted in the literature, there are good reasons to doubt that what is involved here is a constraint involving c-command. In the examples in (8), the second gap is in a position where a reflexive anaphor would be possible. Engdahl (1983: 24) observes that cases where a reflexive is possible do not allow multiple gaps even if there is no c-command relation.

(10) a. I talked to John$_i$ about himself$_i$.
b. Who$_i$ did you talk to $\_\_{i}$ about himself$_i$/*_?

She also shows that in Swedish, where the distribution of reflexives differs from English, the correlation is still present.

(11) a. Jag talade med Johan$_i$ om *sig / honom$_i$.
I talked with Johan about *REFL / him
'I talked to John about himself.' (cf. (10a))
b. Vem brukar du sällan tala med _ om _ ?
who be.accustomed you seldom talk with about
'Who do you seldom talk to about himself?' (cf. (10b))

[5]It is usually stated in terms of the real gap not being able to c-command the parasitic gap. However, since not all multiple-gap constructions are parasitic, and anti-c-command is taken to apply even in the non-parasitic cases, I refrain from stating this in terms of parasitism.

(12) a. Jag såg dig köra Johan$_i$ hem till sig$_i$.
I saw you take John home to REFL
'I saw you take John home to himself.'
b. Johan$_i$ har jag ofta sett dig köra _ hem till *_ / sig$_i$.
John have I often seen you take home to / REFL
'John, I have often seen you take home to himself.'

Thus, the relevant constraint here appears to be based not on c-command but rather on the availability of a reflexive. Formally, given a language-specific path for reflexives, this can be expressed by adding the following equation to the gap:

(13) $\uparrow \neq$ ((ReflPath $\uparrow$) GF)

I conjecture that what motivates such a constraint is a parsing-based phenomenon relating to the usefulness of reflexives in indicating the coreference of (roughly) coarguments. Whether this conjecture is correct or not, examples like (8) do not provide evidence for an anti-c-command condition.

Under closer examination, the examples in (9) also do not involve a c-command-based condition. In all of these cases, the offending first (higher) gap is a subject. C-commanding non-subjects do not block multiple gap constructions, as observed by Chomsky (1986: 61f).

(14) a. Which men did the police warn _ [that they were about to arrest _]?
b. Who did you tell _ [that you would visit _]?
c. Who did you say you convinced _ [_ should fail the course]? (cf. (9a))

In each of these cases, the bracketed clause is an argument rather than an adjunct, and therefore c-commanded by the object; yet the sentences are grammatical. This suggests that the constraint in question refers to higher subjects rather than to c-command. A subject-based constraint also allows the extension of the constraint to languages with different configurational properties. For example, Kiss (2001) argues that subject and object in Hungarian are not distinguished structurally, yet the same "anti-c-command" effects obtain. As we have seen, examples like (9a), with two subject gaps, are already ruled out under my background assumptions. If a subject gap is licensed outside-in, only one such gap is possible. However, this will not help us with the rest of the examples in (9).

As Engdahl (1983: 21) points out, the constraint in question cannot simply be one against SUBJs; non-commanding SUBJs do not block multiple-gap constructions.

(15) a. Which caesar did Brutus imply _ was no good while ostensibly praising $\_{p}$?
b. Who did you say John's criticism of $\_{p}$ would make us think _ was stupid?

Instead, it is SUBJs in a commanding position (presumably f-command).[6] This can be expressed by adding the following off-path constraint to the *wh*-path expression in the inside-out equation annotated to the gap:

(16) $(\rightarrow \text{SUBJ}) \neq \uparrow$

This will correctly rule out the sentences in (9b–d); on the other hand, the sentences in (15) are correctly allowed.

The constraint in (16) has an interesting consequence. It is not a constraint on multiple-gap constructions, but on any gap. It therefore applies any time LDD is licensed inside-out. In particular, any attempt to license a SUBJ LDD inside-out will violate (16): the first outward step will lead to the f-structure of which the gap is the SUBJ. This is the correct result under my assumptions. In Falk (2006 : 114) the ability to license subject LDDs inside-out was ruled out by an ad hoc condition. Under the present proposal, it is ruled out by the same constraint that rules out f-commanding subjects in multiple-gap constructions.

One kind of contrast which this account does not explain is exemplified in the following from Chomsky (1986 : 54).

(17) a. *a man who _ looks old whenever I meet $\_{p}$
b. a man who, whenever I meet $\_{p}$, _ looks old

Since *whenever I meet* is an adjunct to the clause headed by *looks* in both versions, the outward path from the gap within that phrase will pass through the clause headed by *looks*, the subject of which is identical to the gap. Both versions should thus be ungrammatical. This example is presented by Chomsky as evidence of the relevance of c-command. However, given the foregoing evidence that c-command does not play a role, there must be another explanation. A different way of approaching this is to say that the preposing of an adjunct clause makes the subject immune to the condition on subjects. A parallel problem emerges in the analysis of the *that*-trace effect proposed by Falk (2006), as pointed out by Asudeh (2009): the inability to account for the Adverb Effect (Culicover 1993).

[6] Alsina (2008) arrives at a similar conclusion. In his approach, the constraint follows from the imposition of the Relational Hierarchy on LDD constructions. He views subjects and discourse functions as being at the same level on the hierarchy, and thus disallows subjects from also bearing discourse functions. While his approach does not account for the same range of data as the one I am proposing, the two proposals bear a certain similarity to each other.

(18) a. *Who did you say that _ looks old whenever the weather turns hot?
b. Who did you say that, whenever the weather turns hot, _ looks old?

I propose that (17) and (18) display the same effect. As a preliminary approximation, I would attribute this effect not to the syntax per se, but rather to a parsing effect under which a subject which is significantly far from the beginning of the clause is harder for the parser to identify as a subject. It therefore allows certain violations of grammatical constraints on subjects. Perhaps the sentences in question are not technically grammatical, but accepted by the parser.

3.2. Second Gaps as Pronouns

Contrary to the position taken here that both gaps in a multiple-gap construction are true LDD gaps, it has been proposed (Cinque 1990, Postal 1994, Postal 2001) that the second ("parasitic") gap is a pronoun. They argue that these gaps are limited to NPs, and are barred from positions in which weak definite pronouns are not permitted. On the other hand, it has been argued by Levine, Hukari, and Calcagno (2001) and Levine and Hukari (2006) that neither of these constraints holds, and that, as in the account proposed here, second gaps are ordinary gaps.

Examples such as the following (from English and Italian) have been presented as evidence that non-NPs cannot be second gaps.

(19) a. *How sick did John say he felt _ before getting _$_p$?
b. *Unbearable he is _ even when trying not to seem _$_p$.
c. *Abuse my ferret, I refused to accept that he could _ even after seeing him _$_p$.
d. *Quanto importanti si può diventare _ senza sentirsi _$_p$?
how important REFL can become without to.feel
'How important can one become without feeling?'
e. *A chi hai lasciato la lettera _ dopo esserti rivolto _$_p$?
to who you.have left the letter after to.be returned
'To whom did you leave the letter after having returned?'

Similarly, the following are among the examples that have been presented to show that second gaps are excluded from positions excluding weak definite pronouns.[7]

(20) a. *the color that everyone who dyed their sheets _$_p$ praised _ (cf. Mirabelle dyed her sheets purple/*it.)
b. *What your saying the Porsche cost _ led them to try to sell the Jaguar for _ is amazing. (cf. The Porsche cost $50,000/that

[7] I am using capital letters to indicate focal stress.

much/*it.)

c. *How long a time did their saying the concert would last _ make Quentin miss work for _? (cf. The concert lasted for the whole night/two hours/*it/*them.)

(21) a. *Which child did everyone who believed it was _$_{p}$ that the drug had helped see _ in the hospital? (cf. It was *hĕr/HER that the drug helped.)

b. *What several facts that meant _$_{p}$ led Mary to claim _ is that he is guilty. (cf. These facts may mean that he is guilty but those facts don't mean that/*it.)

c. *It was disregard for human rights which the UN criticized _ after the dictator's remarks betrayed _$_{p}$. (cf. That remark betrays [disregard for human rights]/THEM/*thĕm.)

d. *What everyone who remarked _$_{p}$ later denied _ was that it was hot. (cf. Tina remarked [that it was hot]/*it.)

On the other hand, as noted above, Levine, Hukari, and Calcagno (2001) bring counterexamples, both of non-NPs and of second gaps in anti-pronominal contexts.

(22) a. How harshly do you think we can treat THEM _ without in turn being treated _$_{p}$ OURSELVES?

b. That's the kind of table ON WHICH it would be wrong to put expensive silverware _ without also putting a fancy centerpiece _$_{p}$.

c. THAT DRUNK, it would be impossible for ME to get _ without ROBIN getting _$_{p}$ as well.

d. That Robin is a spy would naturally be difficult to refute ___ without (someone) having first conjectured _$_{p}$.

(23) a. Mint green is a color that you might paint your CEILING _ without necessarily wanting to paint the surrounding WALLS _$_{p}$. (cf. *We painted the walls it.)

b. Anybody can become a bureaucrat, but a doctor one could spend one's whole life STUDYING to be _ without ever becoming _$_{p}$. (cf. *Robin wants to be a doctor but I don't think he'll ever become it.)

c. Which countries do you become a citizen of _ only if you were actually born in _? (cf. *Robin thinks the president was born in Argentina, but I know she wasn't born in it.)

The challenge is to account both for the grammatical examples and the ungrammatical ones.

A perusal of the examples points the general way to an explanation. It is clear that one parameter which influences grammaticality is stress. Stress is related to pragmatics, suggesting that (most of) the examples in question are all well-formed syntactically but some of them are ruled out on pragmatic grounds. This is precisely what Levine, Hukari, and Calcagno (2001: 218 fn 22) suggest as regards the non-NP cases.

> This example [*How harshly will our treating Robin _ lead to our being treated _ ourselves?*—YNF] seems to us syntactically impeccable, but it is semantically very odd indeed; we suspect that this oddness is a symptom of why non-NP P-gaps, particularly those involving predicative categories, have struck some investigators as anomalous. The question corresponds to the pseudological translation, For what degree *x* of harshness will our treating Robin *x* harshly lead to our being treated *x* harshly ourselves? The presupposition involved is pragmatically strange, involving as it does the background assumption that, at a particular unique degree of some gradable property, there is an exact reciprocation between action and reaction involving that property. Because P-gaps that involve predicative filler categories, such as [*wh*-degree] APs, necessarily require that a particular degree of some predicate hold in two different, linked situations, they provide ample opportunity for pragmatic anomaly of this kind.

However, they do not propose an explanation of the anti-pronominal cases.

The anti-pronominal cases are not homogeneous. There are some that are anomalous for the same reason as suggested above for non-NPs. Consider the following from Postal (2001).

(24) a. Nora spent/stayed that week in Bermuda.
b. Nora spent/*stayed it in Bermuda.
c. the week that Nora spent/stayed _ in Bermuda
d. the week that Nora's planning to spend/*stay _ in Bermuda made Mike want to spend _ there

The ungrammaticality of the multiple-gap construction here has nothing to do with pronouns. Rather, it is because Nora and Mike are not spending the same week. In fact, despite Postal's grammaticality markings, the version with *spend* is not well-formed either.

Some of the anti-pronominal cases, those in (20), are syntactically ill-formed, but not because these are anti-pronominal contexts. In (20a), for example, the same element is intended as the complement of *dye* and *praise*. But these verbs take different kinds of arguments: the relevant argument of *dye* is an open argument while the complement of *praise* is a closed OBJ. An open argument and a closed argument cannot have the same value, since one needs a subject and the other does not. The same thing is true of (20b,c). The reason these are anti-pronominal contexts is related; pronouns cannot stand for predicative NPs. But the anti-pronominal status is not the reason for the ungrammaticality of the multiple-gap constructions.

The more interesting cases are the ones in (21). The clearest of these is (21a). The parasitic gap in this sentence is in a cleft construction. Clefting is a form of focusing. This is why a stressed pronoun is grammatical and an unstressed pronoun is not. Pronouns are typically used for old information (i.e. they are topical, not focal), and therefore are not appropriate in clefts. Contrastive stress allows the pronoun to be used focally. In a multiple-gap construction, only one gap can represent new information: since other gaps are identical to it and thus coreferential with it, they cannot also be new information, and thus must be topical and not focal. Specifically, since a parasitic gap implies the existence of another gap, a parasitic gap cannot appear in a focal position. Therefore, parasitic gaps cannot appear in clefts. The verbs in (21b,c,d) focus their complements, again making them both anti-pronominal and immune to parasitic gaps.

4. Parasitic Gaps 1: Adjunct-internal

While not all multiple-gap constructions involve parasitic gaps, that is, gaps which would not be grammatical without the second gap, it is undoubtedly the case that most examples of multiple-gap constructions that have appeared in the literature are parasitic. More specifically, they usually involve a gap which appears inside an adjunct island. This section will explore those gaps.

In order to understand adjunct-internal parasitic gaps, it is first necessary to understand the nature of the islandhood of adjuncts. As summarized in Falk (2009), the island status of adjuncts is less clear than it first seems. While extraction from adjuncts is sometimes crashingly bad, there are other instances in which it is relatively acceptable.[8]

(25) a. *Which astronaut did you get to the moon [before _]?
b. *Which book did you cancel your library card [before reading _]?
c. *Which cubicle did you read the file [in _]? (cf. ✓*Which cubicle did you put the file [in _]?*, where the PP is an argument)
d. *Which book did you go to the library [in order to read _]?

(26) a. Which student is Roger capable of working [independently of _]?
b. Which people can Robin run [nearly as fast as _]?
c. Who does Kim write letters [more frequently than _]?
d. Which book did you go to the library [to read _]?

As noted in §1.2, I take islands to be primarily the result of extrasyntactic factors, such as the ability to be pragmatically prominent. In the case of adjuncts, the motivation for their islandhood is not directly a matter of pragmatic prominence, but rather the result of the looser connection between a

[8]Examples (26a–c) come from Bouma, Malouf and Sag (2001).

clause and its adjunct. This looser connection makes it more difficult, but not impossible, for an adjunct to be pragmatically prominent. Thus, extractions from adjuncts are, in general, difficult but not impossible. The one case that appears to be categorically unacceptable is extraction from adjuncts which are PPs. Falk (2009) therefore proposes that only PP adjuncts are syntactically designated as islands.[9] Formally:

(27)
$$\begin{array}{lll} \text{VP} \rightarrow & \text{VP} & \text{PP} \\ & \uparrow=\downarrow & \downarrow\in(\uparrow \text{ ADJ}) \\ & & (\downarrow \text{ WHPATH}) \neq [-\text{T}] \end{array}$$

Viewed from this perspective, adjunct-internal parasitic gaps are the result of not realizing the islandhood of PP adjuncts under certain conditions, roughly the presence of another gap in the non-adjunct portion of the clause.

This raises the question of why being linked to a gap in the main part of the sentence would affect the islandhood of adjunct PPs. The answer lies in the pragmatic underpinning of adjunct islandhood. As noted above, adjuncts are islands because they are only loosely connected to the clause. Sharing a discourse prominent element ties the adjunct more closely to the clause.

To make this analysis work, we need to take a closer look at the conditions under which PP adjunct islandhood does not obtain. I stated above, following standard views on the subject, that the presence of a gap in the non-adjunct portion of the clause is the trigger. However, there are several reasons that this cannot be correct. The first is formal: there is no way in LFG to ascertain that there is a gap in the clause. Gaps are not identified in f-structure by any particular properties. There are also empirical problems with linking parasitic gaps with other gaps, since parasitic gaps are sometimes licensed by constructions not generally thought to involve (LDD) gaps.

One example of a non-gap construction that licenses parasitic gaps is Heavy NP Shift (Engdahl 1983):

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[9]As pointed out to me by Mary Dalrymple and Alex Alsina (personal communication), there are some potential counterexamples to the claim that adjunct PPs are always islands. One such set of cases is the following:

(i) a. Where did you order the pegs at?
b. What do you want to find Homer for?

Both of these appear to be idiomatic constructions: *at where* is ungrammatical, and *for what* does not have the same reading as *what…for*.

(ii) a. *At where did you order the pegs? / *You ordered the pegs at where?
b. ??For what do you want to find Homer? / ??You want to find Homer for what?

Another potential counterexample is (iii).

(iii) What language do you want me to write the paper in?

This kind of exception seems to be limited to specialized non-locative uses of *in*. The exceptions exemplified by (i), (ii), and (iii) all seem to be highly lexicalized. It is possible that they involve lexical entries which overrule the specification in the phrase structure rule. I will not pursue the formal consequences of this here. Other potential counterexamples involve elements that may be arguments rather than adjuncts, such as instrumentals:

(iv) What should I write on the whiteboard with _?

(28) a. John offended (_) by not recognizing _$_p$ immediately his favorite uncle from Cleveland.
b. Susan always files (_) without reading _$_p$ properly all the memos from the low-level administration.

While this has sometimes been taken as evidence for treating Heavy NP Shift as an LDD construction (e.g. Chomsky 1982), it does not have the properties of these construction, such as "movement" to the left and unboundedness. More plausibly, particularly in a constraint-based framework like LFG, Heavy NP Shift is the result of allowing processing considerations (in this case, the preference to place heavy elements at the end) to overrule the ordering constraint (or LP rule) requiring objects to precede other complements of the verb (Falk 1983).

In some languages, object pronoun clitics can license parasitic gaps, as in the following Spanish examples from Campos (1991: 118).

(29) a. *Archivaron el informe sin leer _$_p$.
they.filed the report without to.read
'They filed the report without reading (it).'
b. Lo archivaron sin leer _$_p$.
it.ACC they.filed without to.read
'They filed it without reading (it).'

This is not true in all languages, though. In French, object clitics do not license parasitic gaps (Tellier 1999: 135).[10]

(30) *Vous l' avez rangé sans avoir lu _$_p$.
you it.ACC have put.away without to.have read
'You put it away without reading (it).'

Similarly, in-situ *wh* questions and internally-headed relative clauses license parasitic gaps in some languages but not in others. In Spanish, for example, in-situ questions license parasitic gaps (Campos 1991: 120).

(31) a. ¿ Tú archivaste cuál artículo sin leer _$_p$?
you filed which article without to.read
'Which article did you file without reading?'
b. ¿ Tú mandaste cuál artículo sin revisar _$_p$?
you sent which article without to.proofread
'Which article did you send without proofreading?'

[10]The genitive clitic *dont* does license parasitic gaps, but since it is a relativizer an LDD construction is arguably involved.

Culicover (2001: 50) cites the following from Jedda Arabic (cited from Wahba 1995).

(32) Mona ɣaarat min miin ʕašaan ʕomar yebɣa yetjawwaz _$_p$?
Mona was.jealous of who because Omar wants to.marry
'Who was Mona jealous of because Omar wants to marry?'

Another case cited by Culicover (2001: 48) (from Tellier 1989) is Mooré, where internally-headed relative clauses license parasitic gaps.[11]

(33) M mii fo sen tɷ neb ninga n yaol n ka pogl _$_p$ wa.
I know you REL insult people RELHD after NEG hurt DET
'I know the people that you insulted without having hurt.'

What these all have in common is that the NPs in question are either focal or topical. In those in-situ questions and internally headed relative clauses which are LDD constructions, the questioned or relativized element bears a grammaticized discourse function even though it does not appear in the discourse-function position and there is no gap. It has long been noted that heavy-shifted NPs are focal (Rochemont 1978).

(34) a. The preacher sent off to war HIS ONLY SON.
b. Hitler persuaded to join forces with him, MUSSOLINI.

It is plausible that such NPs bear the FOCUS function at f-structure by virtue of their final position. The same is true of arguments extraposed from NP, which also license parasitic gaps, as noted by Fox and Nissenbaum (1999):[12]

(35) I read a book _ before reading an article _ about John.

Similarly, pronouns, by virtue of referring to old information, are at least potentially topical; it is plausible that, at least in some languages, pronominal clitics can bear the TOPIC function syntactically.[13] I propose, then, that what causes the islandhood of (PP) adjuncts not to obtain is not a gap but the presence of some other element which bears a grammaticized discourse

[11]In-situ *wh* questions, on the other hand, do not. Mooré also has externally-headed relative clauses and *wh*-ex-situ questions, both of which license parasitic gaps. It is possible that in-situ questions are not true LDD constructions.

[12]Fox and Nissenbaum note that this is not true of extraposed adjuncts:
(i) *I read a book _ before reading an article _ from John's library.
I hypothesize that they do not bear the FOCUS function.

[13]Campos also reports that Spanish null objects can license parasitic gaps. Following the usual analysis in the Principles and Parameters tradition, he proposes that null objects are empty operators that undergo *wh* movement. The equivalent in LFG would be to assign them a grammaticized discourse function. They are thus assimilated to the same analysis.

function. Formally:

(36)
$$\begin{array}{lll} \mathrm{VP} \rightarrow & \mathrm{VP} & \mathrm{PP} \\ & \uparrow=\downarrow & \downarrow\in(\uparrow \textsc{adj}) \\ & & \neg(\textsc{df}(\uparrow \textsc{gf}^{+})) \Rightarrow (\downarrow \textsc{whpath}) \neq [-\textsc{t}] \end{array}$$

This results in the following f-structure for (1a), repeated here:

(37) a. Which articles did John file _ [without reading $\_{p}$]?

b.
$$\left[\begin{array}{ll} \textsc{focus} & f \\ \textsc{whpath} & [+\textsc{t}] \\ \textsc{subj} & [\text{“John”}] \\ \textsc{tense} & \textsc{past} \\ \textsc{pred} & \text{‘file}\ \langle(\uparrow \textsc{subj})(\uparrow \textsc{obj})\rangle\text{’} \\ \textsc{obj} & f \\ \textsc{adj} & \left\{\left[\begin{array}{ll} \mathbf{WHPATH} & [\mathbf{-T}] \\ \textsc{pred} & \text{‘without}\ \langle(\uparrow \textsc{obj})\rangle\text{’} \\ \textsc{obj} & \left[\begin{array}{ll} \textsc{whpath} & [-\textsc{t}] \\ \textsc{subj} & [\textsc{pred}\ \ \text{‘}\textsc{pro}\text{’}] \\ \textsc{pred} & \text{‘read}\ \langle(\uparrow \textsc{subj})(\uparrow \textsc{obj})\rangle\text{’} \\ \textsc{obj} & f \end{array}\right] \end{array}\right]\right\} \end{array}\right]$$
$$f = [\text{“which articles”}]$$

The bolded WHPATH feature is the one that would normally be blocked by the annotation on the PP adjunct in the phrase structure rule. However, in this case, (↑ OBJ), an instance of (↑ GF^{+}), has the value [“which articles”] (represented as *f*), and an outward path from [“which articles”] through a discourse function (FOCUS in this case) exists. Since the condition that such a path not exist is not met, the constraint blocking [WHPATH [−T]] does not apply.

5. Parasitic Gaps 2: Subject-internal

Another island in which parasitic gaps appear is subject islands (examples from Engdahl 1983, Gazdar, Klein, Pullum, and Sag 1984).

(38) a. Which boy did Mary’s talking to $\_{p}$ bother _ most?
b. Kim wondered which authors reviewers of $\_{p}$ always detested _.

Falk (2009) attributes subject islands to a different source than adjunct islands. Following up on an idea from Kuno (1973) and Grosu (1981), Falk suggests that the islandhood of subjects is the result of a constraint designed to make processing easier by not allowing clause-internal incomplete constituents.

Formally, this is expressed in the syntax in the same way as adjunct islands.[14]

(39)

$$\begin{array}{lcc} \text{IP} \rightarrow & \text{NP} & \text{I}' \\ & (\uparrow \text{SUBJ}) = \downarrow & \uparrow = \downarrow \\ & (\downarrow \text{WHPATH}) \neq [-\text{T}] & \end{array}$$

Given that the licensing of parasitic gaps in adjuncts was linked to the cause of the islandhood of adjuncts, and that the hypothesized cause of the islandhood of subjects is different, one might expect that the status of parasitic gaps in subjects is different.

It transpires that there is empirical evidence that parasitic gaps in subject islands are different from those in adjunct islands. One of the features of parasitic gaps in adjunct islands is that, aside from the islandhood of the adjunct itself, all island constraints are obeyed. The analysis given above for parasitic gaps in adjuncts accounts for this: the only islandhood that is affected is the islandhood of the adjunct. However, parasitic gaps in subject islands can be contained in relative clauses within the subjects. Engdahl (1983: 17) gives examples in both Swedish and English:[15]

(40) a. This is the type of book that [no one [who has read $\__p$]] would give _ to his mother.
b. Here is the boy who [everyone [who has met $\__p$]] thinks _ is clever.

(41) a. Kalle är en kille som [ingen [som träffat $\__p$]] kan tåla _.
Kalle is a guy REL no.one REL met can endure
'Kalle is a guy who no one who has met can stand.'
b. Fattig vill [ingen [som någonsin varit $\__p$]] bli _ igen.
poor wants no.one REL ever was become again
'Poor, no one who has ever been wants to become again.'

Not imposing the islandhood of the subject would not permit a parasitic gap in the relative clause, since relative clauses are themselves islands.

The distinction between parasitic gaps in adjuncts and parasitic gaps in subjects was raised, in a different context, as early as Engdahl (1983: 17f), where it was noted that parasitic gaps in adjuncts can be replaced by pronouns, while those in subjects cannot. Note the following: the examples from (1) with the parasitic gaps replaced by pronouns.

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[14]Under the standard LFG account (Kroeger 1993), there is a non-$\bar{X}$ category S distinct from IP. The subject positions in the expansions of both IP and S will carry the same annotations.

[15]Engdahl notes that the parasitic gap is possible only when the subject NP is indefinite. However, as she and others have pointed out, factors like definiteness and finiteness play a general role in the parasitic gap construction. I will assume here, without argument, that these effects are not syntactic.

(42) a. Which articles did John file ___ without reading them?
b. This is the kind of food you must cook ___ before you eat it.
c. *Which boy did Mary's talking to him bother ___ most?

Engdahl suggests, plausibly, that this distinction in what she calls obligatoriness of the parasitic gap is a consequence of the weak crossover effect. Following up on this obligatoriness distinction, Engdahl (2001: 144) suggests that optional and obligatory parasitic gaps may not be a uniform phenomenon. I concur.

If both Falk (2009)'s account of subject islands and Engdahl (1983)'s account of the impossibility of pronouns instead of parasitic gaps in subject islands are correct, the crucial point is the linear order of subjects. The subject island combined with weak crossover create a situation where an element within the subject cannot be coreferential with a *wh* element. I propose that the phenomenon of parasitic gaps in subject islands is a way to allow such coreference.[16] Rather than not imposing islandhood, as in the case of adjunct islands, I propose that what is involved in the case of subject islands is a separate LDD. Under this proposal, the f-structure of (1c), repeated here, is as follows:

(43) a. Which boy did [Mary's talking to ___$_p$] bother ___ most?
b.

$$\left[\begin{array}{ll}
\text{FOCUS} & f \\
\text{WHPATH} & [+\text{T}] \\
\text{SUBJ} & \left[\begin{array}{ll}
\text{FOCUS} & f \\
\text{WHPATH} & [+\text{T}] \\
\text{SUBJ} & [\text{“Mary”}] \\
\text{PRED} & \text{‘talk}\left\langle(\uparrow \text{SUBJ})(\uparrow \text{OBL}_{\text{Goal}}\ \text{OBJ})\right\rangle\text{’} \\
\text{OBL}_{\text{Goal}} & \left[\begin{array}{ll}\text{WHPATH} & [-\text{T}] \\ \text{OBJ} & f\end{array}\right]
\end{array}\right] \\
\text{TENSE} & \text{PAST} \\
\text{PRED} & \text{‘bother}\left\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\right\rangle\text{’} \\
\text{OBJ} & f \\
\text{ADJ} & [\text{“most”}]
\end{array}\right]$$

$$f = [\text{“which boy”}]$$

Formally, this is achieved by changing the annotation on the subject term in the IP expansion:

[16] While this may seem contrived, the fact is that language has constructions that extend the range of what can be expressed, such as pied-piping, which allows sentences that would otherwise be ruled out by island constraints.

(44) $$\text{IP} \rightarrow \underset{\substack{(\uparrow \text{ SUBJ}) = \downarrow \\ (\downarrow \text{ WHPATH}) \neq [-\text{T}] \\ (\%\text{ORIG}) = ((\text{GF}^* \uparrow)\ \text{DF}_x) \\ \left((\uparrow \text{ AF}^*) = \%\text{ORIG} \Rightarrow \%\text{ORIG} = (\downarrow (\text{ADJ})\ \text{DF}_x)\right)}}{\text{NP}} \qquad \underset{\uparrow = \downarrow}{\text{I}'}$$

In this rule, %ORIG is a local name for an element bearing a grammaticized discourse function either in the same clause or in a higher clause. In the optional line of the NP annotations, the condition checks if this element also bears some argument function either in the same clause or in a lower clause. If it does, then either the subject itself or an adjunct contained within the subject (such as a relative clause) can contain a copy of the original discourse function. In the current example, %ORIG is ["which boy"], which bears the grammaticized discourse function FOCUS in the same clause as the subject. The same element also bears the OBJ function in the same clause, thus licensing the FOCUS in the SUBJ.[17]

6. Conclusion

The existence of multiple-gap constructions is a natural consequence of the basic LFG analysis of LDD constructions, in particular if one assumes inside-out functional uncertainty. The constraints on such constructions are the result of several independent factors: pragmatics, the special status of SUBJ, and the role of reflexive pronouns. The truly parasitic cases are not a uniform phenomenon: adjunct-internal parasitic gaps result from the lower degree of independence that an adjunct has if it shares an element with the clause, while subject-internal parasitic gaps are a device to allow subject-internal elements to be coreferential with subject-external elements.

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[17]Louise Mycock points out (personal communication) that languages which mark the top layer of an LDD path differently from other layers would be expected to show different marking in the two types of parasitic gap constructions. Unfortunately, I have been unable to find information about parasitic gaps in such languages.

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ON THE SYNTAX-DISCOURSE INTERFACE IN HUNGARIAN

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Abstract

In this paper, we investigate the syntax-discourse interface in Hungarian and propose the first steps of its formalization in LFG. Concerning the syntax, we propose that the c-structure is flat in Hungarian, and the preverbal domain in it is governed by the information structure. After examining the distribution of elements in the topic field and the Prominent Preverbal Position (PPP), we point out that they can be filled differently in *neutral* and *non-neutral* sentences, i.e. depending on the discourse. The PPP in non-neutral sentences can be occupied by an element/constituent referred to as the *hocus*, which cannot easily be accommodated in the i-structure assumed in the mainstream LFG literature. This is why a new architecture is put forth, building on the common features and not the discourse functions themselves, that can account for the Hungarian data more adequately. The syntax-discourse interface is then exposed via the mappings between the c- and i-structures.

1 Introduction

In configurational languages, like English, syntactic structure and the linear order of constituents are determined by syntactic functions, like *subject* or *object*, which constitute functions between constituents and the whole sentence (*"the subject/object of the sentence"*). In discourse-configurational languages (É. Kiss, 1995), syntactic structure and the positions of the elements reflect discourse structure, i.e. the role that the sentence plays in the discourse. Discourse functions (*topic*, *focus*, etc.) are thus not functions between a constituent and the sentence, but between a constituent and the discourse structure.

Many syntactic analyses, especially in derivational frameworks, account for the discourse-relatedness of syntactic structures by positing special functional projections (TopP, FocP) that host a particular discourse function (see for instance Rizzi (1997), É. Kiss (2002)). However, such analyses run into some serious problems. Firstly, positing separate functional projections for every discourse function has little explanatory adequacy. Secondly, as opposed to lexical projections (NP, PP, AP, etc.), discourse functional projections do not encode categories, but discourse-semantic information integrated into the syntax, without a clear formal account of the discourse/syntax interface. Thirdly, as we will show, discourse functions cannot exclusively be assigned to designated syntactic positions, and *vice versa*, a particular syntactic position can host more than one discourse function, even in discourse-configurational languages.

In this paper, we deal with Hungarian, more specifically with the preverbal part/left periphery of the sentence. Schematically, the Hungarian sentence can be divided into two fields: the *topic* and the *comment*, and the comment can be further divided into four subfields: the *pre-comment*, the *prominent preverbal posi-*

[†]We thank Jean-Marie Marandin and Mary Dalrymple for their valuable comments on various aspects of this paper. Needless to say, they are not responsible for any remaining errors or misconceptions.

tion (henceforth PPP), the *finite verb*, and the *postverbal part* (based on Kálmán (2001)). This is illustrated in Figure (1):

$$\text{Topic field} \qquad \overbrace{Quantifiers \quad PPP \quad V \quad Postverbal \;\; part}^{\text{Comment}}$$

Figure 1: The schematic representation of the Hungarian sentence

Although the names (topic, comment, prominent preverbal position, etc.) are of semantic/pragmatic in nature, there are also syntactic (distributional) and prosodic arguments for this division of the Hungarian sentence into these fields and subfields. The topic field and the comment can be divided prosodically: the elements in the topic field exhibit a rising intonation pattern, constituting a preparatory section to the first obligatory stress, which falls on the first (content) word of the comment, starting a falling intonation pattern. This main stress can be followed by other main stresses in a sequence of downsteps (in a level-prosody sentence). The verb can lose its stress, cliticizing onto the element in the prominent preverbal position (verbal modifier, negative word, etc.). The first obligatory stress can also be followed by a so called *eradicating stress* (a sharp falling pitch accent) on the element in the prominent preverbal position, which can only be followed by another eradicating stress (on the right periphery), otherwise the rest of the sentence is deaccented, or all other main stresses are reduced. An eradicating stress can also fall onto an element in the topic field, which is often followed by another one in the PPP. The distribution of elements in these positions and fields is further characterized in the next section, concentrating mainly on the topic field and on the PPP.

2 The Data

2.1 Distribution in the topic field

The topic field is usually reserved for definite or specific indefinite noun phrases and referential (time and place) adverbials (individualizable elements), whose order is free in the topic field (É. Kiss, 2005). However, the rightmost position of certain sentence adverbials, like *tegnap* (yesterday), *idén* (this year), indicates the right frontier of the topic field itself as well. These adverbials are interpreted as sentence adverbials in the topic field (1), but as referring only to the immediately following constituent in the comment (2).[1]

[1]Main stress is indicated with (’), eradicating stress with (”) and a rising-falling intonation pattern with (/) throughout this paper.

(1) A ’vonaton ’tegnap sok ’gyerek ’utazott.
the train.SUPERESS yesterday a lot of child travel.PST
Yesterday, there were a lot of children travelling on the train.

(2) A vonaton ”tegnap utazott sok gyerek.
the train.SUPERESS yestarday a lot of child travel.PST
It was yesterday that a lot of children were travelling on the train.

Example (1) conveys information about an event, answering a question like *What happened?*, whereas (2) contrasts *tegnap* (yesterday) with another day (or other days), when supposedly only a few children were travelling on the train.

The set of elements that can appear in the topic field with a special rising-falling intonation pattern is larger: infinitives, adjectives, bare nouns, quantifiers, verbal modifiers, and adverbs (other than the ones mentioned above) can appear there if pronounced that way. This is the case of *Mari* in the following example:

(3) a. Q: -Mit hoztak a vendégek a bulira?
what bring.PST the guests the party.SUBL
What did the guests bring to the party?

b. A: -/**Mari** ”csokitortát hozott.
Mari chocolate cake bring.PST
As for Mary, she brought a chocolate cake.

2.2 Distribution in the PPP

The prominent preverbal position (PPP), which is between the precomment and the finite verb, can also be occupied by a wide range of elements. Some of them appear in the PPP in level-prosody sentences and can receive an eradicating stress *in situ*. However, they must follow the verb if there is another element that carries the eradicating stress. The explanation is that only one of them can precede the verb, when there is more than one potential element that can occupy the PPP in a sentence. The others occupy postverbal positions (except for some questions in which there is also a focused constituent).

2.2.1 Verbal Modifiers (VM)

The verbal modifiers we mention here are *verbal particles*, *bare nominal complements* and *secondary predicates*. **Verbal particles** can have an adverbial or a lexicalized aspectual meaning. When there is no other potential element appearing in the PPP, they precede the verb, otherwise they follow it[2]:

[2] In what follows, verbal particles will be referred to as verbal modifiers (VM). Verbal particles are written as one word with the noun when they precede it, but as two words when they follow it.

(4) ’János ’**ki**olvasta a ’könyvet.
János VM.read.PST the book.ACC
John finished the book.

(5) ’János ”egy hét alatt olvasta **ki** a könyvet.
János one week under read.PST out the book.ACC
John finished the book in one week.

About a classification and analysis of verbal particles, see Surányi (2009) and Laczkó and Rákosi (2011).

Another type of verbal modifier is **bare nominal complements** (see also de Swart and Farkas (2003)), illustrated by the following example:

(6) János ’**levelet** ír.
János letter.ACC writes
John is letter-writing.

Secondary predicates co-occur with some (other) argument of the verb, about which they state something. They often express a goal or a result (7), and appear in the immediately preverbal position:

(7) János ’**pirosra** festette a ’kerítést.
János red.SUBL paint.PST the fence.ACC
John has painted the fence red.

2.2.2 The Hocus

The hocus (introduced by Kálmán (1985a,b); Kálmán et al. (1986), and also referred to in Kálmán (2001)) is a noun phrase, a negative adverb or a monotone decreasing quantifier (as opposed to monotone increasing ones that appear in the precomment) expressing some participant or circumstance in the event denoted by the predicate. Such elements/phrases can bear main stress and appear in the immediately preverbal position, when the event denoted by the verb is not particularly newsworthy, or it is a regular event, apart from the circumstance or participant denoted by the hocus, which expresses something unusual or unexpected. In these cases the main proposition of the sentence is the identification of this participant or circumstance.

(8) János ’tegnap ’**vonattal** ’utazott ’haza. (NP)
János yesterday by train travel.PST home
Yesterday John took the train to go home.

(9) ’Ma a ’**feleségem** ’vitte az ’óvodába a ’gyerekeket.
today the wife.POSS.1SG take.PST the kindergarten.ILL the children.ACC
(NP)

Today my wife took the children to the kindergarten.

(10) ’**Kevesen** ’jöttek el a ’bulira. (monotone decreasing
few come.PST VM the party.SUBL quantifier)
Only a few people came to the party.

(11) ’János ’**ritkán** ’megy el ’kirándulni. (negative adverb)
János seldom goes VM to hike
John seldom goes hiking.

Example (8) implies that John usually does not take the train, according to (9) it is usually not the wife, but someone else that takes the children to the kindergarten, in (10) more people were expected to come to the party, and in (13) John goes hiking less often that it would be expected.

In identificational sentences, the subject appears as the hocus, preceding the verb (copula):

(12) ’**János** volt az ’igazgató.
János was the director.
John was the director.

(13) A ’nyomozó ’**a sógorom** volt.
the inspector the brother-in-law.POSS.1SG was
My brother-in-law was the inspector.

In the mainstream linguistic literature on Hungarian, sentences containing a hocus are not discussed, and they are not clearly distinguished from narrow-focus sentences. This is a problem, since *hocus* and *focus* are clearly different (see below).

2.2.3 The Focus

The focused constituent differs from the above mentioned elements/phrases in that it bears sharp falling pitch accent, functioning as *eradicating stress*, referring to the fact that no main stress (only another eradicating stress) can follow it in the rest of the sentence. In Hungarian, the main function of focus is contrast, i.e. it identifies the entities about which the predicate holds and restricts the validity of the predicate to only these entities by excluding the other members of the relevant set. Sentences with focus cannot be uttered *out of the blue*. In most cases, they are answers to questions (14), reactions or corrections (15) (capitals indicate the constituent carrying a pitch accent):

(14) Answer:

a. Q: -Ki hívta meg Marit a bulira?
who invite.PST VM Mari.ACC the party.SUBL
Who invited Mary to the party?

b. A: -"**Zoli** hívta meg (Marit a bulira).
ZOLI invite.PST VM (Mari.ACC the party.SUBL)
It was ZOLI who invited her (to the party).

(15) Correction:

a. -'Mari 'tegnap 'kiolvasta a 'Háború és békét.
Mari yesterday VM.read.PST the War and Peace.ACC
Mary finished yesterday *War and Peace*.

b. -Nem, a "**Bűn és bűnhődést** olvasta ki.
no, the Crime and Punishment.ACC read.PST VM
No, she finished *Crime and Punishment* yesterday.

We should note here that not all foci appear in the PPP. If the focus is a universal quantifier (16), it cannot occupy the immediately preverbal position. Similarly, in the presence of a focus in the PPP, a second one must appear on the right periphery of the sentence (17). Thus the syntactic position cannot help in the identification of all foci in Hungarian.

(16) /A csillagok háborúját "**mindenki** megnézte.
Star wars.ACC everyone VMsaw
Star Wars was seen by everyone.

(17) A "**lányok** nyerték meg tegnap a "**kajakversenyt)**, a "**fiúk** pedig
the girls won VM yesterday the kayak contest, the boys and
a "**kenuversenyt**.
the canoe contest
It was the girls who won the kayak contest yesterday, and the boys who won the canoe contest.

The following examples (based on Kálmán (2001)) illustrate the difference between the hocus and the focus:

(18) ’Ezen a héten a ’Mecsekben raboltak ki
this.SUPERESS the week.SUPERESS the Mecsek.INESS rob.PST.3PL VM
egy ’pénzszállító autót.
a money transport car.ACC
This week it was in the Mecsek (mountains) that a money transport vehicle was robbed.

(19) ’Ezen a héten a MECSEKBEN raboltak ki
this.SUPERESS the week.SUPERESS the Mecsek.INESS rob.PST.3PL VM
egy pénzszállító autót.
a money transport car.ACC
This week it was in the Mecsek (mountains) that a money transport vehicle was robbed.

A Mecsekben is hocus in (18) and focus in (19). The difference between the two sentences can be illustrated with the different contexts. In the first case, robbing a money transport car counts as a usual event. The hocus identifies the place where the event happened this week. The location counts as non-canonical, unusual and surprising at the same time, either because this happens less often in mountains, or because the Mecsek is not known for such crimes. In (19), robbing a money transport car is not necessarily a usual event. The focus identifies the place where it happened, contrasting it to other locations, where it could have potentially happened, or correcting a previously proposed other location. In this latter case, the sentence does not form a true prosodic minimal pair with (18), but would have the following form:

(20) (Nem!) A ”Mecsekben rabolták ki a pénzszállító autót
(No!) the Mecsek.INESS rob.PST.3PL VM the money transport car.ACC
(és nem a Bakonyban).
(and not the Bakony.INESS)
No! It was in the Mecsek that the money transport vehicle was robbed (and not in the Bakony)!

(20) is about a single event (indicated by the definite article in front of the noun *pénzszállító autó* and the definite conjugation of the verb). It identifies the location of the event, by contrasting it to another location.

We can thus conclude that both the hocus and the focus are identificational elements, appearing in different discourse contexts. The focus is prosodically distinguished, carrying a pitch accent (followed by the deaccenting or reduced stress of the post-focal material), whereas the hocus is not more prominent prosodically than the other lexical elements of the sentence (except for the verb which cliticizes onto it). In addition, the focused constituent presupposes that the proposition cannot be true simultaneously with another, in which the focused element is changed to an alternative to its denotation (the robbery cannot take place at two locations at the same time). To illustrate this, consider the possible continuations of (18) and (19):

(21) a. ’Ezen a héten a ’Mecsekben raboltak
this.SUPERESS the week.SUPERESS the Mecsek.INESS rob.PST.3PL
ki egy ’pénzszállító autót.
VM a money transport car.ACC
This week it was in the Mecsek (mountains) that a money transport vehicle was robbed.

b. Nem, nem csak ott. A ”Bakonyban is kiraboltak
no not only there the Bakony.INESS too VM.rob.PST.3PL
egyet.
one.ACC
No, not only there. One was robbed in the Bakony too.

(22) a. Ezen a héten ”a Mecsekben raboltak ki egy
this.SUPERESS the week the Mecsek.INESS rob.PST.3PL VM a
pénzszállító autót.
money transport car
This week it was in the Mecsek that a money transport vehicle was robbed.

b. #Nem, nem csak ott. A ”Bakonyban is kiraboltak egyet.

2.2.4 Question words

Finally, question words typically appear immediately in front of the finite verb as well. In the presence of a question word, not only verbal modifiers (23), secondary predicates, etc. but elements of the precomment (24) also occupy postverbal positions:

(23) **Kit** hívott meg János a bulira?
who.ACC invite.PST VM János the party.SUBL
Who did John invite to the party?

(24) **Kire** szavazott mindenki?
who.SUBL vote.PST everybody
Who did everybody vote for?

Question words are often argued to constitute a subclass of focus, based on similarities in prosody, syntactic position, semantics and, in some languages, morphology. Despite the apparent similarities, it would be too hasty a generalization to collapse question words into foci in Hungarian. Although foci and question words seem to share the same syntactic position and prosody, some important differences suggest that they belong to different types of objects. For instance, while strictly only one preverbal focus is permitted in Hungarian (if there is a second, it is obligatorily postverbal), two question words can appear preverbally, and they can even be preceded by a focused constituent or followed by a negated focus in some contexts. Furthermore, two question words can be coordinated, irrespective of their grammatical function, whereas this is not possible with two focused constituents. We will argue that their similarities can also be derived from the fact that they play parallel roles in the discourse they occur in: both question words and foci presuppose the rest of the sentence, and foci in the answers correspond to question words in the question.

The elements in the PPP in (4)-(13) are in complementary distribution with each other, i.e. a verb cannot appear simultaneously with a verbal modifier and a secondary predicate, for instance, even if one of those followed the verb. They can all receive an eradicating stress *in situ*, in the PPP. However, in the presence of the elements in (14)-(15), and (23)-(24) they have to follow the verb.

2.3 The role of discourse structure

Considering the diversity of elements that can occupy the topic field and the PPP, how could we identify what is in common in them? Concerning the PPP, as we have already seen in the case of secondary predicates, these elements contribute to the meaning of the sentence with a secondary/independent proposition that can sometimes modify the proposition formulated by the comment. According to É. Kiss (2006), not only verbal modifiers can be considered as resultative, locative or terminative secondary predicates, but structural focus can be reanalyzed as a *specificational predicate* (similarly to English cleft sentences) as well. Komlósy (1994) also showed that preverbal bare nominals function as predicates that predicate of an existentially bound variable incorporated into the verb. We will argue that apart from the common grammatical function (secondary predicates), the common properties of some of the elements in the PPP are related to the information structure and the discourse the sentence is uttered in.

To see this last point more clearly, an important remark is due here. Some of the above mentioned elements can never appear in the same sentence, since the discourse types they are part of are different. In Hungarian, based on formal, interpretational and discourse factors, two types of sentences can be distinguished: *neutral* ("all-focus")[3] and *non-neutral* "narrow-focus") sentences (see Kálmán (1985a,b)). Formally, non-neutral sentences contain an eradicating stress (25) in the PPP (and

[3]Neutral sentences can answer questions like *What happened?*. They cannot always be referred to as all-focus sentences, since they can contain topics:

possibly also in the topic field), whereas neutral sentences have level-prosody and can contain several main stresses (26):

(25) ’Tegnap ”**Marit** láttam a városban, (nem ”Jánost).
yesterday Mari.ACC see.PST.1SG the city.INESS (not János)
Yesterday I saw MARY in the city, not JOHN.

(26) = (1)

’János ’tegnap ’vonattal utazott ’haza.
János yesterday train.INSTR travel.PST home

Yesterday John took the train to go home.

In (25), the focus (*MARI*) bears a sharp falling pitch accent, after which the rest of the sentence is deaccented (or bears reduced stress), except for the second focus (*JÁNOST*). In (26), the topics (*János*, *tegnap*) have a slightly rising tone, pointing forward to the comment, whereas the falling tone starts on the first constituent of the comment, the hocus (*vonattal*).

Concerning the topic field, the elements occurring there have different properties in narrow-focus and all-focus sentences. It is common in the two cases that they introduce subtopics/subquestions. In a neutral context, there is no topic in the sentence if the sentence continues the previous subtopic. However, when a sentence changes the subtopic, the element in the linearly first position indicates the topic shift. This is why this type of topic is often called *thematic shifter*. The other type of topic that we find in narrow-focus sentences (indicated prosodically with eradicating stress and a rising tone) is closely related to the contrastive property of these sentences and is called *contrastive topic* in the literature. The contrastive topic restricts the domain of the validity of the focused constituent to some element of a set, implying that to other elements of the relevant set the focused constituent does not hold. For instance in (3-b), repeated here as (27-b), the contrastive topic (Mari), indicates *the strategy* of decomposing the set of guests into its elements, the individual guests and associates, each of them with an answer (i.e. a focused constituent). This association means at the same time that as opposed to Mary, there is at least someone else who did not bring a chocolate cake.

(27) a. Q: -Mit hoztak a vendégek a bulira?
what bring.PST the guests the party.SUBL
What did the guests bring to the party?

(i) ’János ’találkozott ’Marival a ’városban.
János meet.PST Mari.INSTR the city.INESS
John met Mary in the city.

In this example *János* is the topic, and the sentence is not *all-focus*.

b. A: -/**Mari** ”csokitortát hozott.
Mari chocolate cake bring.PST
As for Mary, she brought a chocolate cake.

The two types of sentences are used in different contexts. Neutral sentences, present mostly in narrative contexts, only convey information and continue the narrative, whereas non-neutral sentences are used for asking questions, answering questions, corrections and confirmations, disagreement, and highlighting parallels. If we analyze the discourse as the hierarchy of topics and subtopics (or, a question under discussion, subquestions and the possible answers; see for instance Büring (1997, 2003)), we see that both sentence types contain two prominent preverbal parts (the topic field and the PPP), and a set of (in the sense of Jacobs (1984)) prominent element types that can fill these positions. Elements in the topic field relate to the discourse in a way that they thematize it by selecting the subtopic/subquestion with respect to which the given sentence adds new information to the common ground. On the other hand, elements appearing in the PPP (or possibly in the precomment) constitute the most informative, prominent part of the sentence. In some cases, this can be new information, or the part that answers a question, or the unexpected or unusual part of the meaning (as we have seen in the case of the *hocus*). In order to formalize the above sketched syntax-discourse interface, first we take a look at the syntactic structure of Hungarian in the next section.

3 The syntactic structure of Hungarian

The LFG representation of the syntactic structure (c-structure) of Hungarian can differ from that of other theories, since in LFG, constituent structure corresponds to a flexible X-bar theory representation, in which no node, not even the head is obligatory, and exocentric constituents are permitted (there is no binary-branching constraint). The question is, what kind of c-structure should be associated with Hungarian. To our knowledge, there have been two proposals in the LFG literature for the c-structure in Hungarian, but they concentrated mostly on the problem of the preverbal position and the elements it can host: focus and question words.

In the first analysis (Börjars et al., 1999), the immediately preverbal constituent is sister to the verb in an extended verbal projection, which is supposed to host also all the elements of the preverbal domain (topics and quantifiers). The discourse functions are associated with syntactic positions via functional annotations. This analysis does away with the set of functional projections (TopP, CTopP, DistP/QP), whose head position is usually empty, since they are only postulated for accommodating one type of element in their specifier position. FocP is an exception to this, since the verb is supposed to move into its head position, leaving behind the verbal modifier. However, according to Börjars et al. (1999), even a FocP is superfluous in a theory in which no Foc feature is supposed to be assigned or checked. The authors assume OT-type constraints as well, which account for word-order and the immediately preverbal position of the focus. The second analysis to be mentioned here is that of Mycock (2006), who assumes that the focus and the question words are in Spec,VP, thus obligatorily sister to the verb.[4]

According to Dalrymple (2001), functional categories vary from language to language, and each of them has to be motivated for each language. According to this, the I head position can be occupied by a finite verb or an auxiliary, like the C position (in inversion contexts). Thus King (1993) assumes that in Russian, only non-finite verbs reside in the VP, finite verbs occupy the I position, the topic and the contrastive focus the Spec,IP and interrogative words the Spec,CP position. Dalrymple (2001) also mentions that positing a VP projection is motivated only if it contains only the verb and its complements (except for the subject) and these constituents can appear together at other parts of the sentence as well. On the other hand, if the subject can appear as sister to the V, the VP projection is unmotivated. Now, the syntactic structure of non-configurational languages is represented with the help of the non-configurational S node, which does not necessarily contain a CP or an IP projection. It is also possible that one part of the sentence is hierarchical and the other exhibits a free word order, flat structure, in which case the tree diagram contains both CP/IP and S nodes. Such languages are Warlpiri and Welsh.

These considerations about the VP undermine Mycock (2006)'s (and Laczkó and Rákosi (2011)'s) c-structure, since in Hungarian, the subject can be postverbal, appearing as sister to the verb, between the verb and the direct object:

(28) Marinak adta oda János a könyvet.
Mari.DAT give.PST VM János the book.ACC
John gave the book to MARY.

In Hungarian, as we have seen, the preverbal and postverbal parts of the sentence differ, in that in the preverbal section, the position and the order of the elements depend on their role in the information structure. This can be directly represented in LFG via the functional annotations. The question is now, whether a hierarchical preverbal section is motivated even in the LFG framework. In the transformational frameworks, two factors motivated the hierarchical preverbal structure: the obligatory binary branching in the tree diagrams and the fact that the linear order of the elements determines their relative scope as well. As opposed to this, the postverbal part of the sentence exhibits free word-order (obeying, supposedly, certain phonological factors, such as heavy elements tend to follow lighter ones). In LFG, neither of these factors necessitate a hierarchical architecture, since the linear order of elements can in itself reflect the scopal relations, thus there is no reason for positing a hierarchical sentence structure in Hungarian. As was pointed

[4]Laczkó and Rákosi (2011) also assume a VP projection in Hungarian, in which the verbal modifiers occupy the specifier position.

out above, a VP projection is not motivated. In the c-structure, annotations indicate the grammatical and discourse functions. In addition, they can express other constraints as well, for instance, the obligatory presence of other elements, which is needed in the case of sentence-final focus (which can appear on condition if there is a preverbal focus in the sentence). With the annotations, thus, we can express and formalize the observation that the preverbal part of the Hungarian sentence is determined by the information structure. The flat, c-structure with preliminary annotations is shown in Figure (2).

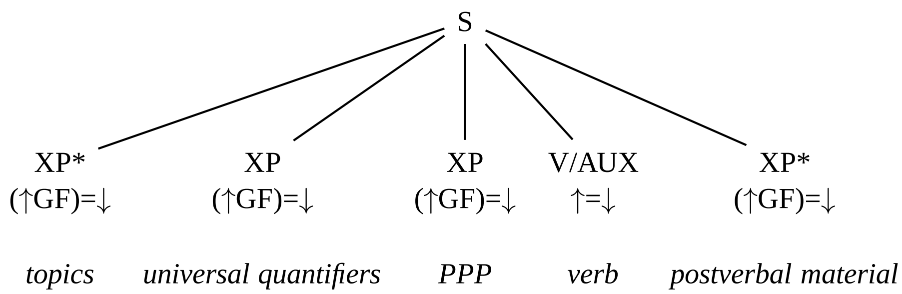

Figure 2: C-structure of Hungarian

The annotations in Figure (2) refer to the grammatical function represented in the f-structure. In order to formalize the interface of the syntactic structure with the information structure, we will consider the latter in the next section.

4 Information Structure

4.1 Information Structure in LFG

The information structure as a separate level of representation in LFG was proposed by Butt and King (1996) and King (1997). In earlier versions of the LFG framework, discourse functions were integrated in the functional structure and one syntactic unit was associated with two functions at the same time, for instance *topic* and *subject*). The proposal was motivated by the problem of focusing the predicate without its arguments and the observation that syntactic constituents do not correspond systematically to constituents of information structure (see King (1997)).

Butt and King (1996) proposed that the information structure consist of four sets, which are defined by the combination of two features: *new +/-* and *prominent +/-*. The *TOPIC* set contains elements that are prominent, but not new, the *(Information) FOCUS* set contains new and prominent elements, whereas old and not prominent elements belong to *BACKGROUND* and new but not prominent ones to *COMPLETIVE INFORMATION* (see Figure 3).

As a recent development, Dalrymple and Nikolaeva (2011) propose to encode semantic information in the information structure. In this representation, which

	Topic	Focus	Background Information	Completive Information
New	–	+	–	+
Prominent	+	+	–	–

Figure 3: I-Structure units (Butt and King, 1996)

we also follow in this paper, the values of the discourse function attributes are the meaning constructors of the elements that appear in a given set.

Although this classification simplifies the definition of discourse functions, for instance, foci are not always new, and prominence also has to be defined, we will propose an analysis which builds on this architecture, but it captures the facts presented above more adequately.

4.2 Problems and new proposal

The architecture of the information structure, as proposed by Butt and King (1996), King (1997) and Choi (1999), contains *topic* and *focus* as i-structure primitives. In this section, an alternative architecture is proposed, which is not fundamentally different from the one presented above, but it could be argued to capture the problematic facts better. The main problem concerns the fact that the set of elements with different discourse, semantic and prosodic properties is larger than the above architecture could accommodate without simplifying these properties. Let us now go through these elements, familiar from previous sections:

Thematic shifters can be defined as the element that links the sentence to the discourse by introducing a new subtopic of the discourse topic. It can be observed that in Hungarian (and, according to Vallduví (1992) in Catalan), a thematic shifter is present in the sentence only if it does not continue the previous subtopic. Such sentence topics are typical in narrative contexts. From this it follows that there are a number of sentence types which do not contain sentence topics, for instance the ones that continue the previous subtopic in narrative contexts, some questions, and answers introducing complex strategies.

The focus is the semantically/pragmatically prominent part of answers to questions, corrections, contrastive and parallel structures, which is usually formally highlighted as well (pitch accent, syntactic position).

Contrastive topics are similar to foci, in that they do not appear in *non-neutral* utterances. They usually co-occur with a focused constituent, which both Büring (2003) and Gyuris (2009) explain by claiming that contrastive topics carry the presupposition that there is a focus value (different from and not entailed by that of the sentence) associated with an alternative to the denotation of the contrastive topic. Contrastive topics can co-occur with sentence topics, in this case the sentence is linked both to a more general discourse topic and to a more restricted one:

(29) [$_T$ János] [$_{CT}$ a levest] $_F$ megette(, de a [$_{CT}$ húst] [$_F$
John the soup.ACC VM.eat.PST but the meat.ACC
nem]).
not
As for the soup, John did eat it (, but he did not eat the meat).

Gyuris (2002, p. 23, 15)

In (29), the thematic shifter is *János*. The sentence contains a contrastive topic (*a levest*), which is implicitly or explicitly contrasted to *a húst*. In the two parallel clauses, the focus values are also different, since different contrastive topic values have to be mapped on different focus values (Gyuris, 2009). The different focus values are verum and falsum foci, respectively.

The hocus is an argument or adjunct appearing in the preverbal position in neutral (or all-focus) sentences in Hungarian. It lacks the pitch accent and the contrastive-exclusive reading of focused constituents in non-neutral sentences.

It follows from the facts presented above that the hocus cannot be analyzed as a subtype of focus, and thus it would be difficult to integrate it into Butt and King (1996)'s model of information structure.

Question words are often assumed to be a subtype of focus and analyzed as such at the level of information structure. However, as King (1993) remarks,

"[t]he discourse functions associated with questions are not fully understood. The term Q(uestion)-Foc(us) is used to indicate the role which corresponds to the focus in the answer to the question."

Mycock (2006) also distinguishes between *interrogative* and *non-interrogative* foci in order to account for Hungarian multiple questions in which two (or more) question words can precede the verb, unlike the case of multiple foci, where only one of them can appear in the PPP. We assume (see also Gazdik (2011, Chapter 7) for the details) that question words cannot be collapsed into focus, but their common properties can be captured if we assume that they have a parallel status in the discourse.

An alternative solution would be to emphasize the common properties of the different discourse functions and to build the i-structure architecture on them. Thus a set would include elements based on a common property, without claiming that these elements must be semantically and discourse-wise identical. The exact semantic and discourse properties would follow, as mentioned above, from the meaning constructors of the individual elements and the discourse structure the sentence appears in. In what follows, our proposed i-structure architecture is presented. It keeps some aspects of Choi (1997)'s features, but also deviates from it in others. First of all, we have seen that certain elements are semantically prominent and formally (syntactically or prosodically) highlighted. These elements are referred to as +PROMINENT, and others as −PROMINENT. Semantic prominence can be defined, based on Jacobs (1984), with respect to the illocutionary operator associated with the sentence. Prominent elements are the ones specially affected by the illocutionary operator. These elements are different in reactive (focus, contrastive topic) and out of the blue sentences (thematic shifter, hocus, certain question words), but constitute the prominent set at i-structure. This distinction defines two sets in the i-structure. Furthermore, we saw that among prominent elements we find some that link the sentence to the discourse (by introducing a subtopic of the discourse topic or reshaping the discourse topic), and others which do not. The first set is called D-LINKED (see Pesetsky (1987); Comorovski (1996), etc.), and the second ¬D-LINKED. This way, we stay neutral with respect to the *new* status of focus, since the focus does not necessarily constitute new information (in the sense of introducing a new discourse referent). In the −PROMINENT set, we also find a D-LINKED and a ¬D-LINKED subset, the first corresponding to background, the second to completive information (these are kept from Butt and King (1996)). The proposed architecture hosts the above mentioned elements as shown in Figure (4).[5] Assuming this structure, the annotated c-structure of Hungarian would look like that in Figure (5).

$$\left[\begin{array}{ll} +\text{PROM} & \left[\begin{array}{ll} \neg\ \text{D-LINKED} & \left\{\text{FOCUS, QW, HOCUS}\right\} \\ \text{D-LINKED} & \left\{\text{THEMATIC SHIFTER, CONTRASTIVE TOPIC, QW}\right\} \end{array}\right] \\ -\text{PROM} & \left[\begin{array}{ll} \neg\ \text{D-LINKED} & \left\{\text{COMPLETIVE INFORMATION}\right\} \\ \text{D-LINKED} & \left\{\text{BACKGROUND INFORMATION}\right\} \end{array}\right] \end{array}\right]$$

Figure 4: Proposed i-structure

[5] QW stands for *Question Word*, without specifying its discourse function as topic or focus. Arguably, some question words in multiple questions show similar properties with topics (Gazdik, 2010).

S

	XP* $\uparrow_\sigma \in (\uparrow_{\sigma\iota}$ +PROM D-LINKED)	XP*	XP $\uparrow_\sigma \in (\uparrow_{\sigma\iota}$ +PROM $\neg$D-LINKED)	V/AUX	XP* $\uparrow_\sigma \in (\uparrow_{\sigma\iota}$ +PROM D-LINKED)
Neutral sentence	thematic shifter(s)	universal quantifiers	verbal modifiers secondary predicates negative words hocus		
Non-neutral sentence	thematic shifter(s) contrastive topics question words	universal quantifiers	question words focus		

Figure 5: Annotated C-structure

5 Conclusion

In this paper, we presented the first steps of the possible formalization of the syntax-discourse interface in Hungarian in the framework of LFG. The discourse-configurational property of the language is reflected by the assumption that the preverbal part of the sentence is determined by the information structure via a direct mapping between this latter and the c-structure. We argued, furthermore, that the traditionally assumed i-structure, containing *topic* and *focus* as its basic sets cannot account for all the Hungarian data, mainly since it could not accommodate the *hocus* (the constituent in the PPP of neutral sentences), and it usually collapses question words into foci. The alternative architecture proposed is based on two features: +/− PROMINENT and D-LINKED/¬D-LINKED, grouping together the elements with discourse functions that share some common properties. Further research should be conducted in order to specify how discourse structure could be included in the representations (in which the vague terms of *neutral* and *non-neutral* sentence would make sense), and also in order to account for the exact role of verbal modifiers and secondary predicates in the system.

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MULTIDIMENSIONAL SEMANTICS WITH UNIDIMENSIONAL GLUE LOGIC

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Abstract

We present an implementation of multidimensional semantics in Glue Semantics. Our approach differs from the proposal of Arnold and Sadler (2010) by restricting multidimensionality to the meaning language and therefore avoiding the introduction of tensors in the compositional glue logic. We use a construction from category theory — monads — to create structured mappings from the algebra of unidimensional semantics to the multidimensional case. Monads have already been successfully employed in theoretical computer science to provide a denotational semantics of side effects. Here we follow the suggestion of Shan (2001) to use monads to model semantic phenomena and show how monads can be used to capture the analysis of natural language expressions like appositives and expressives. We argue that monads allow us to keep the simplicity of unidimensional composition while also allowing the ability to track multiple meaning dimensions and to control information flow between these different dimensions appropriately.

1 Introduction

Recently much attention has been paid to the semantic contribution conveyed by a diverse group of expressions that includes *expressives*, *appositives*, *epithets* and *non-restrictive relative clauses*. The contribution to meaning of this type of expressions regularly escapes the scope of logical operators such as negation and question forming elements. Consider for instance (1):

(1) Most fucking neighbourhood dogs pee on a damn hydrant on this street.

This sentence conveys the information that the majority of the dogs living in the neighbourhood urinate on a hydrant in the contextually defined street. However, the sentence also conveys a generally negative attitude towards dogs and/or their urinating on the aforementioned hydrant. This effect is obtained in (1) by the use of the two expressives *fucking* and *damn* (compare (1) with the more neutral *Most neighbourhood dogs pee on a hydrant on this street*).

Nevertheless, the resulting interpretation is not just the conjunction of the two contributions. If an interlocutor replies to (1) with *No, that's not true*, the interpretation commonly associated with this reply can be paraphrased as "No, the neighbourhood dogs don't pee on a hydrant on this street". The reply does not negate the semantic contribution of the expressive. The same reply to something along the lines of *Most neighbourhood dogs pee on a hydrant on this street and I hate dogs and their urinary habits* or *Most neighbourhood dogs pee on a hydrant on this street and dogs and their urinary habits are detestable* would instead take scope over both conjuncts, thus also potentially targeting the negative attitude towards dogs.

The mini dialogue in (2) exemplifies the same behavior.

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(2) A: John Lee Hooker, the bluesman from Tennessee, appeared in *The Blues Brothers*.
B: *No, that's not true.*
$\Rightarrow$ No, John Lee Hooker did not appear in *The Blues Brothers*.
$\not\Rightarrow$ No, John Lee Hooker was not from Tennessee.

B's reply does not target the information about the birth place of John Lee Hooker, conveyed by A with the appositive *the bluesman from Tennessee.* The only strategy available to B to correct A's utterance is the one illustrated in (3):[1]

(3) B: True, but actually John Lee Hooker was born in Mississipi

In (3) the information conveyed by the main clause is first acknowledged and only then the appositive contribution is amended.

Potts (2005, 2007) introduces a unified analysis of these diverse expressions in terms of two parallel semantic levels, usually called 'dimensions'. According to this view, there are two different dimensions of meaning to which expressions can contribute, the 'at-issue' dimension and the 'side-issue' dimension, also called the 'conventional implicatures dimension' or 'CI dimension'.

Contributions to the *at-issue* dimension represent that part of meaning that speakers present as 'under discussion'. At-issue contributions are sensitive to logical operators and, in a communicative setting, they enter the common ground only after being (possibly silently) acknowledged by the other communicative agents. In (1) the at-issue contribution corresponds to the information about the urinary habits of the neighbourhood dogs.

Expressions contributing to the CI dimension mainly convey information that the speaker presents as *uncontroversial*. Moreover the information is presented as *peripheral* and not *under discussion*. Very often, as in the case of expressives, meaning contributed to the CI dimension is speaker oriented and implicitly expresses the mental state of the speaker. In this sense it enters the common ground in a different way, as the speaker's choice of words indicates that she is the relevant source of truth regarding the propositions contributed (as is always the case for speaker-oriented material). As illustrated above, CI material regularly escapes the scope of logical operators such as negation and question forming operators.

Potts formalizes these intuitions in a type logic based on the addition of a second kind of propositions, *CI propositions*. The logic is set up in such a way that expressions contributing to the CI dimension denote a pair of values, the first one of the type usually associated with the syntactic category they belong to (e.g. a function from sets to sets in the case of a noun-modifying expressive), and the second one, which is always of the CI propositional type. The logic is also structured in such a way that the information can only flow from the at-issue dimension to the CI dimension, in the sense that at-issue meaning components contribute to the CI dimension, while CI material cannot contribute to the at-issue dimension during the compositional phase.

[1] John Lee Hooker was in fact born in Mississippi.

Arnold and Sadler (2010) expand on Potts's proposal and give an implementation of the analysis in LFG (Kaplan and Bresnan, 1982; Bresnan, 2001; Dalrymple, 2001) with Glue Semantics (Glue; Dalrymple et al., 1993; Dalrymple, 1999, 2001). Their starting point is the intuition that, from a resource-logical point of view, expressions contributing to the CI dimension create a pair of resources, one at the at-issue level and one at the side-issue one. To do so, Arnold and Sadler use a tensor pair as the resulting resource produced by a CI-contributing expression. The paired resources that are produced by the compositional process are then split and the at-issue material is used subsequently in the proof, while the side-issue material is only collected at the end of the compositional process.

In this paper we present an alternative treatment of Potts's analysis in LFG that starts from the proposal of Arnold and Sadler (2010) but strives for more generality and for a simpler treatment of multidimensional semantics. At the same time our approach allows for finer control of the flow of information between the two dimensions. In fact, although Arnold and Sadler (2010)'s implementation correctly restricts the flow of information only from the at-issue dimension to the CI-dimension during the compositional phase, at the same it lacks enough structure to model a class of interdimensional meaning interactions that Potts (2005, 2007) and AnderBois et al. (2010) discuss.

Our proposal is based on the suggestion made by Shan (2001) of using *monads* to uniformly model a large number of semantic phenomena. In general, a monad allows us to reproduce the structure of a certain compositional algebra in a more complex but related setting. We will show how the monadic approach allows us to retain a compositional interface based only on functional application and functional abstraction, even in the case of a multidimensional semantics. At the same time, the monadic machinery allows us to combine different semantic phenomena and to control how they interact. This will also allow us to shed light on the restrictions that can be observed in the kind of inter-dimensional meaning interactions that are not directly related to the compositional process.

The paper is structured as follows. In Section 2, we discuss the proposal of Arnold and Sadler (2010) and motivate our version on the basis of the aforementioned data that illustrate more complex patterns of interactions between dimensions. In Section 3, we introduce the concept of monads and discuss how we can use them to give structure to linguistic meanings. Section 4 provides a fully worked out example of how the monadic approach can be used in Glue Semantics to characterize multidimensional meanings and how monads can help us to model the interaction between the dimensions in cases involving non fully compositional phenomena. Section 5 concludes and presents directions for future research.

2 Arnold and Sadler (2010)

In this section we briefly review the proposal of Arnold and Sadler (2010), placing it in the context of Potts's analysis and identify the points of departure of our approach with respect to theirs. Subsequently we review a number of circumstances, initially discussed by Potts (2005, 52ff.), and more recently by AnderBois et al. (2010), in which at-issue content seems to require access to side-issue content, which would be precluded by Potts's type theory. We claim that this form of interaction also calls for an analysis based on monads.

Arnold and Sadler (2010) start their analysis from the assumption that expressions like appositives, non-restrictive relative clauses and expressives are fully integrated in the constituent and functional structures of the sentences to which they contribute, a view we fully agree with. All these constructions contribute to meaning as adjuncts and compose with the rest of the linguistic material following the standard projection architecture of LFG. The focus of their proposal is on the compositional rules that govern the interactions between dimensions.

The implementation they discuss is based on the analysis of Potts (2005) and, in particular, on a suggestion made by Potts (2005, 85ff.) for a resource-sensitive implementation of the theory. As discussed above, the idea of Potts is that each linguistic expression denotes a pair of objects: the at-issue contribution, of the type usually associated with the expression, and a possibly empty side-issue contribution, always of type t^c, a distinct CI propositional type. The meaning of linguistic expressions is composed according to the structure of a semantic tree derived from a syntactic tree using two different modes of composition. The first one involves only the at-issue dimension and corresponds to functional application:

(4)
$$\begin{array}{c}\langle\alpha(\beta), \_\rangle \\ \langle\beta, \_\rangle \quad \langle\alpha, \_\rangle\end{array} \qquad \begin{array}{c}\langle\alpha(\beta), \_\rangle \\ \langle\alpha, \_\rangle \quad \langle\beta, \_\rangle\end{array}$$

In these rules, the at-issue meaning, the first component of the pairs, is composed via functional application. The CI dimension is left untouched and Arnold and Sadler particularly stress that it is not percolated up the tree. There is then another form of composition, specific for CI meaning:

(5)
$$\begin{array}{c}\langle\beta, \alpha(\beta)\rangle \\ \langle\beta, \_\rangle \quad \langle\alpha, \_\rangle\end{array} \qquad \begin{array}{c}\langle\beta, \alpha(\beta)\rangle \\ \langle\alpha, \_\rangle \quad \langle\beta, \_\rangle\end{array}$$

Here the at-issue material is combined and transferred to the CI dimension (the second component of the pairs). At the same time the β component is duplicated and copied in the at-issue part of the meaning. These types of rules regulate the flow of information between the dimensions. In particular the type theory is set up so that values can only travel from the at-issue dimension to the side-issue one. The interpretation process is then completed by an additional step that collects all the CI propositions and conjoins them with the propositional content of the at-issue dimension. These rules break the resource sensitivity assumption of Glue Semantics (Asudeh, 2004, 2012), which is grounded in the use of linear logic (Girard, 1987), a resource logic, for semantic composition. In both cases the argument value β is used two times: it is first copied to the at-issue dimension but it is then reused as the argument of the function α in the side-issue dimension.

Arnold and Sadler follow and extend the suggestion of Potts of considering CI-contributing lexical items as objects producing a *pair* of resources, one for the at-issue dimension and one for the side-issue dimension. So, in general, the glue term describing the compositional behavior of these expressions will have a return type composed by two resources, one of the CI propositional type, combined with the tensor $\otimes$. This is reflected in the meaning terms for these expressions, as they will result, after all their arguments have been saturated, in a pair of objects.

However only the at-issue resource is going to be further used in the Glue proof, as the CI material must be inaccessible once it has been created. Therefore Arnold and Sadler introduce a rule to split the tensored pair into two resources. They call this rule *at-issue-ci-split*; we repeat it here in (6)

(6) $$\frac{\langle m, m' \rangle : r \otimes r_{t^c}}{m : r \quad m' : r_{t^c}}$$

Any CI resource obtained by the split rule is not used in the inferential process, as there are no linguistic expressions that consume a resource of that type. Nevertheless, to obtain the final interpretation, the CI propositions must be collected. To this end, Arnold and Sadler use the 'of course' operator, '!', which allows the term that it takes scope over to be used any number of times, thus relaxing resource sensitivity. This operator is then used for the meaning constructor of a silent linguistic operator applied to the root of the derivation. The silent operator simply scans the derivation, collects the CI propositions and conjoins them with the at-issue proposition. The silent operator would need to be different in case of other types of utterances, for instance in the case of questions, as in these cases the CI contribution cannot just be conjoined with the at-issue content of the speech act.

Arnold and Sadler also propose an alternative implementation that departs from Potts's proposal by adding a new projection to the LFG architecture. The idea is to avoid having to introduce a special propositional type for CI material distinct from the other standard type t, and, at the same time, to avoid having to introduce the of course operator. This new structure — *CI-structure* — is projected from the functional structure and parallel to the semantic structure. In this way, Arnold and Sadler can keep the resources separated, as they are instantiated from different structures, without the need to introduce an *ad hoc* type for CI propositions.

Our approach has points of contact with the implementation of Arnold and Sadler but there are also some fundamental differences. We will present here our account in an informal way but stressing the differences with Arnold and Sadler's system. In the next section we will give the formal details that justify our claims.

We start from the same assumption that linguistic constructions contributing to the CI dimension are fully integrated in the syntactic and functional structure of the sentence they appear in. We also share Potts's intuition that the denotation of linguistic expressions corresponds to a pair (or more generally, a tuple) of values. However, in our case the CI dimension is represented by a collection of propositions (the CI contributions made so far) rather than a single propositional value. This also means that in our analysis the CI content is percolated through the semantic tree/proof. However the process of combining and percolating the CI component is built into the compositional process and is not accessible to lexical resources. This means that the CI material remains accesible only locally and only to those lexical items that operate on it by adding new propositional content.

Given that the compositional process is in a sense "aware" of the paired nature of meanings, we can uniformly treat them as atomic resources. Therefore we do not replicate the asymmetry present in Arnold and Sadler's system in which all expressions denote a pair, but where, at the level of the resource logic, some of them are represented as atomic resources while others are represented as pairs of resources. This also means that we do not need a special rule to split the resources and then recombine them, nor do we need to postulate a special type for CI propositions. In our derivations, the CI component is implicitly kept separated from the at-issue material and threaded through the compositional process in the background. As a result the proofs we obtain easily satisfy a strict version of resource-sensitive composition, as we do not need an operator like of course, !, which, with its possibility of repeated application, breaks down resource sensitivity.

By exploiting the paired nature of denotations we can also avoid introducing a special propositional type for the CI dimension, while simultaneously avoiding the introduction of a new kind of semantic structure. The two dimensions are in fact identified completely by the position they occupy in the pair. In this way we distinguish not between two different types of proposition but rather between two different modalities with which propositions are introduced in the common ground, a very similar distinction to the one proposed by Arnold and Sadler with the projection to the CI-structure.

Finally the monadic approach can be seen as more parsimonious from a theoretical point of view. Shan (2001) in fact shows how the organizing principles of monads can be used to model a wide range of semantic phenomena. He lists among the possible applications of monads phenomena such as focus, question formation, and intensionality. Giorgolo and Unger (2009) show how monads can also model dynamic phenomena like anaphora. This is particularly relevant for parenthetical constructions as they seem to interact with these type of phenomena in non-trivial ways. In particular, dynamic effects have raised some interest as they seem to create contexts in which the flow of information between dimensions is less constrained than we would predict on the basis of Potts's theory. Potts (2005, 52ff.) himself and AnderBois et al. (2010) present a number of cases in which information flows from the CI dimension to the at-issue dimension. All these cases have in common the fact that they involve some form of *uncertainty* in the meaning they denote. We list here some examples of "unruly" contexts:

1. Presupposition

   (7) Mary, a good drummer, is a good singer <u>too</u>.

2. Anaphora

(8) Jake$_1$, who almost killed a woman$_2$ with his$_1$ car, visited her$_2$ in the hospital.

3. VP ellipsis

(9) Lucy, who doesn't help her sister, told Jane to.

4. Nominal ellipsis

(10) Melinda, who won three games of tennis, lost because Betty won six.

What we see is that, in order to resolve the uncertainty introduced in the at-issue dimension by these constructions, we need to take into consideration the CI dimension. For instance in the case of (7), the presupposition triggered by *too* is resolved by the information that Mary has some additional musical talent beside singing, a fact we are informed of by the appositive *a good drummer*. Similarly in the case of anaphora and ellipsis, the unstated referent/property in the matrix clause is introduced in the CI contribution. The possibility of modeling multidimensionality and dynamic phenomena using the same theoretical apparatus seems to us a good reason to propose an alternative approach to Arnold and Sadler's.

3 Monads

The concept of a monad arises in category theory (Barr and Wells, 1984). It has found many applications in theoretical computer science as a model for the denotational semantics of side-effecting computation (Moggi, 1989, 1990) and in functional programming as a way to structure and compose side-effects (Wadler, 1992a,b). Here we try to provide the main intuitions behind monads and how they can be used in the context of natural language semantics.

The first intuition behind monads is that they are a way to reproduce a certain algebraic structure, in our case the algebra of meaning composition, in a richer setting that carries *more information*. The idea is that if we have a collection of functions and values that represent our meanings we can map them to new objects that contain the original information plus some additional meaning material. The monadic mapping allows us to maintain in the new richer setting the same compositional configurations we started with. The additional information varies in different types of monadic mappings, but in all cases we are able to reconstruct the original compositional configurations.

The characteristic of a monadic mapping is that the original meanings are associated with some kind of default information. In this way we obtain an object of the correct enriched type without committing to any particular enriched information. For example, in the case of multidimensionality, the meanings of linguistic expressions that contribute only to the at-issue dimension are mapped from the traditional unidimensional collection of meanings to a collection of paired meanings, and the objects they are mapped to consist of the original meaning and a vacuous CI contribution.

The principles behind this intuitive view of monads continue to apply when we consider monads as models of computations. According to this perspective, a monad is a computation that yields a value while at the same time producing some side effects, like modifying some global environment or communicating with the "real world". Also in this case we can assume that we start from pure — i.e. side-effect free — functions and values and map them to computations with possible side effects that yield the starting object as the result of running. A monadic mapping will map a pure value/function to a computation that has no side effect and that only returns the original value when run. The computational perspective also exposes another important property of monads that makes them an interesting model of natural language meaning. The notion of side effects is intimately connected to the idea of sequentiality. For instance, the order in which we access a file by reading from and writing to it is fundamental in determining whether the computation fails or not. Monads can be composed to create larger computations from more elementary ones and the monadic approach requires the specification of a fixed order of evaluation. This property is particularly relevant for the non-compositional phenomena that we discussed above, in which we need to keep track of the linear order of appearance of the various expressions in order to predict the licit patterns of anaphora, presuppositions and ellipsis.

We formalize these intuitions by defining a monad as a triple: $\langle M, \eta, \star \rangle$.[2] M can be understood as the mapping that tells us to which type of enriched collections of values/functions we are lifting our unidimensional meanings. M can also be interpreted as a name for this specific collection. We will use the notation $M\ \alpha$ to indicate the type of objects that result from the application of the mapping M to objects of type α. η (pronounced 'unit') is the operation that brings us from the original, information-poor collection of meanings to the information-rich collection. It does so by encapsulating each object in the source collection in a "container" that also stores default, vacuous information. $\star$ (pronounced 'bind') is a binary operation that performs both the role of creating new monads from simpler ones and imposing an evaluation order for their computation. $\star$ takes a monad and a function from the type of the result yielded by the monad to another monad of the same kind. The operation runs the first monad, passes the result to the function and creates a new monadic computation. In the background, the side-effects/enriched information from the first monad and the second one are run sequentially/accumulated. In this way, the resulting monad creates a new value using the value produced by the first one and combines the side-effects/enriched information of the two monads. In order to obtain the properties we ascribed to monadic mappings above, the two

[2]We use here the definition normally found in the computer science literature (Moggi, 1989; Wadler, 1992b). This particular definition allows us a more natural description of the meaning of the expressions contributing to the CI dimension. The categorical definition is normally given in terms of a different triple (Barr and Wells, 1984); this is in any case completely equivalent to the one used here.

operations must satisfy the following laws for all x, f, g and m:

$$\eta(x) \star f = f\,x \tag{11}$$

$$m \star \eta = m \tag{12}$$

$$(m \star f) \star g = m \star (\lambda x. f\,x \star g) \tag{13}$$

Laws (11) and (12) characterize η as the left and right identity with respect to the composition of monads. This is a way to require η to couple the lifted value with vacuous information/no side-effect. Law (13) states that $\star$ behaves as an associative operator. This is relevant for us because it guarantees us that the ordering of the side effects is independent of the order of composition.

The specific monad we are going to use to model multidimensional semantics is known in the functional programming tradition as the *Writer* monad. The *Writer* monad maps values and functions to a pair composed by the value/pair and an element of a *monoid*. A monoid is an algebra with a single binary associative operation and an element that is the left and right identity of the operation. In our case the underlying set of the monoid is a set of sets of proposition (i.e. the possible collections of CI contributions), the binary operation is set union and the identity element is the empty set.[3] In the *Writer* monad the identity element corresponds to the vacuous information and the binary operation describes the way in which information is accumulated.

In our case the mapping *Writer* sends an object of type α to an object of type $\langle \alpha, p \rightarrow t \rangle$, a pair of an object of type α and a set of propositions. Type p is a quite conservative extension to the standard type theory based on e and t. p in fact represents the set of names of propositions. In this sense t can be seen as a subtype of p, namely the domain containing only the names $\{\top, \bot\}$.

Having defined *Writer* in this way we have, for example, that the interpretation of an intransitive verb, an object of type $e \rightarrow t$, will be mapped to an object of type $\langle e \rightarrow t, p \rightarrow t \rangle$, or more compactly *Writer* $(e \rightarrow t)$. η pairs every object with the empty set:

$$\eta(x) = \langle x, \{\ \} \rangle \tag{14}$$

$\star$ is instead defined as follows:

$$\langle x, P \rangle \star f = \langle \pi_1(f\,x), P \cup \pi_2(f\,x) \rangle \tag{15}$$

where π_1 and π_2 are respectively the first and second projection of a pair. In words, $\star$ is a binary function that takes 1) an input pair of a value and a collection of propositions and 2) a function f that produces a computation using the first value of the input pair. $\star$ produces a new computation whose value is the value of the computation produced by f and a new collection of propositions that is the union

[3]By using set union we make our monoid commutative. In the applications described in this paper this is not of particular relevance, but in certain cases it may be necessary to use a non-commutative operation to keep track of the order in which the propositions are combined.

of the input collection of propositions with the collection of propositions produced by f. The step involving the union of the collections of propositions is the one that allows us to use the *Writer* monad as a kind of logging system.

Notice that we have not added to the term language anything besides pairs and projections. The monoid structure in the second component of our monads is already expressible in the simply typed lambda calculus that we use for our meaning constructors. The identity element corresponds in fact to the function $\lambda t.\top$ and union can be expressed in terms of disjunction: $\lambda s.\lambda r.\lambda t.s\ t \vee r\ t$.

We still need to see how we can integrate the monadic approach with the LFG framework. Our solution, again inspired by Shan (2001), is to give a new Curry-Howard isomorphism interpretation of the elimination and introduction rules for the glue implication $\multimap$. We will however also need to introduce a new kind of implication in order to give an interpretation to the expressions contributing to the CI dimension.

Our goal is to be able to reproduce the unidimensional compositional configuration at the monadic level. This means that, starting from at-issue only lexical items and lifting them to the monadic level via η, we want to able to saturate a predicate of type *Writer* $(\alpha \rightarrow \beta)$ with an argument of type *Writer* α. Notice how we cannot simply use functional application because we are dealing here with two pairs. The solution proposed by Shan (2001) is to use the $\star$ operator to define a general notion of functional application for monadic meanings. The definition of this new form of functional application, which we call A following Shan (2001), is given in (16):

$$A(f)(x) =_{def} f \star \lambda g.x \star \lambda y.\eta\ (g\ y) : M\ (\alpha \rightarrow \beta) \rightarrow M\ \alpha \rightarrow M\ \beta \qquad (16)$$

The monad encapsulating the function is run via $\star$ and its result (the function) is bound to the variable g. Similarly the argument monad is run and the result is bound to y. As a final step a new monad is created that returns the result of applying the function g to the argument y, without adding any additional information/side effect. In the background, the $\star$ operator takes care of threading the additional information (in our case the collection of CI propositions).

To obtain an isomorphism between the proofs in Glue Semantics and the monadic meaning terms we need to define a notion of *functional abstraction*. The definition of abstraction for monads is less mathematically pleasant and depends more heavily on its use in Glue proofs than the definition of monadic functional application. A is in fact just a function operating on values. The corresponding abstraction cannot be defined in the same way but makes use of the specific shape of the meaning language we use to decorate our proofs. The definition is given in (17).

$$\eta(x) \triangleleft m =_{def} m \star \lambda b.\eta\ (\lambda x.b) : M\ \alpha \rightarrow M\ \beta \rightarrow M\ (\alpha \rightarrow \beta) \qquad (17)$$

The term $\eta(x) \triangleleft m$ indicates the monadic abstraction of a value x in the computation represented by the monad m. The interpretation of the term is close to that of a classical abstraction $\lambda x.t$, in the sense that $\triangleleft$ signals a hole in m called x in the same way that λ signals a hole in t called x. The precise definition is however a bit more involved. In (17), $\eta(x)$ is assumed to be a hypothesis introduced in the proof. x must be a fresh variable. The hypothesis allows us to deduce the computation corresponding to m from which we then discard the hypothesis $\eta(x)$ via this form of abstraction. We extract the value yielded by m, bind it to b and return a new computation that returns the abstraction x over b.

In (18) we give the elimination and introduction rules for the glue logic implication, $\multimap$, using the newly defined monadic functional application and functional abstraction.

$$\frac{x : A \qquad f : A \multimap B}{A(f)(x) : B} \multimap E \qquad\qquad \frac{\begin{array}{c}[\eta(x) : A]_i \\ \vdots \\ m : B\end{array}}{\eta(x) \triangleleft m : A \multimap B} \multimap I_i \tag{18}$$

The mode of composition just outlined is not powerful enough to describe how certain expressions move information from the at-issue dimension to the CI one. In fact the class of objects composable with $\multimap$ is restricted to those that operate on the two components independently. To understand why this is so, consider the case of an expressive, like *fucking* in (1). This expressive takes an argument, a noun, and contributes to the at-issue dimension by returning its argument untouched, which means that it encapsulates the identity function as its at-issue meaning, and to the CI dimension by applying the predicate $\frown$ to its argument.[4] Given its at-issue contribution the type we would assign to its denotation is *Writer* $((e \to t) \to (e \to t))$. However an object of this type would not be able to apply the predicate $\frown$ to its argument. If we take a look at the definition of monadic application we can see that the functional value is actually applied to its argument outside of the original monad. The monad is in fact run and its return value collected, but only at the end is it combined with its argument. This means that the denotation for the expressive would not be able to access its argument to generate a CI contribution.

In order to properly generate the CI contribution, we need to assign to expressions like *fucking* a denotation that corresponds to a function that is "aware" of the monadic context in which it is evaluated. The idea is to have these types of expressions take monads as arguments, in our case pairs of at-issue and side-issue meaning material. The type we will assign to an expression like *fucking* is therefore *Writer* $(e \to t) \to$ *Writer* $(e \to t)$. This is the type of function that takes a monadic object encapsulating a predicate and returns another monadic object also encapsulating a predicate. In the case of the expressive, the function will return a monad containing the same predicate but paired with the CI proposition expressing a negative judgment about it.

To keep track of which type of composition it is necessary to introduce in the glue logic a new implication, $\multimap_*$. This new implication behaves exactly like the

[4]The frown symbol, $\frown$, is meant to evoke the idea of a negative judgement.

original one and comes equipped with its own notion of functional application and functional abstraction. By a slight twist of logic, application and abstraction for this new connective corresponds to standard application and abstraction, as we use them in traditional Glue Semantics, as shown by the term to the left of the colon in the following:

$$A_*(f)(x) =_{def} f\,x : (M\ \alpha \to M\ \beta) \to M\ \alpha \to M\ \beta \tag{19}$$

$$x \lhd_* m =_{def} \lambda x.m\,x : M\ \alpha \to M\ \beta \to (M\ \alpha \to M\ \beta) \tag{20}$$

In (21) we give the Curry-Howard isomorphism for respectively elimination and introduction of $\multimap_*$ and this additional type of monadic functional application and abstraction.

$$\frac{x : A \qquad f : A \multimap_* B}{A_*(f)(x) : B} \multimap_* E \qquad \frac{\begin{array}{c}[x : A]_i \\ \vdots \\ m : B\end{array}}{x \lhd_* m : A \multimap_* B} \multimap_* I_i \tag{21}$$

In the next section we show how the formal machinery introduced here can be used to analyse expressions involving side issue contributions.

4 Monads in action

In this section we present the details of our proposal. We start by working out in some detail the analysis of the contribution to the CI dimension of an expressive. We then move to another example illustrating the interaction between dimensions in the case of presupposition. This example allows us to see how the monadic approach controls the information flow in the desired manner.

Consider the sentence in (22).

(22) John loves goddamn Marilyn Manson.

We assume a standard constituent structure and associated functional structure. In particular we take it that *goddamn* works as a regular modifier that contributes to the ADJUNCT feature of *Marilyn Manson*. In Table 1 we present the meaning constructors that form our lexicon.

Lexical entries that contribute only to the at-issue dimension are assigned a meaning term very similar to the standard one. The one difference is in the 'lifting' of their meaning term to the monadic level by means of the η mapping. The expressive *goddamn* is instead given an interpretation that makes full use of the monadic setting. First of all the glue term associated with it denotes the fact that the expressive composes with the surrounding lexical material in a way that produces a contribution to the CI dimension. The expressive takes the NP *Marilyn Manson* as

WORD	MEANING TERM + GLUE TERM
John	$\eta(j) : j$
loves	$\eta(love) : m \multimap j \multimap l$
Marilyn Manson	$\eta(m) : m$
goddamn	$\lambda x.x \star \lambda y.\mathtt{write}(\frown(y)) \star \lambda\_.\eta(y) : m \multimap_* m$

Table 1: Lexicon for *John loves goddamn Marilyn Manson.*

$$\dfrac{[\![\mathit{John}]\!] : j \qquad \dfrac{[\![\mathit{loves}]\!] : m \multimap j \multimap l \qquad \dfrac{[\![\mathit{goddamn}]\!] : m \multimap_* m \qquad [\![\mathit{Manson}]\!] : m}{A_*([\![\mathit{goddamn}]\!])([\![\mathit{Manson}]\!]) : m}}{A([\![\mathit{loves}]\!])(A_*([\![\mathit{goddamn}]\!])([\![\mathit{Manson}]\!])) : j \multimap l}}{A(A([\![\mathit{loves}]\!])(A_*([\![\mathit{goddamn}]\!])([\![\mathit{Manson}]\!])))([\![\mathit{John}]\!]) : l}$$

Figure 1: Glue Semantics proof for *John loves goddamn Marilyn Manson.*

its argument via the special implication $\multimap_*$. In this way it can control the evaluation of the meaning term corresponding to the NP and extract from it the necessary information. The meaning term associated with *goddamn* illustrates how this is done: the expressive takes the NP as its first x argument, extracts from it its value (the referent of the NP) and, via the $\star$ operator, passes in the background the side-issue material that may have been computed by its argument (in this case none). The referent is bound to the variable y and using an auxiliary operation `write` the application of the predicate $\frown$ to y is logged to the CI dimension. `write` is a simple function, taking a proposition as its argument and returning a pair of a vacuous value and a collection of propositions containing only the argument. We can therefore assign to `write` the type $t \rightarrow Writer\ \ \bot$, where $\bot$ is a domain with a single inhabitant also named $\bot$. `write` is defined as follows:

$$\mathtt{write} = \lambda p.\langle \bot, \{p\} \rangle \tag{23}$$

The final step performed by the denotation of *goddamn* is to return the interpretation of its argument without any additional change to the collection of CI propositions. Notice that the value returned by the `write` operation is not used anywhere in the lambda term and, following a common practice in programming languages, we indicate this by binding it with an underscore.[5]

The Glue proof is shown in Figure 1. The proof makes one use of the new rule for the elimination of $\multimap_*$, which is reflected in the proof term by the use of the special application A_*.

The resulting proof term encapsulates the instructions for computing the denotation of the utterance. The final result will be a pair whose first projection and second projection represent respectively the at-issue and side-issue dimensions. As discussed above, *goddamn* will take the denotation of *Marilyn Manson* to create a

[5]We could have of course used any variable different from y.

new computation whose result is the denotation of *Marilyn Manson* but that contributes a proposition to the CI dimension. The other applications are all instances of standard functional application lifted to the monadic level: the monads corresponding to the function and the argument are 'run', their values applied and, in the background, the CI contributions are collected. To see how this happens we will show the full expansion of the term. We will use the symbol $\rightsquigarrow$ to indicate a reduction and decorate it with subscripts indicating which steps are taken: we will use lex-def for the use of lexical postulates, η-def and $\star$-def for the definition of η and $\star$, A-def and A_*-def for the definition of A and A_*, `write`-def for the definition of `write`, and β for beta reduction (including the reduction of projections and unions).

The term we are reducing is repeated in (24).

$$A(A(\llbracket \textit{loves} \rrbracket)(A_*(\llbracket \textit{goddamn} \rrbracket)(\llbracket \textit{Manson} \rrbracket)))(\llbracket \textit{John} \rrbracket) \tag{24}$$

We start by reducing the subterm $A_*(\llbracket \textit{goddamn} \rrbracket)(\llbracket \textit{Manson} \rrbracket)$.

$$\begin{aligned}
&A_*(\llbracket \textit{goddamn} \rrbracket)(\llbracket \textit{Manson} \rrbracket) && \rightsquigarrow_{\text{lex-def}+A_*\text{-def}}\\
&(\lambda x.x \star \lambda y.\mathtt{write}(\frown(y)) \star \lambda_.\eta(y))\ \langle m, \{\ \}\rangle && \rightsquigarrow_{\beta}\\
&\langle m, \{\ \}\rangle \star \lambda y.\mathtt{write}(\frown(y)) \star \lambda_.\eta(y) && \rightsquigarrow_{\star\text{-def}}\\
&\langle \pi_1((\lambda y.\mathtt{write}(\frown(y)) \star \lambda_.\eta(y))\ m),\\
&\ \{\ \} \cup \pi_2((\lambda y.\mathtt{write}(\frown(y)) \star \lambda_.\eta(y))\ m)\rangle
\end{aligned} \tag{25}$$

The term $(\lambda y.\mathtt{write}(\frown(y)) \star \lambda\_.\eta(y))\ m$ appears two times in (25); we show here its reduction and plug the result directly in (25) below.

$$\begin{aligned}
&(\lambda y.\mathtt{write}(\frown(y)) \star \lambda_.\eta(y))\ m && \rightsquigarrow_{\beta}\\
&\mathtt{write}(\frown(m)) \star \lambda_.\eta(m) && \rightsquigarrow_{\mathtt{write}\text{-def}}\\
&\langle \bot, \{\frown(m)\}\rangle \star \lambda_.\eta(m) && \rightsquigarrow_{\star\text{-def}}\\
&\langle \pi_1((\lambda_.\eta(m))\ \ \bot), \{\frown(m)\} \cup \pi_2((\lambda_.\eta(m))\ \ \bot)\rangle && \rightsquigarrow_{\beta+\eta\text{-def}}\\
&\langle \pi_1(\langle m, \{\ \}\rangle), \{\frown(m)\} \cup \pi_2(\langle m, \{\ \}\rangle)\rangle && \rightsquigarrow_{\beta}\\
&\langle m, \{\frown(m)\}\rangle
\end{aligned} \tag{26}$$

Substituting (26) for $(\lambda y.\mathtt{write}(\frown(y)) \star \lambda\_.\eta(y))\ m$ in (25) we obtain

$$\langle \pi_1(\langle m, \{\frown(m)\}\rangle), \{\ \} \cup \pi_2(\langle m, \{\frown(m)\}\rangle)\rangle \tag{27}$$

which, after computing the projections and the union, reduces to

$$\langle m, \{\frown(m)\}\rangle \tag{28}$$

In words, the denotation of the NP *goddamn Marilyn Manson* is a pair whose first projection is the individual Marilyn Manson and whose second projection is the proposition stating a negative judgement about that individual.

We continue the reduction by plugging (28) in (24) and expanding the inner application of *loves* to *goddamn Marilyn Manson*.

$$A(A(\llbracket \textit{loves} \rrbracket)(\langle m, \{\frown(m)\}\rangle)(\llbracket \textit{John} \rrbracket) \quad \rightsquigarrow_{\text{lex-def}+A\text{-def}}$$

$$A(\langle love, \{\ \}\rangle \star \lambda f.\langle m, \{\frown(m)\}\rangle \star \lambda x.\eta(f\ x))(\llbracket \textit{John} \rrbracket) \tag{29}$$

As was the case before, the expansion of the $\star$ operator requires us to compute the same term $(\lambda f.\langle m, \{\frown(m)\}\rangle \star \lambda x.\eta(f\ x))\ love)$ twice. We reduce here independently and plug it in (29) below.

$$(\lambda f.\langle m, \{\frown(m)\}\rangle \star \lambda x.\eta(f\ x))\ love \quad \rightsquigarrow_{\beta}$$

$$\langle m, \{\frown(m)\}\rangle \star \lambda x.\eta(love\ x) \quad \rightsquigarrow_{\star\text{-def}}$$

$$\langle \pi_1((\lambda x.\eta(love\ x))\ m), \{\frown(m)\} \cup \pi_2((\lambda x.\eta(love\ x))\ m)\rangle \quad \rightsquigarrow_{\beta+\eta\text{-def}}$$

$$\langle \pi_1(\langle love\ m, \{\ \}\rangle), \{\frown(m)\} \cup \pi_2(\langle love\ m, \{\ \}\rangle)\rangle \quad \rightsquigarrow_{\beta}$$

$$\langle love\ m, \{\frown(m)\}\rangle \tag{30}$$

The first and the second projection of (30) are needed in the expansion of (29) as show in the following reduction steps:

$$A(\langle love, \{\ \}\rangle \star \lambda f.\langle m, \{\frown(m)\}\rangle \star \lambda x.\eta(f\ x))(\llbracket \textit{John} \rrbracket) \quad \rightsquigarrow_{\star\text{-def}}$$

$$A(\langle \pi_1(\langle love\ m, \{\frown(m)\}\rangle), \\ \{\ \} \cup \pi_2(\langle love\ m, \{\frown(m)\}\rangle)\rangle)(\llbracket \textit{John} \rrbracket) \quad \rightsquigarrow_{\beta}$$

$$A(\langle love\ m, \{\frown(m)\}\rangle)(\llbracket \textit{John} \rrbracket) \quad \rightsquigarrow_{\text{lex-def}+A\text{-def}}$$

$$\langle love\ m, \{\frown(m)\}\rangle \star \lambda f.\langle j, \{\ \}\rangle \star \lambda x.\eta(f\ x) \tag{31}$$

Also in this case we can avoid clutter in the derivation by reducing only once the term $(\lambda f.\langle j, \{\ \}\rangle \star \lambda x.\eta(f\, x))\,(love\, m)$ needed for the expansion of the $\star$ operator:

$$\begin{array}{ll} (\lambda f.\langle j, \{\ \}\rangle \star \lambda x.\eta(f\ x))\ (love\ m) & \rightsquigarrow_{\beta} \\ \langle j, \{\ \}\rangle \star \lambda x.\eta(love\ m\ x) & \rightsquigarrow_{\star\text{-def}} \\ \langle \pi_1(\lambda x.\eta(love\ m\ x)\ j), \{\ \} \cup \pi_2(\lambda x.\eta(love\ m\ x))\rangle & \rightsquigarrow_{\beta+\eta\text{-def}} \\ \langle \pi_1(\langle love\ m\ j, \{\ \}\rangle), \{\ \} \cup \pi_2(\langle love\ m\ j, \{\ \}\rangle)\rangle & \rightsquigarrow_{\beta} \\ \langle love\ m\ j, \{\ \}\rangle & \end{array} \tag{32}$$

We proceed by plugging (32) in (31):

$$\begin{array}{ll} \langle love\ m, \{\frown(m)\}\rangle \star \lambda f.\langle j, \{\ \}\rangle \star \lambda x.\eta(f\ x) & \rightsquigarrow_{\star\text{-def}} \\ \langle \pi_1(\langle love\ m\ j, \{\ \}\rangle), \{\frown(m)\} \cup \pi_2(\langle love\ m\ j, \{\ \}\rangle)\rangle & \rightsquigarrow_{\beta} \\ \langle love\ m\ j, \{\frown(m)\}\rangle & \end{array} \tag{33}$$

The first projection is the proposition that John loves Marilyn Manson and the second projection is the proposition stating a negative judgement about Marilyn Manson.

We mentioned in Section 2 that monads can also be used to model other types of semantic phenomena. We discuss here an example involving a non-restrictive relative clause and a presupposition trigger. Consider the following sentence:

(34) John, who likes cats, likes dogs also.

The sentence contributes two propositions to the common ground: 1) the fact that John likes cats and 2) the fact that John likes dogs. However the presupposition trigger *also* additionally imposes a test on the structure of the common ground. The speaker expresses with this item that in the common ground we must already have some information corresponding to the fact that John likes something besides cats. The information is indeed already present, as the non-restrictive relative clause informs us that John likes dogs and it does so *before* the position in which we are required to apply the test to the common ground. Our analysis will capitalize on the fact that monads can be layered to create new types of monads that combine their ability to enrich meaning. We will therefore create a monad that jointly deals with multidimensionality and presupposition by composing the monad we have described for multidimensional meaning with a monad to keep track of presuppositions. Fortunately, we can also use the *Writer* monad for the treatment of presupposition.

To combine two monads we actually need to consider an additional construct: *monad morphisms*. For our purposes it will be sufficient to understand monad morphisms as monad "factories". The idea is that a monad morphism can be instantiated as a monad by specifying the monads we want it to combine with. The monad

WORD	MEANING TERM + GLUE TERM
comma	$\lambda j \lambda l.j \star \lambda x.l \star \lambda f.\mathtt{write}(f\ x) \star \lambda\_.\eta(x) : j \multimap_* (j \multimap l) \multimap_* j$
also	$\lambda v.\lambda o.\lambda s.s \star \lambda x.v \star \lambda f.o \star \lambda y.\mathtt{lift}(\mathtt{check}(\exists z.f\ z\ x \wedge z \neq y)) \star$ $\lambda\_.\eta(f\ y\ x) : (d \multimap j \multimap l) \multimap_* d \multimap_* j \multimap_* l$
John	$\eta(j) : j$
who	$\eta(\lambda P.P) : (j \multimap l) \multimap (j \multimap l)$
likes	$\eta(like) : c \multimap j \multimap l$
cats	$\eta(\iota x.cat^*(x)) : c$
likes	$\eta(like) : d \multimap j \multimap l$
dogs	$\eta(\iota x.dog^*(x)) : d$

Table 2: Lexicon for *John, who likes cats, likes dogs also.*

morphisms will provide some additional enrichment to the information stored in the monad we wrap it around. In our case we simply take the monad morphisms to add an additional component to our meanings. This means that the meanings we will end up with will be formed by a pair whose first component is another pair. To be able to use the functions defined for the internal monad we also need a way to lift them to the level of the more complex monad. This can be done in our case using the following function `lift`:

$$\mathtt{lift}(m) = m \star \lambda x.\eta(\langle x, \{\ \}\rangle) : \textit{Writer}\,\alpha \to \textit{Writer}\,(\textit{Writer}\,\alpha) \tag{35}$$

where $\star$ and η are the operator for the monad around which we wrap the morphism.[6]

In Table 2 we list the relevant lexical entries. The entries for the at-issue-only items are constructed in the same way discussed above, by applying the η operator. The only difference here is that η is the operator bringing us to the monad composed by the multidimensional monad (which starts as a monad morphism) together with the presuppositional one. *comma* is a silent operator that we borrow from Potts's and Arnold and Sadler's analysis of non-restrictive relative clauses. Looking at the associated glue logic term we see that *comma* takes 1) the resource corresponding to the NP to which the relative clauses is attached and 2) the relative clause, and returns the NP resource. These resources are consumed via the second monadic functional application, indicated in the term with the special implication $\multimap_*$. Behind the scenes, *comma* saturates the denotation of the relative clause, a one place predicate, with the denotation of the NP, stores the resulting proposition in the CI storage using the now familiar `write` function and returns the denotation of the NP as its final value.

The denotation of *also* introduces the new presuppositional monadic level. As was the case with *comma*, its glue term is built using the special implication $\multimap_*$,

[6] Notice that although we say that we wrap the monad morphism around the monad the result in our case will be "inside-out": the additional information expressed by the monad morphism will end up in the internal pair, while the information coming from the simple monad will be collected in the second component of the external pair.

a signal of the fact that this lexical item performs some additional work besides returning a value. We analyse *also* as a sentential operator that takes as arguments the verb, the subject and the object of the sentence. The result type is the one corresponding to the propositional value of the at-issue component of the sentence. The meaning term describes the semantic operations corresponding to the evaluation of *also*. The meaning of the verb, the object and the subject are extracted and bound respectively to the variables f, y and x. The next step is to perform a side-effect in the presupposition monad. As stated earlier, the presupposition monad is really just another instance of the *Writer* monad, again constructed as a pair of a value and a set of propositions. The presupposition monad is defined in exactly the same way as the multidimensional monad is. The function we see here, `check`, is really just another name for the function `write`, used here to clarify the levels at which the operations take place. `check` adds the presuppositional condition that in the model in which the sentence is evaluated there has to be an entity z such that the subject (x) likes z but z is different from the object (y). This operation is lifted to the level of the multidimensional monad via `lift` and the computation terminates by returning the application of the verb to its arguments.

The resulting proof term is show in (36):

$$\begin{aligned}&A_*(A_*(A_*([\![\textit{also}]\!])([\![\textit{likes}]\!]))([\![\textit{dogs}]\!]))(A_*(A_*([\![\textit{comma}]\!])([\![\textit{john}]\!]))\\&\quad(A([\![\textit{who}]\!])(A([\![\textit{likes}]\!])([\![\textit{cats}]\!])))) : l\end{aligned} \tag{36}$$

After reducing the term we obtain the following pair:[7]

$$\begin{aligned}&\langle\langle like(j, \iota x.dog^*(x)), \{like(j, \iota x.cat^*(x))\}\rangle,\\&\quad\{\exists z.like(j, z) \wedge z \neq \iota x.dog^*(x)\}\rangle : l\end{aligned} \tag{37}$$

The first component is a pair containing the at-issue proposition that John likes dogs and the side-issue proposition that John likes cats. The second component of the outer pair lists the conditions that must be met to satisfy the presuppositions triggered in the evaluation of the sentence. In this case, the only condition is that there must be something else besides dogs that John likes. The proposition that satisfies this condition can be found in the CI dimension.

5 Conclusion

In this paper we presented an analysis of multidimensional semantics based on a monadic analysis of meaning. Our approach exploits the abstraction capabilities of monadic mappings in order to maintain a largely standard, unidimensional glue logic for composition while assigning more complex meanings to the linguistic resources. The only innovation in the glue logic is the introduction of a new implication, $\multimap_*$.

[7]We use $\iota x.dog^*(x)$ and $\iota x.cat^*(x)$ to denote respectively the contextually relevant plural dog individual and the contextually relevant plural cat individual.

We started by discussing the proposal of Arnold and Sadler (2010) to model multidimensional meaning in Glue Semantics by the use of a tensor conjunction. While their approach is capable of accounting for the basic data, it does so at the price of breaking the resource sensitive contract of linear logic. Our approach does not contravene this fundamental assumption of Glue Semantics. At the same time, our approach seems more flexible and general, as it can be adapted to different scenarios, in particular if we decide to further differentiate non-at-issue contributions. Monads allows us to retain the simple, familiar compositional configurations in the unidimensional case, while at the same time composing more complex objects on the meaning side of the derivation. Another promising characteristic of the monadic approach is the possibility of using the same abstractions to deal with different semantic phenomena.

The analysis of example (34), presented in Section 4, points to the fact that the interaction between dimensions may be more complex than previously theorized. Here we have just started sketching a possible analysis in terms of layering of monadic mappings. We leave for future work the study of the different varieties of contexts that make the picture about meaning interactions more complex and how these interactions can be reconstructed in terms of unifying principles.

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MULTIMODAL COMMUNICATION IN LFG: GESTURES AND THE CORRESPONDENCE ARCHITECTURE

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Abstract

In this paper we investigate the interaction between verbal language and the non-verbal behaviours that commonly accompany it. We focus on spontaneous hand gestures. We discuss the complex network of interactions between the two modalities and how we can model the interpretation of a multichannel signal. We embed this model of interpretation in the LFG correspondence architecture and we show how the flow of linguistic information that characterizes the architecture can be used to make the interpretation more precise. The result is an enriched architecture in which a complex signal is first broken up into its component parts. The subcomponents are initially interpreted independently but are then fused at the end into a single meaning object. Our model can capture quite precisely the intuitive meaning associated with multimodal utterances.

1 Introduction

In this paper we take a step back from the intricacies of the grammar of natural language and look at it together with the non-verbal behaviours that, more often than not, accompany it. In particular, we examine the spontaneous manual gestures that are produced universally in connection with verbalizations. The goal of the paper is to show how this behaviour is actually very much connected to the complex grammatical structures of natural language and how we can capture these relationships in the framework of the correspondence Architecture of Lexical-Functional Grammar (LFG; Kaplan and Bresnan 1982, Bresnan 2001, Dalrymple 2001). Our claim is that the correspondence architecture (Kaplan, 1987, 1989; Asudeh, 2006, 2012) is an ideal model to represent the interactions between the verbal and the gestural modalities, given the possibility of controlling, at a very fine-grained level, the flow of information between different analytical structures.

The fact that spontaneous gestures play a role in *conveying information* together with verbal language is nowadays well supported by a growing body of studies. Gesture is not a primary mode of communication, and yet the information conveyed solely in this modality is quite consistently integrated in the mental models of reality that we create during a face to face conversation. The first studies of gestural behaviour, in particular the seminal work of Adam Kendon and David McNeill (Kendon, 2004; McNeill, 1992), already stressed that veridical information that is not verbalized is present in the mental representations of participants of a conversation. This observation has been confirmed over the years by a number of behavioural (Kita, 2000; Kita and Özyürek, 2003; Giorgolo, 2010) and neuropsychological experiments (Özyürek et al., 2007; Willems and Hagoort, 2007).

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Another important characteristic of the interaction between language and gesture that emerges from the data collected in the field and the lab is the fact the two modalities are not simply paired in an unrestricted way, but instead that there are *constraints* on how gestures and language can co-occur. The constraints, that apply both to the production (Kita et al., 2007) and the perception (Giorgolo and Verstraten, 2008) ends of communication, cut across the classical levels of analysis of natural language. Therefore gesture and language are, in McNeill's terminology, simultaneously *synchronized* along different dimensions of analysis (McNeill, 1992):

1. At the prosodic level we observe a strict relationship between *pitch* and *amplitude* peaks (and in general stress patterns) and the *stroke* of a gesture, the most effortful and kinetically prominent phase of a gestural action (Loehr, 2007; Giorgolo and Verstraten, 2008).

2. The alignment between prosodic peaks and gestures' strokes has a clear effect on the overall temporal alignment between gesture and speech, in particular with respect to syntactic constituents and their interpretation: gestures are temporally aligned with the linguistic expressions they are informationally related to.

3. Temporal alignment is in a sense also a form of semantic alignment, as the information conveyed by the gesture must be compatible with the interpretation of the linguistic expression they accompany (i.e. gestures cannot negate information that is expressed verbally (Lascarides and Stone, 2009)); there is however another sense in which gestures are semantically aligned with language: there are in fact limitations to the distribution of the semantic "constituents" gestures can accompany. In particular, gestures seem to behave as modifiers of first order properties/relations; we return to this point below.

4. Finally, at the level of discourse and information structure, we see that gestures are sensitive to linguistic patterns; for example they align with anaphoric relations by re-offerring related manual representations accompanying the linguistic expressions that take part in the relation.

The fact that the data about gestures so strongly suggests a fundamental role of simultaneous alignment patterns in determining the "grammaticality" of gestures motivates our choice of using the correspondence architecture to jointly model gesture and verbal language. In fact, at a sufficient level of abstraction, the correspondence architecture is a model of alignment, as the different structures hypothesized by LFG can be interpreted as *simultaneous constraints* that jointly direct the interpretation of a linguistic expression. With a physical metaphor we could interpret the linguistic expression as a complex signal built up by the composition of synchronized more elementary signals (the various structures). Then the interpretation of the expression becomes a process of decomposion of the signal in its subparts that together allow us to estimate its source (the meaning of the expression). Our idea is to extend the process to include the input coming from an additional synchronized modality.

In this paper we will focus on the interaction between language and gesture at the syntactic and semantic levels. We will demonstrate how we can use the correspondence architecture to capture the joint contribution of speech and gesture to interpretation and how we can use the rich grammatical information associated with linguistic syntactic structure to make more precise the massively ambiguous meaning that we can attach to a gesture in isolation. For this demonstration, we will analyze some general properties of gestures and show for a particular example how a grammatical feature like NUMBER can restrict the space of possible meanings of a gesture.

In Section 2 we introduce some background notions on gestures and on the theory of gestural interpretation presented by Giorgolo (2010), which we use as a basis for our analysis. Section 3 discusses the details of the integration of an additional expressive modality to the correspondence architecture and how the interpretation process must be modified to generate a single joint meaning object. Section 4 explores the implications of our proposal by analyzing in depth an example from the Speech and Gesture Alignment (SaGA) corpus (Lücking et al., 2010), an annotated multimodal corpus of diadic interactions. We conclude in Section 5 with some final remarks.

2 Background: Iconic Gesture

For reasons of space, we will concentrate our discussion about multimodality to a class of gestures known in the literature as *iconic gestures*. An example of this type of gestures is shown in Figure 1. The example is extracted from the SaGA corpus (Lücking et al., 2010).[1] The gesture accompanies the utterance *und hat zwei Türme* 'and has two towers', describing a church with two towers. The stroke of the gesture temporally overlaps with the DP *zwei Türme*, and it provides a visual representation of the spatial extension of the two towers referred to by the verbal expression.

2.1 Properties of Iconic Gestures

This example allows us to present some of the key properties of iconic gestures. The first key property of iconic gestures illustrated by the example is the type of information they normally convey. The gesture under discussion provides a visual representation of the physical/spatial properties of the towers, such as their

[1]The SaGA corpus was collected with German speakers and therefore all the examples in the paper will be in German. However all our generalizations are intended to be extended also to other languages. We decided to use naturally occurring data to stress that the study of such a subconscious activity as spontaneous gestures requires the use of empirical data to be study successfully.

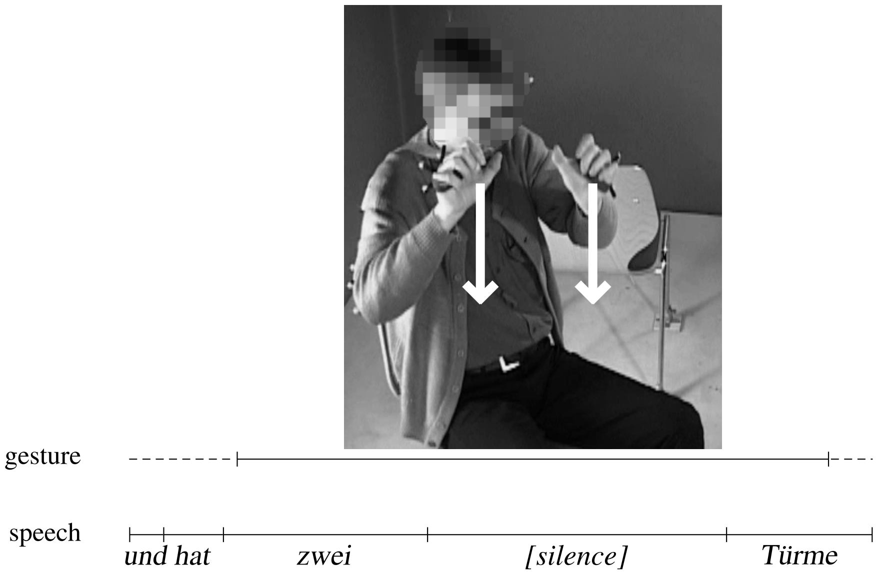


Figure 1: Example iconic gesture.

relative position, their orientation, the fact that they are disconnected, and we are also given a rough approximation of their shape. Iconic gestures generally convey information that is spatio-temporal in nature, as they normally describe properties of physical referents and events. They differ in how this information is conveyed; for example this gesture creates a sort of miniature image of the towers, while a gesture describing an action performed by a human being will normally take the form of an enactment of the action, giving us an internal perspective on it. However the information can always be modeled as specific regions of a spatio-temporal frame of reference.

Another interesting property of iconic gestures illustrated by the example is the way in which they are generated. The gesture shown in Figure 1 is created on the spot by the speaker, possibly on the basis of the mental imagery that the speaker has of the referent he is describing. In general iconic gestures lack a conventionalized form and in this sense they are different from those gestures that have a fixed meaning inside a speech community. Iconic gestures manage to convey meaning solely by the fact that they somehow *resemble* their referent. This fact will be quite relevant in the choices we will make when modeling iconic gestures in LFG, as the lack of a conventionalized form, and consequently of an agreed upon meaning, prevents us from treating them as regular lexical resources. Our solution will be to associate with gestures a very general (i.e. underspecified) lexical entry, constructed only on the basis of the properties that are observable from their formal appearance.

This last choice is also motivated by the fact that the interpretation of iconic gestures is massively dependent on contextual factors, in particular on the linguistic context in which they are embedded. The interpretation of iconic gestures becomes in fact almost impossible without an accompanying verbal expression. The only information obtainable is, as stated above, the bundle of spatial properties associated with the virtual space created by the gesture. This reflects a more general limitation of the possibility of conveying information via the gestural channel. As we will see below the semantic function that a gesture has is restricted to a form of intersective modification of first-order properties. A gesture imposes additional constraints (of a spatial nature) on the set of referents identified by a property. Other functions, such as the introduction of new referents, the independent introduction of a negative polarity context or the creation of a predicate-argument structure, are beyond the semantic expressivity of gestures. Gestures rely on the logical structure set up by verbal language and simply operate inside these logical structures without modifying them. The semantic contribution of gestures is therefore comparable to that of content words.

2.2 Interfacing Gesture and Language

With this information in the background, we now move on to analyze how the two modalities collaborate in conveying a conjoined meaning. To answer this question we first need to address two subquestions. The first one concerns the interpretation of gestures as isolated objects. Iconic gestures never occur outside of a speech fragment; nevertheless their interpretation must first go through an independent interpretation step, given that the processing of the activity of the hands is not in any way connected to the processing of verbal language. The second question concerns the fusion step of the interpretation process: once we have associated with a gesture a (largely ambiguous) interpretation we must specify how this information is combined with speech, keeping in mind the multiple constraints coming from the different levels of alignment.

To give precise answers to these questions we use the formal framework for the analysis of gestures introduced in Giorgolo (2010). The framework consists in an extension of classical Montagovian semantics together with a formal logic designed to describe space and time. With these ingredients we can be very precise about the process of interpretation of a multimodal utterance.

The answer to the first subquestion is based on the representational characteristic of gestures and their communicative function. We take a gesture to convey a type of information that we can model as an equivalence class of spatial objects that are informationally indistinguishable from the virtual space set up by the hands. The equivalence part of the meaning is contributed by the *representational semantic function* of the gesture: a representation in general does not refer necessarily to a single instance but rather it can refer to all objects and events that are similar (in a way to be made more precise) to the physical appearance of the representation. The specific equivalence class and the level of informativity is instead provided by the actual formal properties of the gesture. Giorgolo (2010) introduces a family of description logics that are used to match the expressive power observed in iconic gestures. Each logic is not a single language, but rather a family of related languages. This is motivated by the following considerations:

Modularity. Certain spatial properties are necessarily preserved by iconic gestures. Other spatial properties may be disregarded. For instance a gesture may give us a faithful representation of the relative position of different entities, such as when we draw a virtual map for our interlocutor, but the precise shape of these objects is usually largely left unspecified (they could be for instance just amorphous blobs). We need a modular language in which we can selectively add or remove predicates that are associated with specific spatial properties (e.g. orientation predicates, position predicates, shape predicates, etc.). Most importantly, these predicates should be independent of each other as we need to be free to fine tune the logic according to what we observe in the gesture (however, see Giorgolo (2010) for a discussion of a number of possible interdependencies among different groups of properties).

Simplification. Consecutive gestures that refer to the same entity or event follow a pattern of decreasing informativity. The sets of spatial properties that the subsequent gestures conserve are ordered by a subset relation. So, for instance, the gesture shown in Figure 1 is repeated by the speaker two other times later in the conversation, when referring back to the same church. In both cases we observe a decrease in the amount of visual information expressed in the gesture. In the first repetition the speaker drops the depiction of the three dimensional shape of the towers, while the fact that they are disconnected and that they are vertical is still depicted. In the last repetition, the only information available seems to be that the towers are two in number, as the gesture resembles the conventionalized gesture for the number two. This pattern mirrors quite closely the tendency in language to consecutively refer to entities and events in more economic/simpler ways (e.g., *The man who Thora saw yesterday … the man … he*).

Specifically, we use a family of languages based on a theory of region-based spacetimes to reproduce the third-person perspective we observe in the gesture of Figure 1, and another family of languages based on a theory of human gestural articulators (e.g., fingers, hands, arms, joints) to represent the embodied perspective typical of gestures representing actions. In this way we can represent the informational content of a gesture as the collection of the proposition in the chosen description logic that are satisfied in the virtual space set up by the gesture, what we will call the *theory* of the gesture. The interpretation of a gesture in isolation will then correspond to the characteristic function of the equivalence class of spaces that are models for the theory of the gesture. For instance, in the case of the gesture in Figure 1 we first select an appropriate description logic (in this case the third-person perspective one) and create a theory by checking all the spatial properties involving the two regions depicted in the gesture. The theory is the collection of all propositions (positive for the present properties, and negative for the absent ones) that are satisfied in the space under consideration. In our case, the collection would include a proposition stating that the two regions are disconnected, that they are vertical, that they are *not* one above of the other and so on. The interpretation we assign to the gesture corresponds to the set of all spaces made up of two regions that also possess the spatial properties (both positive and negative) encoded in the theory.

We now move on to the second question, the one about the integration of the two modalities. As already stated, gestures cannot introduce novel referents, nor can they change the polarity of the context in which they appear, the only function they can perform is to place additional constraints on the interpretation of the referents and the events already introduced by language. This suggests a semantic function akin to the one of *intersecting modifiers*. Therefore we propose to reduce the interface between the two modalities to a generalized form of *intersection*. To obtain this generality we assume that the semantic toolkit at out disposal includes a collection of boolean algebras for all the boolean types. This is actually a rather inexpensive assumption, as the same process is necessary in language to model the cross categorial behaviour of conjunctions. We can therefore consider this logical operation to be one of those available in general in communication. Intersection is implemented as the *meet* operation of each boolean algebra. This allows us to have a flexible notion of intersection, because the same gesture can combine with constituents of different semantic types, as shown indirectly by Alahverdzhieva and Lascarides (2010). At the same time we predict that gestures combine only with semantic constituents with the appropriate type. In fact, beside excluding any non-boolean expression from the set of possible linguistic correlates of a gesture, the meet operation also requires the two semantic expressions to be of the same type. We will see in the next paragraph that we relax this requirement to a form of equality under a homomorphic mapping, but the meaning terms that are intersected are required to have the same "arity". This requirement is sometimes too strict, as there are cases in the data in which we want to combine objects that *prima facie* have different arities. In all these cases it seems that linguistic factors influence the integration of the modalities by providing clues for the adaptation of the gestural interpretation. The Correspondence Architecture allows us to model these effects elegantly and in Section 4 we will see how a grammatical feature can be used to resolve such a type-clash situation.

2.3 Multimodal Interpretation

At this point we are ready to describe in detail the process of interpretation for a multimodal utterance. We give a graphical representation of the process in Figure 2. The diagram describes the process by which a single gesture and a verbal language fragment are first independently interpreted and how their interpretations are then joined into a single one. Γ and Σ respectively represent the gesture and the language fragment. The verbal expression, Σ, is interpreted by a standard interpretation function, $[\![\cdot]\!]_f$, yielding values taken from a frame of reference, F. F is a collection of domains of the usual kind, built on top of an ontology of entities e, truth-values t and events s. The frame, F, is related to a spatial frame of reference, S, by a family of (possibly partial) functions, Loc, which mirrors the compositional structure of F into S. S is a set of domains constructed in a way similar to F: we start from a set of primitive types and then we inductively define the remaining types as those corresponding to all the functions whose domains and codomains are the primitive and the derived types. In the case of S the primitive types will be *regions* r, truth-values t and events s. The types of F (i.e. e, t, s) are then mapped through members of Loc to the types of S according to the following conditions (where loc_a is the specific member of Loc mapping objects of type a to objects in S):

1. $loc_e(x) = y$, where y is of type r
2. $loc_t(x) = x$
3. $loc_s(x) = x$
4. $loc_{a \to b}(f) = g$, such that for all objects x of type a we have that:

$$g(loc_a(x)) = loc_b(f(x)) \ .$$

In other words, Loc identifies a homomorphic image of the traditional abstract interpretation of the speech signal in the spatial domain and specifies how the spatial interpretation is constructed from the abstract frame of reference obtained from the speech signal.

The composition of the interpretation function from Σ to F and Loc therefore defines a interpretation function, $[\![\cdot]\!]_s$, from Σ directly to S. The composition may not always be defined, as we do not require every verbal expression to have a spatial extension (e.g. logical words like determiners, modals and conjunctions lack a direct spatial interpretation, although they may have a metaphorical one). The distribution restriction of iconic gestures allows us to be sure that the interpretation process will never require us to access the spatial extension of those expressions. On the left side of the diagram, ω maps from a collection of features representing the gesture to a representational space, RS. ω takes into account various constraints, such as the mode of representation (drawing, sculpting, shaping, enacting, etc.) and deformations of the gestural space due to physiological constraints. Finally, the representational space, RS, corresponding to the gesture and the spatial representation, S, of the speech signal are combined by requiring an informational equivalence, such that they must satisfy the same set of spatial constraints. The combination is implemented as the meet operation. The meaning of the verbal expression becomes intersectable with the meaning of the gesture thanks to its transformation via the Loc mappings.

In the next section we show how we propose to embed the interpretation process just described in the correspondence architecture. To do so we will need to

$$
\begin{tikzcd}
\text{Gesture Structure } (\Gamma) \arrow[dr, "\omega"] & & F \arrow[d, "Loc"] & \text{Phonological String } (\Sigma) \arrow[l, "⟦\cdot⟧_f"'] \arrow[dl, dashed, "⟦\cdot⟧_s"] \\
& RS \arrow[r, leftrightarrow, "\equiv"] & S &
\end{tikzcd}
$$

Figure 2: Interpretation process for a multimodal utterance.

accommodate the gestural component in the architecture. But the model will also be enriched by the rest of the architecture. We will see how access to the other structures created during the interpretation process in the LFG architecture can be used to improve on the predictions made by the model in its current form.

3 Integration of Gesture in the Correspondence Architecture

In order to extend the LFG framework to deal with multimodal utterances, we introduce certain modification to the correspondence architecture. The new version of the architecture is shown in Figure 3. This version of the correspondence architecture is based on the pipeline version of the standard architecture, which is discussed by Bögel et al. (2009) and Asudeh (2012).

The first modification is to assume that the **Form** end of the pipeline is a multimodal utterance, rather than a phonological string. The linguistic part of this utterance is then mapped to the phonological string by the υ correspondence function.

Parallel to the υ function we introduce the γ correspondence function. The γ function maps the multimodal utterance to a timed stream of *gesture structures*. Each gesture structure is simply a feature structure describing the physical appearance of the gesture (typical features include hand shape, trajectory, orientation, and so on).

The third modification is to define a level of time structure, whose purpose is to align gestural elements and linguistic elements. Time structure is a time-indexed set of the substrings in the phonological string. The time structure is populated by a function τ from the phonological string. These time indexes are then propagated to the constituent-structure, resulting in a tree whose nodes are time indexed. The correspondence function κ specifies in the time structure the substrings that are temporally aligned with different gesture structure in the gesture stream by creating links between gesture structures and those substrings with which the gesture is synchronized. We assume that two types of links are established, depending on the nature of the linguistic context in which the gesture appears. The first type

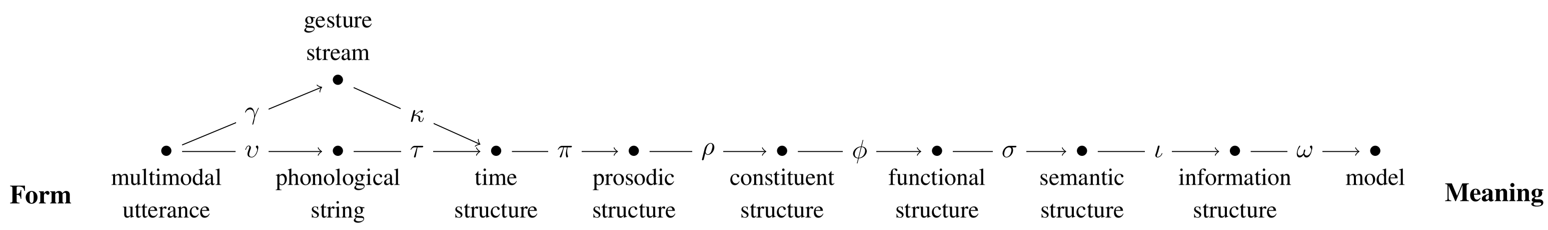


Figure 3: Correspondence architecture, modified pipeline version

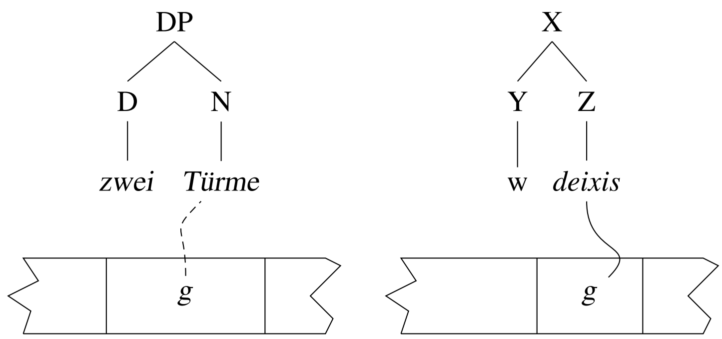
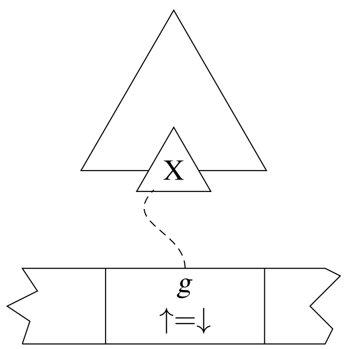


Figure 4: Temporal links between gesture stream and constituent structure.

of link correspond to the case of gestures that are simply performed in parallel with language, while the second one corresponds to the case of those gestures that are "marked" explicitly in language via some form of deixis (e.g. *I caught a fish <u>this</u> big*). Figure 4 shows how these links can be propagated in the architecture to create links between the gesture stream and the constituent structure. The dashed line represents the first type of links while the continuous line the second type. In the rest of the paper we will concentrate only on the first type of link.[2]

The last modification we propose is in the way the functional-structure is generated. In the language-only case, the functional structure is the result of applying the ϕ mapping to the constituent structure. In our case we need to make the ϕ map aware also of the gesture structures contained in the gesture stream and of the links defined between the time-structure and the gesture stream. All this information is of course available to the ϕ structure (given the pipeline shape of the architecture) and simply requires the introduction of a rule that determines how a gesture contributes to the functional structure of the multimodal utterance. We give here a graphical representation of the rule:



The rule consists in a functional constraint saying that the functional structure of a gesture g (see below for typical functional structures of gestures) is the same

[2]The case of links generated for deictic elements is actually trivial once we have defined the first type of link, but requires in depth discussion of the linguistic elements that trigger this type of link. We leave this discussion for future work.

as the one of the node X that it is linked to, obtaining the same effect of the familiar constraint $\uparrow=\downarrow$. To maintain a uniform notation in our functional constraints, we will use the abbreviations $\downarrow$ and $\uparrow$ also for the multimodal links: $\downarrow$ will refer to the functional structure of the gesture, while $\uparrow$ will be used to refer to the functional structure associated with the node to which the gesture is linked.

Finally, the ω correspondence function completes the mapping from the bundle of kinetic, physical features to the representational space. Since ω is late in the Form-Meaning pipeline in the modified correspondence architecture, it can also be sensitive to information earlier in the pipeline, particularly functional structure information. Information extracted from the functional structure can be used to appropriately instantiate the meaning of the gesture such that it takes into account morphosyntactic properties of its linguistic correlate.

In the next section we provide an in depth analysis of how a multimodal utterance is interpreted in our revised architecture.

4 Analysis

To demonstrate the advantages offered by the projection architecture in modeling the integrated interpretation of gesture and speech, we reanalyze an example presented in Giorgolo (2010), which is extracted from the SaGA corpus. The example is the one presented in Section 2. The speaker is describing a church with two towers and accompanies the utterance of the DP *zwei Türme* 'two towers' with a gesture depicting some spatial information about the towers. The gesture gives us information about the relative position of the towers (they are parallel) and about the fact that the towers are disconnected. We are also given a rough representation of the shape of the two towers, two vertically oriented prisms. We now follow the interpretation process depicted in Figure 2 and see how the various components of our revised correspondence architecture contribute to produce the final meaning of the expression.

The multimodal utterance is split by the υ and γ maps into its component parts. The gesture stream in this case is composed of a single gesture structure. The gesture structure is generated by the γ function from the raw, visual data (in our case the role of the γ function has already been played by the team of annotators that created the corpus). A partial representation of the resulting functional structure is shown in Figure 5.

The phonological string is mapped to a time structure and a link is created between the gesture and the substring it is related to. In our case we have two choices, depending also on the status we attribute to the word *zwei* 'two'. If we consider the numeral a determiner (possibly the most conservative of the two options), then, given the distributional restriction on gestures we are forced to link the gesture structure to the substring *Türme*, as the quantified phrase *zwei Türme* is of too high an order for a gesture (being a property of properties). The other option is to consider the numeral a form of intersecting modifier: in this case we are free to link

$$
\begin{bmatrix}
\textsc{Left.HandShapeShape} & \text{loose C} \\
\textsc{Left.PathofHandShape} & 0 \\
\textsc{Left.HSMovementDirection} & 0 \\
\textsc{Left.HandShapeMovementRepetition} & 0 \\
\vdots & \vdots \\
\textsc{Right.HandShapeShape} & \text{loose C} \\
\textsc{Right.PathofHandShape} & 0 \\
\textsc{Right.HSMovementDirection} & 0 \\
\textsc{Right.HandShapeMovementRepetition} & 0 \\
\vdots & \vdots
\end{bmatrix}
$$

Figure 5: Partial gesture structure.

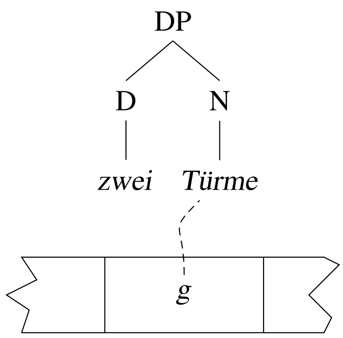


Figure 6: Links between the gesture stream and the DP *zwei Türme*.

the gesture either to substring *Türme* or to *zwei Türme*. Giorgolo (2010, p. 65) shows that in similar cases the resulting interpretations are not truth-functionally distinguishable. Both choices are motivated by the temporal alignment we observe, as strokes are not perfectly aligned with their linguistic correlates (they can "leak" over other elements and have some freedom of movement inside a specific time-window). We choose the first link point, in order to avoid having to include an existential closure operation to bind the plural tower referent. The result is the linking structure shown in Figure 4. However notice that in this case, had we made the other choice, the final interpretation would have been the same. Our model is therefore not capable of distinguishing the two choices at the truth functional level. This could be a limitation of our proposal but it could also reproduce a real indeterminacy and a limitation of the contexts with which a gesture can compose. The answer to this question requires an in depth analysis of the distribution of gestures according to compositional parameters, a task we leave for future work.

The gesture and the noun it is linked to are defined by the linking rule to map to the same functional structure. The gesture generally does not add functional

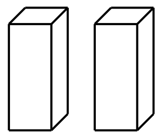


Figure 7: Virtual space generated from the gesture structure.

structure information, but uses information in its functional structure to constrain interpretation and potentially places constraints on the functional structure it contributes to. The resulting structure for the DP is shown in (1). As we can see, it is same one we would obtain without considering the gesture.

(1) $$\begin{bmatrix} \text{PRED} & \text{`tower'} \\ \text{NUMBER} & \text{PL} \\ \text{SPEC} & \begin{bmatrix} \text{PRED} & \text{`two'} \end{bmatrix} \end{bmatrix}$$

As stated above, iconic gestures lack a conventionalized meaning: they are not lexicalized. However we can associate with them a lexical entry that is directly obtainable from the formal features of the gestures, as they are described in the gesture structure. To generate the lexical entry for a gesture we need to extract some information from the gesture structure. We interpret the description of the gesture in the gestural structure as the input for a constraint resolution problem that in the end generates a spatial configuration that corresponds to the virtual space set up by the hands. Specifically, features like hand shape, direction of movement, etc., allow us to determine the number, location and shape of the regions involved in the gestural representation. This information can then be used to generate the functional constraints and the semantic terms that make up the lexical entry of the gesture. In the specific case we are considering here, we can see that from the feature structure we generate a space like the one represented in Figure 7. The space generated in this way does not correspond yet to the core meaning of the gesture. We need to extract from it the spatial information that allows us to define the equivalence class forming the meaning of the gesture in isolation. To do that, we generate the theory of the gesture, as described above, by taking the set of propositions of the desired spatial logic that are true in the virtual space.

At this point we are ready to discuss the lexical entry for a gesture of the type of our example. A partial general lexical entry is shown in (2). The representation is partial in the sense that the disjunction should be extended to deal with additional structures whose interpretation corresponds to a binary relation or to a property of entities composed by two sub-elements. Alternatively we could introduce variables for propositions in the glue logic terms.

(2) g $(\uparrow \text{NUMBER}) \neq \text{PL}$

$$\lambda R.\lambda x.\lambda y.R(x,y) \wedge core(loc_e(x))(loc_e(y))$$
$$((\uparrow \text{ OBJ})_\sigma \multimap (\uparrow \text{ SUBJ})_\sigma \multimap \uparrow_\sigma) \multimap$$
$$((\uparrow \text{ OBJ})_\sigma \multimap (\uparrow \text{ SUBJ})_\sigma \multimap \uparrow_\sigma)$$

$$\vee$$

$(\uparrow \text{NUMBER}) =_c \text{PL}$

$$\lambda P.\lambda x.P(x) \wedge (\delta(core))(loc_e(x))$$
$$((\uparrow_\sigma \text{ VAR}) \multimap (\uparrow_\sigma \text{ RESTR})) \multimap$$
$$((\uparrow_\sigma \text{ VAR}) \multimap (\uparrow_\sigma \text{ RESTR}))$$

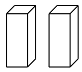
The general shape of the entry is suitable for any iconic gesture depicting two distinct regions. The entry lacks a syntactic category, as gestures do not take part in any grammatical function but are merely a reification of meaning. Notice that even in those cases in which language marks through deixis the necessity of interpreting the gesture to obtain a full interpretation, gestures are not necessary to determine the grammaticality of the verbal utterance.

The semantic part is composed by a disjunction of possible interpretations. This models the strong ambiguity of a gesture outside of a linguistic context. To reflect the necessity of linguistic information to disambiguate the meaning of a gesture we use functional constraints and the shape of the glue logic terms (Dalrymple, 1999; Asudeh, 2012) to select for a specific interpretation. In the case under consideration the two interpretations presented here can be distinguished by the feature NUMBER of g's functional structure. The idea is to distinguish between two possible interpretations of the two regions depicted by the gesture. The two regions can in fact be considered as two independent entities related in some way made precise by language, or they could be the discontinuous spatial extension of a single entity, either a plural entity composed of continuous sub-entities or a singular inherently discontinuous entity. As the referent for the gesture is introduced in the linguistic expression, in our case the variable bound by the determiner *zwei*, we use the grammatical information at our disposal to distinguish between the competing interpretations. The first interpretation presented is selected on the basis of a negative constraint on the feature NUMBER. This interpretation should be selected in case the gesture accompanies a transitive verb. In this case we require the related object not to have a plural NUMBER feature. A verb's f-structure satisfies this constraint, because it is only arguments to verbs, not verbs themselves, that are specified for NUMBER. In fact, we could obtain the same result with a constraint of the type $\neg(\uparrow \text{NUMBER})$. In the case of the second interpretation we use a constraining equation to ensure that the gesture combines with a set of entities whose elements are plural objects. A third interpretation, which we do not discuss here, would require an argument of the linked verbal element to have a singular NUMBER feature, and would give rise to the interpretation that combines the two regions into a singular discontinuous entity.

The two glue terms reflect these distinctions. In the first case we assign to the gesture a semantic function similar to the one of a verbal modifier. The gesture consumes a resource corresponding to a transitive verb and returns the same type of resource. In the second case the gesture acts as a nominal modifier, consuming a first order predicate and returning a new predicate of the same type.

The lambda terms give us the details of how the information contributed by the gesture obtains the modification effect. The two terms of course reflect the different nature of the elements on which they operate. However their general shape is comparable and the gesture-only contribution is identical in the two terms. The core meaning of the gesture is represented by the function $core$, which is a shorthand for the function presented in equation (3).

$$core = \lambda r_1.r_2.\,(r_1 \cup r_2) \equiv \tag{3}$$



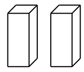
The core meaning of the gesture is a boolean function, taking two regions (of type r) as arguments and returning a truth-value. The two regions are combined in a single space via a sort of union operation and the resulting space is then required to be a model for the theory of the gesture that we represent synthetically as the figure in the righthand side of the equivalence. In other words, the function checks if the space composed by the two regions passed as arguments is similar to the one represented by the gesture. This function corresponds to the equivalence class of spaces of which the gesture can be a representation. In this case the equivalence class defined by the theory of the gesture corresponds to the set of spaces composed by two distinguished regions that are disconnected, that are parallel, whose main axis is vertical and whose shape is of two prisms.

In the case of the first interpretation, the arguments to the $core$ function are simply the spatial projections (i.e. the image under loc_e) of the two referents corresponding to the object and the subject of the transitive verb. The boolean result of the function is then "met" with the application of the binary transitive predicate to the same referents.

In the second case, the two arguments are obtained by using a *distributivity* operator δ, defined in equation (4), that splits a plural entity into its atomic parts (in our case the plural towers are decomposed into the singular towers) and then passed to the $core$ function. Also in this case the result of the application is met with the meaning provided by verbal language.

$$\delta(x) = \lambda e.x(e_1 \cdots e_n) \tag{4}$$

Given the functional structure associated with *Türme* we select the second interpretation. The resource offered by the gesture enters the glue proof in the same way as standard lexical items (i.e. as an axiom) and the resulting proof term is the one shown in (5). The term describes a function from first order properties to truth values. The argument Q represents the scope of the quantified phrase *zwei Türme*. The determiner *zwei* introduces the existential quantifier and the condition on the variable x to be assigned a plural entity with cardinality 2. The predicate $tower$ is contributed in the usual way by the noun *Türme*. The rest of term is contributed by the gesture and corresponds to the condition imposed on the existentially quantified variable x by the manual representation. Specifically, the spatial extension of the referent should be a plural object decomposable into its composing regions (which should be two) and such that the two regions are disconnected, they are parallel, their main axis is vertical and their shape is roughly that of a prism.

$$\lambda Q.\, \exists x.\, Q(x) \;\wedge\; |x| = 2 \;\wedge\; tower(x) \wedge \tag{5}$$
$$(\delta(\lambda r_1.r_2.\, (r_1 \cup r_2) \equiv$$

$$))(loc_e(x))$$

This interpretation corresponds to the intuitive meaning that we would associate with the gesture under consideration in this linguistic context.

5 Conclusion

In this paper we have investigated the nature of the relationship between verbal language and the non-verbal behaviours that commonly accompany it. We have focused on spontaneous iconic gestures and discussed how the interaction between the two modalities is not restricted to a simple pairing of different communicative channels, but rather follows a number of complex rules. The interaction is based on constraints on the temporal and prosodic alignment between the two modalities but also on deeper connections that include interactions between gesture and language at the morphosyntactic and semantic levels.

The goal of the paper was to approach multimodal communication from the perspective of LFG's correspondence architecture. We have demonstrated that we need a rich and fine-grained framework, such as the one offered by LFG, in order to capture the complexities of multimodal communication. We have first presented a model for the interpretation of multimodal utterances based on standard semantic tools and a logical language that matches the representation power observed in iconic gestures. We have discussed how the interpretation is nevertheless dependent on linguistic factors that need somehow to control the creation of meaning. The correspondence architecture offers precisely this possibility thanks to the flow of information between different levels of analysis that allows for an interaction between them.

To integrate multimodal signals in the LFG framework we introduced a number of additions to the architecture, leaving the language-only components basically untouched. One of the main innovations is the introduction of a structure parallel to the phonological string that we called the gesture stream and that represents the temporal sequence of gestures as observed in the multimodal signal. The gestures are represented as feature structures describing their physical appearance. The other fundamental innovation is the introduction of links between the elements of the gesture stream and the nodes of the constituent structure. In this way we are able to let the gesture have access to the functional structure of its linguistic correlate. The information available in the functional structure is used to specify the otherwise largely ambiguous interpretation that we associate with gestures. In particular we have demonstrated how a grammatical feature such as NUMBER can guide the interpretation of a gesture in the desired direction. We envisage that other grammatical features play a similar role in other contexts. For instance a feature like ASPECT can guide the interpretation of the properties of gestures such as repeated similar movements in the case of contexts made up by a verbal phrase. In these cases, ASPECT could allow us to interpret the presence of a repetition as a visual marking that we associate with an imperfective verbal form (e.g. habituality) and therefore constrains the interpretation of the gesture as the depiction of multiple but identical events.

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BACKWARD CONTROL IN ANCIENT GREEK – SUBSUMPTION OR LINEARIZATION?

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Abstract

This article discusses control of adjunct participle clauses in New Testament Greek. I present data from two corpus studies which show that the phenomena cannot be dealt with in a subsumption approach to control. Instead I argue for a c-structure based approach to constraining control, retaining the classical equality at f-structure but imposing linearization constraints on the overt realization of the shared argument. I discuss the characteristics of adjunct participle control and how it differs from complement control, arguing that we might need different approaches to the two phenomena.

1 Introduction

Many syntactic relations are asymmetric and among these is also the relation between controller and controllee. In derivational frameworks, syntactic asymmetries are typically captured by c-command constraints ensuring that controllers outrank a coindexed PRO, or that moved constituents outrank their traces (given the existence of raising but not lowering rules).

In contrast, LFG and other non-derivational frameworks typically model structure sharing using the equality relation, which is symmetrical. Asymmetry is instead ensured by c-structural mechanisms, such as controlled, typically non-finite, clauses being of category VP rather than S (or IP) and therefore not allowing an overt realization of the controlled subject.

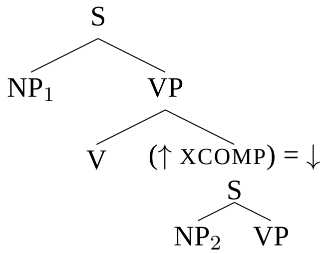
The recent surge of interest in so-called 'backward control' (see e.g. Polinksy and Potsdam, 2002; Potsdam, 2009) has shown that controller-controllee relations do not always exhibit the expected asymmetry. Although forward control, where a structurally higher clause contains the overt controller, is clearly the most widespread, 'unmarked' case in the world's languages, there are several languages which appear to attest backward control, where the controller appears overtly in the embedded clause and controls an empty position in the structurally more prominent clause. The two possibilities are illustrated schematically in (1) (from Sells 2006):

(1) a. Kim$_i$ hopes [Δ_i to be singing]. (forward)
  b. Δ_i hopes [Kim$_i$ to be singing]. (backward)

If information flows freely between the two subject positions at f-structure, c-structure must determine where the subject actually appears. Consider the phrase structure in (2).

†I thank Miriam Butt, Mary Dalrymple, Tracy Holloway King and John Maxwell for comments and discussion.

(2)



If we suppress NP_2 (by making the embedded clause a VP) we get a forward construction and if we suppress NP_1 we get a backward construction – but as pointed out by Sells (2006), it is not clear that we *can* suppress NP_1 in a natural way.

However, there is a very natural way of modelling asymmetric information flow at f-structure, namely by using subsumption rather than equality, as explored e.g. by Zaenen and Kaplan (2002, 2003) and Sells (2006). Generally speaking, subsumption allows us to constrain the directionality of information flow through f-structures: if f-structure *f* subsumes f-structure *g*, then all the information present in *f* is also present in *g*, but not vice versa.[1] Using the subsumption mechanism, then, languages (or even invididual predicates) can force both backward and forward control on the level of f-structure, depending on the control equations:

(3) a. $\uparrow$ SUBJ $\sqsubseteq$ $\uparrow$ XCOMP SUBJ enforces forward control
b. $\uparrow$ SUBJ $\sqsupseteq$ $\uparrow$ XCOMP SUBJ enforces backward control

Although Zaenen and Kaplan (2002, 2003) argue that equality rather than subsumption is the correct analysis for some structure sharing phenomena, they raise the question ‘whether subsumption might not be the default way to model relations between f-structures where one f-commands the other’. Sells (2006) takes this further and argues that subsumption might be removed from the options in Universal Grammar altogether.

The literature on subsumption and control in LFG has so far focused exclusively on structure sharing in complementation and its interaction with topicalization. In this paper I take a closer look at control into adjunct clauses in Ancient Greek and show that a subsumption theory cannot handle the facts, and that a c-structure solution, based on precedence relations rather than category differences, is more appropriate.

In section 4 we then review the earlier evidence for a subsumption approach. If subsumption is sometimes needed, the question arises what separates subsumption-based control from linearization-based control. We suggest that there might be two different classes of structure sharing phenomena, which might warrant separate treatments.

[1]See Zaenen and Kaplan (2003) for a formal definition of subsumption.

2 The Greek data

2.1 Ancient Greek participles

Ancient Greek (AG)[2] is a 'free word order' language, where all permutations of the major constituents are found with some frequency, and phrases can be discontinuous. The word order is obviously influenced by information structure, and the syntactic function of phrases is indicated by case. Although there is no worked out formal grammar of AG, it is the kind of language that would seem to lend itself well to a constructive case analysis (Nordlinger, 1998).[3]

In this paper we will focus on control of participles. AG participles can be used as attributes (*the running boy*), heads in argument position (*the running (ones)*), complements (*stop running*) and as free adjuncts. The latter come in two types, absolute participles (4), which have their own subject that need not be coreferent with a matrix argument,[4] and conjunct participles (5)-(6), whose subject is also a matrix argument.[5]

(4)

hautê	apographê	egeneto	prôtê
this.NOM.SG.F	taxing.NOM.SG.F	happened.PFV.PST.3S	first.NOM.SG.F
hêgemoneuontos	tês	Surias	
govern.IPFV.PTCP.GEN.SG.M	DEF.GEN.SG.F	Syria.GEN.SG.F	
Kurêniou.			
Cyrenius.GEN.SG.M			

'This taxing was first made when Cyrenius *was governing* Syria.' (Lk. 2:2)

(5)

hoi	**andres**	**hoi**	**sunekhontes**
DEF.NOM.PL	men.NOM.PL	DEF.NOM.PL	guard.IPFV.PTCP.NOM.PL
auton	enepaizon	autôi	*derontes*
him.ACC.SG	mock.PST.IPFV.3P	him.DAT.SG	flog.IPFV.PTCP.NOM.PL

'The men guarding him were mocking him, *flogging* (him).' (Lk. 22:63)

(6)

exelthonti	de	**autôi**	epi	tên
walk out.IPFV.PTCP.DAT.SG	but	him.DAT.SG	on	DEF.ACC.SG
gên	hupêntêsen	anêr	tis	
earth.ACC.SG	meet.PST.PFV.3S	man.NOM.SG	some.NOM.SG	

'As he *stepped* ashore, a man met him' (Lk. 8:27)

[2] As will become clear, this paper uses evidence from New Testament Greek and it is debatable whether that constitutes Ancient Greek. But NT Greek does not seem to differ from Classical Greek in its participle system, so I will just refer to the language as AG.

[3] In the c-structures in this paper, I will nevertheless put functional annotations about grammatical functions on phrasal nodes, as if they were contributed by the c-structure. This makes the trees easier to read and grammatical function assignment is in any case not central to the paper.

[4] In fact, most standard grammars claim that the subject of absolute participles *cannot* be coreferent with a matrix argument although it is well known that there are exceptions to this which are not understood.

[5] The glossing in the examples follows the Leipzig standard, but may omit unimportant details. Participles and their English translations are italicized and their subjects are bold-face.

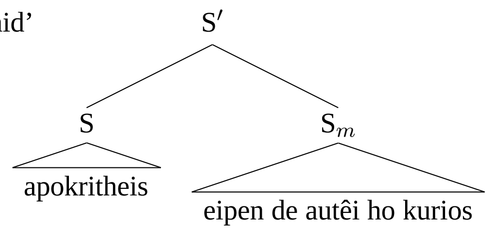
As the examples show, absolute participles get genitive case and so do their subjects. Conjunct participles, on the other hand, agree in case with their subjects, which in turn are assigned case in the matrix clause. By far the most common case is that participle's subject is also the matrix subject and thus gets nominative case, but as (6) shows, control by elements with other grammatical functions (at least OBJ and OBJ_{θ}) is possible. For absolute participles the control issue obviously does not arise.

I have argued elsewhere (Bary and Haug, 2011; Haug, forthcoming) that free adjunct participles have three different functions which are distinguished at c-structure, although the string is often ambiguous. **Frame** participles appear in the specifier of the matrix S′,[6] refer to events that have been previously mentioned or are easily inferrable and serve to locate the matrix clause in time: they are often translated with adverbial clauses, but also by fronted *ing*-adjuncts. **Independent rheme** participles are adjoined to the matrix S, refer to new information events, often ones that 'lead up to' the matrix event, but are otherwise information structurally on a par with it: they are typically translated with a coordinated main clause. **Elaboration** participles appear inside the matrix S and typically express manner, instrument or accompanying circumstances: they are the ones most likely to be translated with an *ing*-adjunct in English.

A sentence-initial participle will be ambiguous between a spec-S′ position and an adjunction to S: if there is no material following that must clearly be outside the matrix, the participle could even be inside the matrix S. (7) (from Lk. 10:41) is just such an ambiguous example, and (8)-(10) show the possible analyses and the translations they imply.

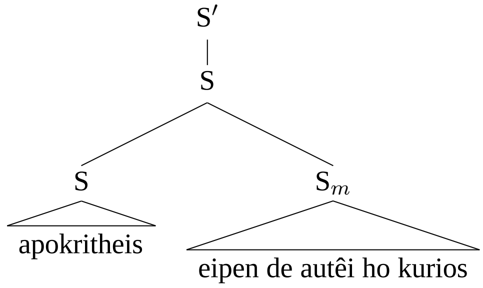
(7)	*apokritheis*	de	eipen	autêi	**ho kurios**
	answer.PFV.PTCP.NOM	but	said.PST.PFV.3S	her.DAT	the lord.NOM

(8) 'When the Lord *answered*, he said'

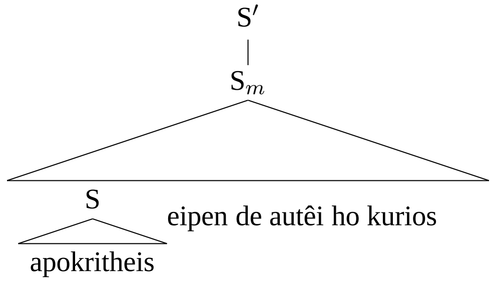


[6] In order not to preempt a category-based approach to control, we assume here that all verbs, finite and non-finite, project S; but only finite verbs project S′.

(9) ‘The Lord *answered* and said’



(10) ‘The Lord said *in answer*’



Let us note in passing that the independent rheme analysis (9) is out because independent rhemes seem always to denote sequential events, i.e. it would imply that the Lord first answered and then said. The analyses as frame and elaboration are both possible, but as we will see, the control facts support the analysis in (10).

Finally, notice that independent rheme participles can be ‘stacked’, i.e. there can be several of them, typically describing events leading up to the event of the matrix clause, in what we will refer to as a ‘serial construction’, e.g. in (11).

(11) *dramôn* de **tis** kai *gemisas*
running.PFV.PTCP.NOM but some.NOM and filling.PFV.PTCP.NOM
spoggon oxous *peritheis* kalamôi
sponge.ACC vinegar.GEN putting.PFV.PTCP.NOM stick.DAT
epotizen auton legôn:
give-to-drink.PST.IPFV.3S him.ACC saying.IPFV.PTCP.NOM
Someone *ran* and *filled* a sponge with sour wine, *put* it on a stick, and gave him a drink, saying … (Mk. 15:36)

2.2 Control and phrase structure

The subject of AG participles is functionally controlled, as witnessed among other things by long-distance agreement in case (Andrews, 1982).

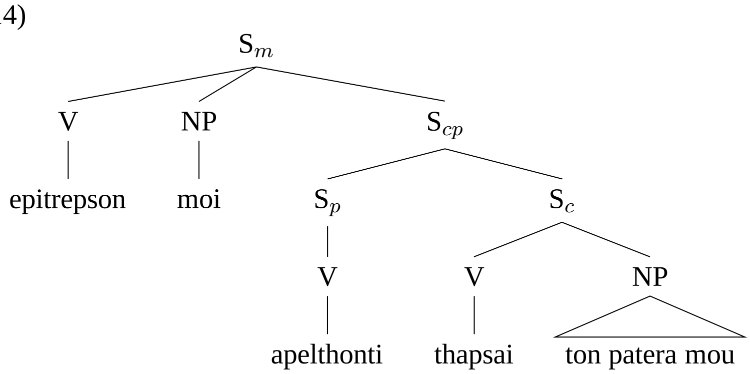
(12) epitrepson **moi** *apelthonti* thapsai
permit.IMP.PFV.ACT me.DAT go.PFV.PTCP.DAT.SG bury.INF.PFV
ton patera mou
DEF.ACC.SG father.ACC.SG my
‘Let me *go* and bury my father’ (Lk. 9:59)

The f- and c-structure of this example are given in (13) and (14).

(13)

$$
{}_{m}\left[\begin{array}{ll}
\text{PRED} & \text{`PERMIT}\left\langle\text{SUBJ, OBJ}_{\theta}\text{, XCOMP}\right\rangle\text{'} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{`PRO'} \\ \text{CASE} & \text{NOM} \\ \text{PERSON} & 2 \end{array}\right] \\
\text{OBJ}_{\theta} & \left[\begin{array}{ll} \text{PRED} & \text{`PRO'} \\ \text{CASE} & \text{DAT} \\ \text{PERSON} & 1 \end{array}\right] \\
\text{XCOMP} & {}_{c}\left[\begin{array}{ll}
\text{PRED} & \text{`BURY}\left\langle\text{SUBJ, OBJ}\right\rangle\text{'} \\
\text{SUBJ} & [\quad] \\
\text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{`FATHER'} \\ \text{CASE} & \text{ACC} \end{array}\right] \\
\text{XADJ} & \left\{ {}_{p}\left[\begin{array}{ll} \text{PRED} & \text{`GO AWAY}\left\langle\text{SUBJ}\right\rangle\text{'} \\ \text{CASE} & \text{DAT} \\ \text{SUBJ} & [\quad] \end{array}\right] \right\}
\end{array}\right]
\end{array}\right]
$$

(14)



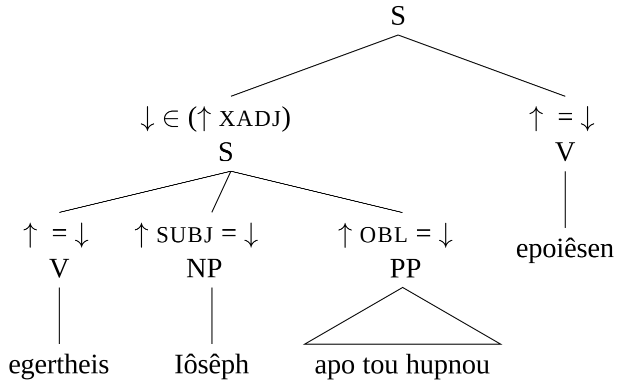
The dative case on *apelthonti* is due to subject-predicate agreement with *moi*, indicating that we have functional control.

From an f-structure information flow perspective, it would seem natural to say that CASE and PRED information flows from (*m* OBJ_{θ}) to (*c* SUBJ) to (*p* SUBJ), i.e. from a position in the outer f-structure *m* to positions in the embedded f-structures *c* and *p*, corresponding in effect to a chain of three c-commanding sentences S_m, S_c and S_p. But as we saw in the introduction, nothing in LFG's traditional, equality-based structure sharing actually forces this directionality of information flow. This raises the question of how to deal with sentences like (15).

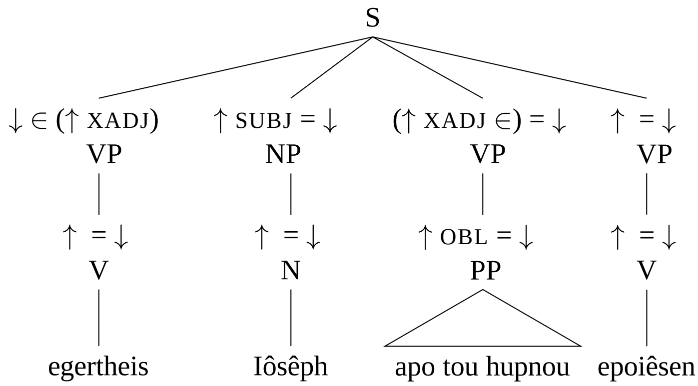
(15) *egertheis* de **Iôsêph** apo tou hupnou
wake up.PFV.PTCP.NOM but Joseph.NOM from DEF.GEN dream.GEN
epoiêsen
did.PST.PFV.3S
'When he woke up from the dream, Joseph did . . . '

Here *Iôsêph*, which is the shared argument, seems to sit in the participle clause, since it appears between the participle and its governed PP *apo tou hupnou*. There are in principle two ways we can deal with this in the c-structure: either the shared argument does in fact appear in the participle clause (16), or AG word order is free to the point that participles and their governing matrix form flat S-domains (17). To deal with the freedom of word order implied by the second option, we would assume headless VPs, much like discontinuous NPs can be dealt with using headless NPs.[7]

(16)



(17)



[7] However, when the discontinuous phrase has a non-argument function as here, functional uniqueness does not enforce identity of the f-projection of two nodes with the same annotation. For this reason, the constraint on the headless VP must be different (non-constructive rather than constructive) than that on the VP containing the head.

Both these analyses are prone to over-generation in that they allow the shared argument to appear indiscriminately in the participle clause and the matrix, a problem we will adress in section 2.4, but apart from that they make strikingly different predictions. (17) predicts that any matrix constituent can intervene between participle clause constituents: there is nothing special about the shared argument. (16), on the other hand, predicts that are no clausal discontinuities (except as may arise from other processes such as unbounded dependencies).

2.3 First corpus study: projectivity across categories

To decide between these two hypotheses, we performed a corpus study based on the PROIEL corpus data on New Testament Greek.[8] For the study, we selected the four Gospels, which amount to 64529 words.

The PROIEL corpus is annotated with dependency structures and the annotation is conservative, so shared arguments are consistently made dependents of the matrix in control structures. On the other hand, the control relation is made explicit through secondary edges, making it possible to automatically transform the dependency structure to make the shared argument dependent on the participle in the cases where it occurs adjacent to, or intermingled with, material from the participle clause.

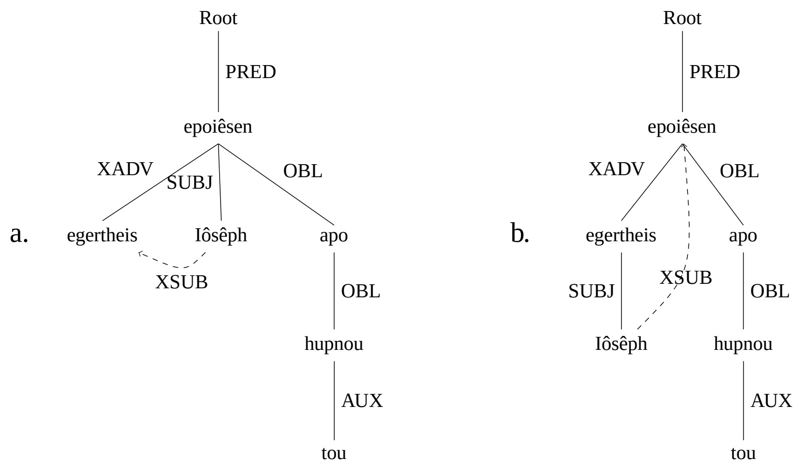
For the first study, we converted the original dependency structures into c-structures using a simple algorithm described in Haug (2011). We then counted the projectivity of all branching phrasal nodes[9] in the c-structure data, sorting them into three groups: continuous phrases, where no material that is functionally dependent on the head appears outside the functional head's phrase; phrases with long-distance dependencies, where material that is functionally dependent on the head appears outside the functional head's phrase, in a left-peripheral position of a finite clausal projection; and scrambled phrases, where material that is functionally dependent on the head appears outside the functional head's phrase and not in a left-peripheral position in a finite clausal projection. For free adjunct participles, we did these counts both on phrase structures derived from the original dependency tree and on those derived from the transformed dependency tree.[10]

[8] The corpus is browseable on http://foni.uio.no:3000, where it is also possible to download the source files.

[9] Participle phrases with overtly realized subjects but no other dependent were counted as branching, since they would potentially be branching in the transformed structure.

[10] The grammatical functions are similar to those used in LFG; XADJ is called XADV and AUX is used for words that do not contribute their own PRED feature. XSUB marks the external subject in a control construction.

(18)



(18) shows the original (a.) and transformed (b.) dependency trees for (15). When these dependency trees are transformed into c-structures, they yield (17) and (16) respectively. Table 1 shows the projectivity data for the various categories.

Type	LDD	Scrambling	Projective
NP	42	210	5170
AdjP	4	44	337
Adv	2	12	222
PP	2	11	4423
finite S	27	6	9849
absolute ptcp.	0	0	166
conjunct ptcp.	3	48	1253
conjunct ptcp. (transformed)	0	0	1304

Table 1: Projectivity across categories

As these numbers show, it is not at all uncommon for lexical phrases (headed by N, Adj, Adv or in some instances even P) to show discontinuities that are not due to unbounded dependencies. Finite clauses, on the other hand, rarely show such discontinuities.[11] The same holds for absolute participle clauses (i.e. those with an internal subject), but conjunct participle clauses seem to be different – until, that is, one considers the data from the transformed sentences, which are all continuous. This shows that in the 51 apparently discontinuous participle phrases, it is always the participle's subject which intrudes, as in (15). In other words, the predictions of the internal-subject hypothesis are borne out, against those of the free word order hypothesis.

One is led, then, to the conclusion that AG has backward control in participle

[11]The six apparent exceptions are in fact due to complex constructions such as internally headed relative clauses, where the automatic transformation of the dependency analysis produces a discontinuous phrase, but other analyses are possible.

adjuncts. If we assume that participles project S, the classical, equality-based analysis of functional control would predict random variation between forward and backward control, as information would flow in both directions. However, as it turns out, the distribution is not at all random.

2.4 Second corpus study: the distribution of control types

To study the distribution of the control types, we again looked at the phrase structure trees. As we saw in section 2.1, there are essentially three positions where adjunct participles can occur: in the specifier of S′, adjoined to S, or inside the S. Since it is not always possible to decide the actual position, cf. example (7) and the possible analyses in (8)-(10), we noted the highest possible analysis, so the participle in (7) was counted as occurring in spec,S′. For participles that were adjoined to S, we also noted whether they were left- or right-adjoined, and for S-internal participles, we noted whether they were to the left or the right of their verbal head.

In addition, we noted the type of control relation, dividing participles into six categories: **ambiguous** control are cases where the shared argument occurs at the edge of the participle phrase, so that it could form a constituent with both the participle and with the matrix, without giving rise to a discontinuity. **No controller** cases are the ones without an overt controller present in the sentence. **Backward** control are the cases where the participle subject occurs between constituents of the participle clause; since the previous study had already made the backward control analysis plausible, we slightly extended the definition to also include cases where a forward control analysis would lead to discontinuity of a coordination, such as (19).

(19) . . . *prosdramôn* **heis** kai *gonupetêsas*
run.PFV.PTCP.NOM.SG one.NOM.SG and kneele.PFV.PTCP.NOM.SG
auton epêrôta auton
him.ACC.SG asked.IPFV.PST.3S him.ACC.SG
'One man ran up to him, kneeled to him and asked him' (Mk. 10:17)

If *heis* belongs to the matrix, the coordination becomes discontinuous, so *prosdramôn* was counted as backward controlled and correspondingly, *gonupetêsas* was treated as **companion controlled**, meaning that its subject unambiguously occurs inside another XADJ participle. It should be noted that discontinuous coordiations are possible, though marked, in AG, but in view of the apparent normality of backward control, the analysis seems improbable here. If the position of *prosdramôn* and *heis* were swapped, *prosdramôn* would be counted as ambiguously controlled, and *gonupetêsas* as a case of **ambiguous companion** control.

The results of the classification are seen in table 2. We observe a significantly different distribution of backward and forward control ($p < 0.1 \times 10^{-9}$, Fisher's exact test). The first impression is that backward control is limited to specifiers and left-adjoined participles, except in (20).

Control type	Spec.	L-adj.	S-int.(L)	S-int.(R)	R-adj.
Ambiguous	366	39	1	22	90
No controller	285	50	1	12	110
Backward control	51	7	1	0	1
Forward control	8	10	11	18	129
Companion control	10	8	0	7	1
Ambig. comp. control	7	9	1	0	49

Table 2: Control type across positions

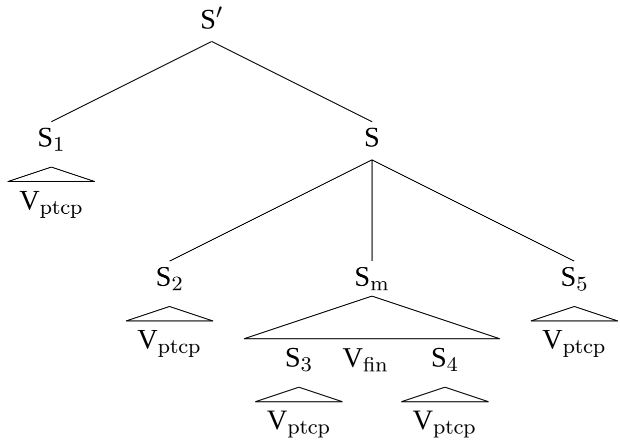
(20) ekraxen oun en tôi hierôi *didaskôn* **ho**
shout.PST.PFV.3S then in the temple teaching.IPFV.PTCP.NOM.SG DEF
Iêsous kai legôn
Jesus.NOM.SG and saying.IPFV.PTCP.NOM.SG
'Then cried Jesus in the temple as he *taught* saying' (John 7:28, King James Version)

However, we see that this example is actually one which has been counted as backward control because of the coordination. Given the lack of other examples of backward controlled participles in this position, it seems reasonable to analyse (20) as a discontinuous coordination instead.

Forward control, on the other hand, appears to distribute over all positions. But as we noted above, the position assigned in the counting is the highest possible: a lower analysis is always possible, and in fact, from inspection of the examples, likely, although we will spare the reader the philological details here.

The correct statement of the control facts, then, seems to be that participles in the specifier of S′ or left-adjoined to S′ have backward control: and if there are several such participles sharing the same argument, the shared argument appears in the leftmost one. Right-adjoined participles, on the other hand, do not allow backward control: their subject must appear in the matrix (or in a left-adjoined participle clause if there is one). Finally, participles that appear inside the matrix clause (i.e. the manner adjuncts) do not allow backward control, irrespective of whether they appear to the left or the right of the matrix verb. The situation can be summarized on the basis of the tree in (21).

(21)



If all the participles in (21) are present, the shared argument must be realized in S_1. If S_1 is not present, it must be in S_2. If neither S_1 or S_2 are present, the shared argument must be in the matrix clause, since neither S_3, S_4 or S_5 allows backward control.

3 Analysis

3.1 Subsumption

If we wanted to capture the set of facts discussed in the previous section in a subsumption based approach, a natural approach would be to use rules like in (22) for clause-internal participles and (23) for adjoined participles.

(22)
$$\text{S} \rightarrow \begin{array}{c} \text{S} \\ \downarrow \in (\uparrow \text{XADJ}) \\ \downarrow \text{SUBJ} \sqsupseteq \uparrow \text{GF} \end{array} , \begin{array}{c} \text{V} \\ \uparrow = \downarrow \\ \end{array} , \begin{array}{c} \text{XP*} \\ \uparrow \text{GF} = \downarrow \\ \end{array}$$

(23)
$$\text{S} \rightarrow \begin{array}{c} \text{S} \\ \downarrow \in (\uparrow \text{XADJ}) \\ \downarrow \text{SUBJ} \sqsubseteq \uparrow \text{GF} \end{array} \begin{array}{c} \text{S} \\ \uparrow = \downarrow \\ \end{array} \;\Bigg|\; \begin{array}{c} \text{S} \\ \uparrow = \downarrow \\ \end{array} \begin{array}{c} \text{S} \\ \downarrow \in (\uparrow \text{XADJ}) \\ \downarrow \text{SUBJ} \sqsupseteq \uparrow \text{GF} \end{array}$$

(22) says that the subject of the embedded S should be subsumed by some GF in the matrix.[12] Conversely, (23) says that the subject of the left-adjoined S should subsume some grammatical function in the adjoined-to S.

However, this approach runs into several problems. First, it would imply that participles can have pro-dropped subjects. In the case where the shared argument is only implicit, completeness could only be guaranteed by an optional (↑ PRED = 'PRO') on the participle, since the information would otherwise not flow from the matrix to the participle. This is not a serious problem, however, since it is certainly possible, if not usual, to assume that participles have pro-dropped subjects.

[12]The range of possible grammatical functions might be limited to SUBJ, OBJ and OBJ_θ but for simplicity we use just GF in our rules in this and the next section.

A more serious problem is due to the rule in (23) being too local. This means it will not interact correctly with a rule which makes the participle's matrix a complement clause, such as in (12) with the f-structure in (13), both repeated here for convenience. The clause structure is indicated by brackets.

(24) [$_m$ epitrepson **moi** [$_c$ [$_p$ *apelthonti*]
permit.IMP.PFV.ACT me.DAT go.PFV.PTCP.DAT.SG
thapsai ton patera mou]]
bury.INF.PFV DEF.ACC.SG father.ACC.SG my
'Let me first go and bury my father' (Lk. 9:59)

(25)
$$
{}_{m}\left[\begin{array}{ll}
\text{PRED} & \text{`PERMIT}\left\langle\text{SUBJ, OBL, XCOMP}\right\rangle\text{'} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{`PRO'} \\ \text{CASE} & \text{NOM} \\ \text{PERSON} & 2 \end{array}\right] \\
\text{OBL} & \left[\begin{array}{ll} \text{PRED} & \text{`PRO'} \\ \text{CASE} & \text{DAT} \\ \text{PERSON} & 1 \end{array}\right] \\
\text{XCOMP} & {}_{c}\left[\begin{array}{ll}
\text{PRED} & \text{`BURY}\left\langle\text{SUBJ, OBJ}\right\rangle\text{'} \\
\text{SUBJ} & [\quad] \\
\text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{`FATHER'} \\ \text{CASE} & \text{ACC} \end{array}\right] \\
\text{XADJ} & \left\{ {}_{p}\left[\begin{array}{ll} \text{PRED} & \text{`GO AWAY}\left\langle\text{SUBJ}\right\rangle\text{'} \\ \text{CASE} & \text{DAT} \\ \text{SUBJ} & [\quad] \end{array}\right] \right\}
\end{array}\right]
\end{array}\right]
$$

In this case, the overt controller appears in m, and from there it can only flow to c, since the complement rule does not 'know' that there is an adjunct participle. But given (23), information would not flow from c to p.

Another problem related to locality arises when there are multiple adjuncts, as in (11). In this case, the shared argument should appear in the left-most clause, which would be captured by (26).

(26)
$$
\begin{array}{ccccc}
\text{S} & \rightarrow & \text{S} & \text{S*} & \text{S} \\
 & & \downarrow \in \uparrow \text{XADJ} & \downarrow \in \uparrow \text{XADJ} & \uparrow = \downarrow \\
 & & \downarrow \text{SUBJ} \sqsubseteq \uparrow \text{GF} & \downarrow \text{SUBJ} \sqsupseteq \uparrow \text{GF} &
\end{array}
$$

However, it is not obvious how to extend this approach to frames appearing in the specifier position of S′, since it would require the rules for adjunction to S to be different whenever there is a participle in spec,S′.

Notice also that the intuitive appeal of the subsumption approach is weak in the multiple adjunction cases: for an example like (11), it requires that information flows from the first participle clause in the sequence to the matrix and then ‘back again’ to the second participle clause. Although this gives the right results when there is no frame, it seems more reasonable to explore a linearization based analysis, where the shared argument simply has to appear in the first S (not counting clause-internal participles) in which it has a function. In the next section, we develop such an analysis.

3.2 A linearization based account

In a linearization-based account, we model the AG control facts through constraints on the c-structural realization of shared arguments, rather than constraints on the information flow through the f-structure. Essentially we need to ensure that only the leftmost S in a serial construction can dominate a node whose ϕ-projection is shared between several clauses. Intuitively, then, an S-node admits a shared argument node if and only if its f-structure f-precedes all f-structures containing the f-structure of the shared argument in some grammatical function.

However, it is clear that when we talk about f-precedence relations between f-structures which share an argument function, we cannot use a notion of f-precedence based on the all c-structure nodes corresponding to the f-structures (e.g. Dalrymple 2001, p. 172): when the shared argument is overtly realized in the c-structure, there would be no precedence relation in such cases. Instead, we need the edge-based f-precedence relation from Bresnan (2001, p. 195):

(27) F-structure f f-precedes f-structure g ($f <_f g$) iff the rightmost node in $\phi^{-1}(f)$ precedes the rightmost node in $\phi^{-1}(g)$.

Under this definition of f-precedence, we can capture the AG control facts through the rule in (28).

(28)
$$\begin{array}{lllllll} \mathrm{S} & \rightarrow & \mathrm{NP} & , & \mathrm{V} & , & \mathrm{XP^*} \\ & & \uparrow \textsc{subj} = \downarrow & & \uparrow = \downarrow & & \uparrow \textsc{gf} = \downarrow \\ & & @\textsc{shared} & & & & \end{array}$$

@SHARED here refers to the template in (29).

(29) $@\textsc{shared} = (\textsc{gf}\downarrow) \not<_f \uparrow$

$(\textsc{gf}\downarrow)$ is an inside-out functional uncertainty which matches any f-structure in which the shared argument has a grammatical function. Inside the scope of negation, it gets a universal interpretation (Crouch et al., 2008), so that the end effect is that for all f-structures containing the shared argument, it must be true that they do not f-precede $\uparrow$. This yields the desired effect: $\uparrow$ itself matches $(\textsc{gf}\downarrow)$, but trivially does not f-precede itself. All other f-structures containing $\downarrow$ must have a right edge to the right of the right edge of $\uparrow$: since we use a notion of f-precedence based on the right edge, unbounded dependencies, which are the only discontinuities allowed for clausal f-structures, do not affect the f-precedence relations.

In (28), we marked only the subject NP with @SHARED since that is the only function shared arguments can have in the participle clause; but in the matrix, other functions are possible and we need to mark those too with @SHARED. This of course creates a potential for unwanted interaction with other sorts of structure-sharing for which we might not want @SHARED to apply, especially, in our context, the clause-internal participles: recall that these never allow backward control. Going back to our example (7), we want to disallow the analyses in (8) and (9), as these imply forward control of clause-external participle subjects; but we want to allow (10), as the participle is clause-internal on this analysis, and therefore should have forward control.

As the analysis stands, however, the subject *ho kurios* would be marked with @SHARED, disallowing (10) because the participle clause f-precedes the matrix. We therefore need a feature EXTERNAL + to mark clause-external participles and amend (29) to (30).[13]

(30) $$@\text{SHARED} = (\underset{\leftarrow\ \text{EXTERNAL} =_c +}{\text{GF}} \ \downarrow) \not<_f \uparrow$$

In comparison with the subsumption approach, using linearization constraints does away with the need to have optional pro-drop on participles and generalizes directly to cases with multiple adjunction. Also, unlike a subsumption approach, it does not interfere with control in complementation, since it does not alter the information flow in the f-structure.

But how do we treat the clause-internal participles, which never allow backward control? In this case, a linearization approach is not very attractive: we want to prevent the shared argument from being realized in the adjunct clause at all, so we would have to supply some impossible constraints. A c-structural analysis is still possible, just as it is for English, if clause-internal participles are of category VP rather than S. Alternatively, we could use a subsumption-based approach to force forward control. Which analysis is appropriate depends partly on whether

[13]Note that (30) will not be interpreted in the intended way by the XLE (beside the fact that XLE does not implement f-precedence, only head precedence). The negation will scope over the off-path constraint, which means that the interpretation will be as in 2 rather than the intended 1:

1. $\forall f.((f\ \text{GF}) = \downarrow\ \wedge (f\ \text{EXTERNAL}) =_c +) \rightarrow f \not<\uparrow$
2. $\forall f.(f\ \text{GF}) = \downarrow \rightarrow ((f\ \text{EXTERNAL}) \neq + \wedge f \not<\uparrow)$

The polarity of the EXTERNAL constraint is easy to fix, but the intended scope of $\rightarrow$ cannot be expressed. From the perspective of theoretical LFG, both constraints should be expressible and 1 would not seem to extend the complexity of the formalism (which is already NP-complete). But from a computational perspective, verifying 1 would interfere with the current implementation of functional uncertainty and disjunction in the XLE and possibly increase parsing time (John Maxwell, personal communication).

subsumption (or VP constituents) are needed in other parts of the AG grammar, such as control into complements. But it also depends on the status of subsumption in the general framework, which of course depends on the cross-linguistic evidence. In the next section, we briefly review the evidence that has been put forward in support of subsumption and discuss what similarities and differences there are compared to what we have observed in the Greek data.

4 Subsumption vs. linearization constraints

Although coming from a dead language, the data used in this paper are in fact exceptionally clear compared to the data used in other discussions of 'non-standard' structure sharing.

Zaenen and Kaplan (2003) discuss French. The central discussion revolves around the realization of the shared argument in object control and raising. As they note, however, the control cases could equally well be analysed as anaphoric control, so let us focus on raising. The basic contrast is the following (examples (59) and (60) in Zaenen and Kaplan 2003):

(31) Ce professeur russe que je crois sincèrement persuadé de devoir
this professor Russian that I believe sincerely convinces to have-to
enseigner cette version de l'histoire à ses étudiants
teach this version of the history to his students
'This Russian professor that I think sincerely persuaded to have to teach this version of history to his students'

(32) *Voilà la version de l'histoire récente que je crois persuadé de
see-here the version of the history recent that I believe persuaded to
devoir enseigner ce professeur russe à ses étudiants, encore
have-to teach this professor Russian to his students even
aujourd'hui.
now.
'This is the version of recent hisotry that I think this Russian professor is sincerely persuaded to have to teach to his students even now.'

In (31) the object of *croire* and subject of *persuadé* is realized as a relative pronoun in an operator position in the matrix. In (32), the shared argument is unsuccesfully realized in the embedded clause. In contrast, realization of the shared argument in the embedded clause is possible in some cases of subject control, so Zaenen and Kaplan (2003) conclude that subject control involves structure sharing with equality whereas raising to object involves structure sharing with subsumption.

However, Zaenen and Kaplan (2003) also note that object raising is only possible with relative clauses, or for some speakers also with clitic objects. This restriction is in fact crucial, since many ways of enforcing that distinction will automatically also rule out (32). In fact, although we cannot go into the details of the conditioning of this construction here, it is possible that a version based on linearization will fare well, at least for the grammars that allow a clitic object preceding *croire*.

Zaenen and Kaplan (2002) discuss German partial VP fronting (PVPF). The crucial evidence here comes from the interaction between PVPF and raising and control, in the contrast in (33) ((25) in the original paper).

(33) a. *Ein Aussenseiter zu gewinnen versuchte hier noch nie.
an outsider to win tried hier still never
'An outsider never tried to win here.'

b. Ein Aussenseiter zu gewinnen schien hier eigentlich nie.
an outsider to win seemed here actually never
'An outsider never actually seemed to win here.'

Control and raising verbs thus contrast in the latter, but not the former accepting fronting of the embedded infinitive with its subject:[14] according to Zaenen and Kaplan (2002) this would follow from control involving subsumption so that information only flows from the matrix to the embedded clause. This approach relies on control in German being treated as functional rather than anaphoric control, which is of course not the only option. If German equi is anaphoric control, the embedded subject position can be made unavaible by an equation $(\text{COMP PRED}) = \text{`PRO'}$.[15]

Finally, Sells (2006) relies on the cross-linguistic evidence for backward control and raising that has been brough forward most notably by Eric Potsdam and Maria Polinsky. All of these examples involve structure sharing between positions with different case marking.[16] Here I give the example from Tzez, where the verbalizer *-oqa* ('begin') is ambiguous between a control and a raising use. As a raising predicate it requires forward raising (34-a), while as a control predicate it is backward (34-b):

(34) a. kid$_i$ [t$_i$ ziya b-išr-a] y-oq-si
girl.II.**ABS** [cow.III.ABS III-feed.INF] II-begin.PAST.EVID
'The girl began to feed the cow.'

b. Δ_i [kid-bā$_i$ ziya b-išr-a] y-oq-si
[girl.II.**ERG** cow.III.ABS III-feed.INF] II-begin.PAST.EVID
'The girl began to feed the cow.'

The crucial argument for the analysis in (34-b) is the generalization that the verb agrees with the absolutive, not the ergative. But this implies a case mismatch between the two positions. There are various ways of overcoming the difficulty, e.g.

[14]A complication here is that many German speakers find (33-b) at least dubious, although better than (33-a).

[15]In fact, as pointed out by Sells (2006), it would be possible to generalize this treatment even to raising, if one accepts that raising is always 'Copy Raising' (Asudeh, 2004). But at that point all but the most ardent opponents of subsumption would probably back off.

[16]This is not evident from the Malagasy examples in Sells (2006), but clearly emerges from the discussion of Malagasy in Potsdam (2009).

by restricting out CASE from the subsumption equation, or by not having CASE as an f-structure feature at all. However, the case difference makes the argument for structure sharing weaker and suggests an anaphoric control treatment. This weakens the general case for treating cross-linguistic phenomena like backward control and raising in terms of subsumption.

In contrast, the AG data that have been considered in this article are perfectly clear cases of functional control. On the other hand, they are different from the data typically considered in the subsumption literature, because although the participle is non-finite and syntactically dependent on its finite verb, it is not clear that it is semantically dependent, except for the clause-internal participles, but precisely these do not allow backward control.

In particular, there is a generalization often found in the control literature that the controlled clause is temporally dependent on the controlling clause. By this generalization we do in fact expect clause-external participles to control their matrix: Bary and Haug (2011) argue in an LFG + Glue setting that although the temporal morphology appears on the matrix verb, the semantics of finiteness applies to the leftmost verb whether it is finite or a (clause-external) participle, in the sense that it is the leftmost verb that must be anchored in the discourse context – each subsequent verb is then related temporally to its preceding 'host'.

A result of this is that for clause-external participles, sequence matters. If we change the sequence, we change the temporal interpretation of the discourse. In contrast, a clause-internal participle may be moved around for pragmatic reasons, but the temporal interpretation is the same, namely overlap with the matrix event. This also holds for complement control: when complement clauses are topicalized, as in (33-a) and (33-b), topicalization does not alter their temporal interpretation.

An often observed difference between subordination and coordination is the fact that subordinated elements can be embedded in their governor whereas coordinated elements cannot generally be embedded inside each other. From this perspective, it is interesting to note that exactly the participles that are embedded in their matrix and thus more clearly subordinated, cannot have backward control. The non-embedded and more coordinate-like participles do have backward control. Nevertheless, it seems impossible to analyze these as actual syntactic coordination, since the shared argument gets its case in the matrix, cf. (6).

From a discourse perspective, however, clause-external participles in AG often behave like coordination; it is interesting to note that the direction of information flow is the same as we find in VP coordination.[17] If two coordinated VPs share an argument, that argument is typically expressed only in the first conjunct, unless there is strong focus on the shared argument.

(35) exele auton kai bale apo sou
remove.IMPV it.ACC and throw.IMPV from you
'Take it out and throw (it) away from you.' (Mt 18:9)

[17] Or S-coordination: since AG allows pro-drop, the difference between VP- and S-coordination can be hard to establish.

Similarly, if a clause-external participle has the same object as its matrix, that object is only realized in the participle clause.

(36) kai labôn tous hepta artous eukharistêsas
and taking.PFV.PTCP.NOM the seven bread.ACC blessing.PFV.PTCP.NOM
eklasen kai edidou tois mathêtais
break.PST.PFV.3S and give.PST.IPFV.3S DEF.DAT.PL disciples.DAT.PL
autou hina paratithôsin
his that put forth.3.PL
'Taking the seven bread and blessing (them), he broke (them) and gave (them) to his disciples, that they may serve (them)' (Mk 8:6)

Structurally, of course, this phenomenon is different and must be anaphoric control, since it is in fact possible to realize a different object. But it is another case of information flow between constituents that are information structurally on a par, and shows the same tendency for information to flow from the left to the right. This makes intuitive sense from a processing perspective.

5 Conclusion

We have seen that AG offers a particularly clear example of backward control. 'Backward', naturally, is taken in a structural sense (so 'upward' could have been more appropriate) and the defining feature of this type of control in AG is in fact that it is linearly forward and therefore appropriately handled by linearization constraints in the c-structure rather than subsumption at f-structure (or a category-based approach).

Corresponding to the importance of linearization for their control, these participles also rely on linearization for their temporal interpretation and this sets them apart from many other typical control phenomena. So even if subsumption cannot deal with Greek adjunct control and although the case for subsumption is perhaps not all that solid at the moment, it could still turn out to be the right way of dealing with control in complemenation.

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ON PARTICULARLY PREDICATIVE PARTICLES IN HUNGARIAN

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Abstract

This paper investigates the grammar of two types of spatial particles in Hungarian. We provide an analysis in the framework of Lexical-Functional Grammar (LFG), which has been successfully implemented on the Xerox Linguistic Environment (XLE) platform of the Parallel Grammar international project. We propose that, in the productive cases, syntactic predicate composition of a special sort takes place via XLE's restriction operator. We treat the non-productive cases by dint of appropriate specifications in the (distinct) lexical entries of verbs and particles in combination with XLE's concatenation template.

1. Introduction

Particle verb constructions (henceforth: PVCs) present well-known challenges for linguistic analysis, even extending into the broader context of complex predicate formation, see Alsina et al. (1997). For an overview of the PVC problems to be addressed, a discussion of the major types of solutions offered in the literature, and a range of case studies on languages including Dutch, English, German, Swedish and Hungarian, see Dehé et al. (2002). The major issue is that PVCs exhibit a mixture of very strong lexical and syntactic properties. Their combination seems to have a straightforward derivational flavour, while they are separable in the syntax. This mixed behaviour is problematic for the classical designs of the majority of generative frameworks, and, consequently, it also poses significant problems for implementational platforms based on some of these generative theories.

In this paper, and in our other paper (Rákosi and Laczkó, this volume), we discuss Hungarian particle verb constructions expressing spatial dependencies. We distinguish the following four major types.[1]

(1) (A) non-inflecting adverbial PVC:

A	*macska*	*fel*	*szaladt*	*az*	*asztal-ra*.
the	cat.NOM	up	ran.3SG	the	table-onto

'The cat ran up onto the table.'

(B) non-inflecting, case-assigning postpositional PVC:

A	*macska*	*át*	*szaladt*	*az*	*asztal-on*.
the	cat.NOM	across	ran.3SG	the	table-on

'The cat ran across the table.'

[1] Diverging from standard spelling conventions, we consistently spell the particle and the immediately following V as two separate orthographic units, which is in accordance with a crucial syntactic aspect of our analysis: even an immediately preverbal particle occupies a distinct constituent structure position.

(C) inflecting, reduplicating suffixal PVC:

A	*macska*	*rá*	*szaladt*	*az*	*asztal-ra*.
the	cat.NOM	onto.3SG	ran.3SG	the	table-onto

‘The cat ran onto the table.’

(D) inflecting, possessive postpositional PVC:

A	*macska*	*mögé*	*szaladt*	*az*	*asztal-nak*.
the	cat.NOM	behind.to.3SG	ran.3SG	the	table-DAT

‘The cat ran behind the table.’

As the names of the types express, one of the fundamental differences between Types (A-B) and Types (C-D) is that in the former the particle cannot be inflected, while in the latter it can be inflected for person and number. Types (C-D) are analyzed in Rákosi and Laczkó (this volume), and in the present paper we concentrate on Types (A-B). Here we develop an LFG analysis which we have successfully implemented on the XLE platform. The general motivation for an account along these lines was provided by Forst-King-Laczkó (2010). The most crucial aspects of our approach are as follows. In the productive cases, the particle and the verb are combined in the syntax: a special sort of syntactic predicate composition takes place via XLE’s restriction operator. The special nature of this process is that the verb is taken to be an argument, without any grammatical function, of the particle, which has the main predicate status. We handle the non-productive cases by the help of appropriate specifications in the (distinct) lexical entries of verbs and particles. The felicitous co-occurrence and combination of the particle and the verb is ensured by XLE’s concatenation template. In our analysis, we assume that the particles in question are non-projecting words in the sense of Toivonen (2001). In this connection, our terminology is as follows: we use the word particle as a cover term for certain verbal modifiers that, in neutral sentences, immediately precede the verb. When, on our account, the particle has a non-projecting word status, we assume that it has the PRT syntactic category.

The structure of the paper is as follows. In section 2, we discuss the traits of Hungarian non-inflectional spatial markers. In section 3, we offer a brief overview of the literature most relevant from the perspective of this paper. In section 4, we present our LFG-XLE analysis of the two types of non-inflectional spatial markers. We cover both compositional and non-compositional uses. In section 5, we summarize and make some concluding remarks.

2. Non-inflecting spatial markers in Hungarian: a descriptive overview

2.1. Shared properties of the two types of non-inflecting PVCs

The following properties are shared not only by the two non-inflecting PVC types, but by all the four types presented in (1).

- The PVC licenses an oblique associate.
- The particle occupies an immediately preverbal position in neutral clauses.
- The particle can be separated from the verb in non-neutral clauses under clearly definable circumstances.
- The semantic type of the particle itself is *goal* or *path*.
- Particular PVCs can be fully compositional or fully idiomatic in each construction type.
- The particle typically telicizes the verb.
- In the compositional cases typically the *PVC + OBL* combination alternates with a *plain V + OBL* combination.

2.2. The non-inflecting adverbial PVC

The particle word occurring in this PVC type is used as an adverb elsewhere. Consider the use of *ki* 'out' in (2).

(2)	*Men-j*	*ki*	/	*ki-jjebb!*
	go-IMP.2SG	out	/	out-COMP
	'Move out / more outwards.'			

As a particle, it only requires its associate to be of a given semantic type, but it does not govern its associate's case:

(3)	*Ki*	*fut-ott-am*	*a*	*park-ból*	/	*a*	*fa*	*alól.*
	out	run-PAST-1SG	the	park-from	/	the	tree	from.under
	'I ran out from the park / from under the tree.'							

As (3) shows, *ki* 'out' as a particle licenses a source oblique argument. The fact that the licenser is the particle and not the verb is clearly demonstrated by the ungrammaticality of (4), in which the verb is used on its own, and it is incompatible with a source argument.

(4)	**Fut-ott-am*	*a*	*park-ból*	/	*a*	*fa*	*alól.*
	run-PAST-1SG	the	park-from	/	the	tree	from.under
	'I ran out from the park / from under the tree.'						

The following particles also belong to this type: *be* 'in', *le* 'down', and *fel* 'up'.

2.3. The non-inflecting, case-assigning postpositional PVC

The particle word occurring in this PVC type is used as a postposition elsewhere, and in that use it takes a complement with a selected oblique case. Consider the use of *keresztül* 'across' in (5).

(5) *a* *park-on/*park-ban/*park-ból* *keresztül*
the park-on/ park-in/ park-from across
'across the park'

As (6) shows, when *keresztül* 'across' is used as a particle, it also prescribes the same case form for the oblique argument of the PVC.

(6) *Keresztül* *fut-ott-am* *a* *park-on/*park-ban.*
across run-PAST-1SG the park-on/ park-in
'I ran across the park.'

The fact that the licenser of the oblique argument with its designated case is the particle and not the verb is clearly demonstrated by the ungrammaticality of (7), in which the verb is used on its own and, thus, it is incompatible with an oblique argument in superessive case.

(7) *Fut-ott-am* *a* *park-ban/*park-on.*
run-PAST-1SG the park-in/ park-on
'I ran in the park / *on the park.'

The following particles also belong to this type: *át* 'across, over', *által* 'across', which is an archaic or dialectal synonym, and *szembe* 'against', which requires an oblique argument in instrumental case, as opposed to the superessive case required by the other particles of this type.

3. Previous literature on spatial dependencies in Hungarian

Hungarian PVCs have been analyzed from various perspectives and in a variety of descriptive as well as generative theoretically- and implementationally-oriented frameworks; see, for instance, Ackerman (1983, 2003), É. Kiss (1987, 1992, 2006), Komlósy (1992), Piñón (1992), Ackerman-Webelhuth (1993), Kiefer-Ladányi (2000), Surányi (2009a,b, 2011), Forst-King-Laczkó (2010), Laczkó-Rákosi (2011b), and the references in these works.

The basic line of demarcation between various approaches has to do with the locus of the combination of PVCs. The following two radically different views can be distinguished: most crucial properties of PVCs have to be captured (i) lexically or (ii) syntactically.

As regards the first view, a variety of strongly lexicalist accounts (predominantly but not exclusively in an LFG-style framework) is proposed by Ackerman (1987, 2003) and Ackerman-Webelhuth (1993). The most significant aspects of this approach are as follows: (i) only lexical rules (as opposed to syntactic rules) can create new argument structures; (ii) in the unmarked case, lexical representations are expressed by single synthetic word forms; however, as a marked option, they can also be expressed by combinations of words without joint morphological status. Given that these papers concentrate on inflecting Type (C) PVCs, the relevant details of this analysis are discussed in Rákosi-Laczkó (this volume).

É. Kiss's (1987) account, in the framework of Government and Binding theory (GB), can also be taken to be lexical in nature. Its essence is that the particle+verb combination is a V^0 element in the lexicon and its peculiarity is that it is exempt from the otherwise obligatory morphological process called bracket erasure. In É. Kiss's notation, it has the following lexical representation: $[[\text{Prev}]\ [V^0]]_V{}^0$. This is roughly comparable to Ackerman's notion of an analytic lexical form.

As far as the strongly syntactic analyses of PVCs are concerned, Types (A-B) have received much less attention in the GB/Minimalist tradition than Types (C-D); see the overview of the relevant literature in Rákosi-Laczkó (this volume). We can only find outlines of an analysis along syntactic lines in É. Kiss (2002) and Surányi (2009a,b; 2011). The essence of the account is the movement of the particle from an underlying appositive structure:

(8)	*Fel*$_i$	*ugr-ott-am*	[~~*fel*~~$_i$	[*az*	*asztal-ra*]].		(Surányi 2009b)
	up	jump-PAST-1SG	up	the	table-onto		
	'I jumped up onto the table.'						

Our analysis presented in this paper and in Rákosi-Laczkó (this volume) has been substantially motivated by Forst-King-Laczkó (2010), which aims at developing a uniform LFG/XLE approach to PVCs in German, English, and Hungarian. The crucial aspects of this approach are as follows. When the particle and the verb are combined non-productively (typically non-compositionally) then the two elements have distinct lexical entries in such a way that the particle only has FORM information in its entry and all the relevant information is encoded in the lexical entry of the verb: the meaning and argument structure of the PVC in question, and the constraint that the verb in the given use has to co-occur with a designated particle. The XLE device that efficiently handles this phenomenon is the hard-wired concatenation template. When the particle and the verb are combined productively then this combination takes place in the syntax. The following types of PVCs are distinguished in this domain:

a) the particle is an adjunct of the verb,
b) the particle is an oblique argument of the verb,
c) the particle is an aspect marker,
d) the particle is a secondary predicate,
e) the particle is the main predicate taking the verb as one of its arguments.

Fundamentally, Forst-King-Laczkó (2010) give only German examples of these five types and they point out that there are Hungarian and English counterparts in each type. In the case of type e), they assume that a special instance of syntactic predicate composition takes place, which is implemented in XLE by dint of the restriction operator. In this connection, our goal in this paper is twofold: (i) we aim to prove that Hungarian Type (A-B) PVCs as we introduced them above are genuine examples of type e) and (ii) we provide arguments in favour of taking the particle to be the main predicate in these cases (which is only postulated in Forst-King-Laczkó (2010)).

Note that the crucial details of Forst-King-Laczkó's (2010) account are spelled out in the presentation of our analysis of PVC Types (A-B).

4. Our analysis

4.1. A structural issue

As has been emphasized several times, the particles under investigation are separable, and they are forced to appear in positions other than [Spec,VP] under clearly definable conditions. The two most important conditions are as follows: (i) the clause contains a focussed constituent; (ii) the clause contains negation. These cases are exemplified in (9) below.

(9)	a.	*ÉN*	*szaladt-am*	*ki*	*a*	*ház-ból.*
		I.NOM	ran-1SG	out	the	house-from
		'It was ME who ran out of the house.'				
	b.	*Nem*	*szaladt-am*	*ki*	*a*	*ház-ból.*
		not	ran-1SG	out	the	house-from
		'I didn't run out of the house.'				

In a large body of GB literature on Hungarian focus constructions, a FocP is postulated, with the focussed constituent itself occupying the [Spec,FocP] position distinct from [Spec,VP], which is assumed to be occupied by (non-focussed) verbal modifiers (including particles), see Brody (1990) and É. Kiss (2002), among others. However, we agree with Börjars et al. (1999) that the postulation of a FocP in a language like Hungarian is unjustified in an LFG framework, and we think that the most LFG-friendly way of capturing the syntactic (preverbal) complementarity of focussed constituents and verbal modifiers (including particles) is to assume that they target the same syntactic position. We believe that the most appropriate salient single position for this purpose is [Spec,VP].[2] Thus, it is a general aspect of our account, both in this paper and in Rákosi-Laczkó (this volume), that we assume that all the spatial

[2] Our [Spec,VP] analysis, which we defend in Laczkó-Rákosi (2011a) at greater length, has been partially motivated by É. Kiss's (1992) GB approach. For a [Spec,VP] account of Hungarian focus in LFG, see Mycock (2006).

particles in the four types under investigation (irrespective of their syntactic category and their function) occupy the [Spec,VP] position when they immediately precede the verb.

4.2. The non-inflecting adverbial PVC

We discuss this type using examples containing the particle *ki* 'out'. In its productive, compositional use, the particle denotes a path, and it introduces (at least) an optional OBL source argument, without specifying its form of expression. Consider the following examples.

(10)	*Fut-ott-am*	*a*	*park-ba*	/	**park-ból.*			
	run-PAST-1SG	the	park-into	/	park-out.of			
	'I ran into the park / out of the park.'							

(11)	*Ki*	*fut-ott-am*	a	*park-ból*	/	*a*	*fa*	*alól.*
	out	run-PAST-1SG	the	park-out.of	/	the	tree	from.under
	'I ran out from the park / from under the tree.'							

(12)	*Ki*	*fut-ott-am*	a	*park-ba*	/	*a*	*fa*	*alá.*
	out	run-PAST-1SG	the	park-out.of	/	the	tree	to.under
	'I ran out into the park / under the tree.'							

As (10) shows, the motion verb *fut* 'run' is compatible with an optional goal oblique argument and it is not compatible with a source argument. However, as (11) demonstrates, when this verb combines with *ki* 'out', the PVC is compatible with a source argument. The actual form of this argument is not constrained as long as it satisfies the source semantic requirement, so it can be expressed, for example, by an (elative) case-marked noun phrase or a prepositional phrase. (12) illustrates the fact that the source argument of the PVC is optional and the PVC (just like the verb alone) is compatible with a goal argument. Two remarks are in order at this point. On the one hand, as follows from the discussion of the status of *ki* 'out' below, it stands to reason to assume that this 'path' particle is capable of introducing both a source and a goal oblique, and, thus, the verb, the particle or both elements can be taken to be the licenser(s) of the goal. We cannot explore the problems and consequences of this issue in this paper, especially in the light of the next remark. On the other hand, given the fact that our HunGram implementation of the XLE system only admits one "general" oblique argument per predicate (we do not employ several differently theta-marked obliques in an argument structure) and the fact that the source is solely introduced by the particle, we assume that the constituent analyzed as an oblique, whether a source or a goal, is an argument of the particle.

In the presentation of our analysis, we first concentrate on the productive (compositional) use of *ki* 'out' as exemplified in (11) and (12). Following the relevant aspects of the approach developed in Forst-King-Laczkó (2010), we assume that a special kind of predicate composition takes place when such PVCs are created.

The first issue to be addressed in any instance of predicate composition is the (semantic) relationship between the two predicative elements. It is our conviction that in the case at hand the right assumption is that the particle is the main predicate. This is based on the following considerations.

(A) These particles themselves are capable of contributing the ‘directional path’ semantic feature to the (complex) PVC predicate, consider their potential combinability with non-motional verbs, and the result is a source-path-goal geometry of the semantics of the PVC. Consider the following examples.

(13) *A szurkoló-k meg tapsol-t-ák a focistá-k-at.*
the fan-PL.NOM PERF applaud-PAST-3PL the footballer-PL-ACC
‘The fans applauded the footballers.’

(14) *A szurkoló-k ki tapsol-t-ák a focistá-k-at*
the fan- PL.NOM out applaud-PAST-3PL the footballer-PL-ACC
az öltöző-ből a pályá-ra.
the dressing.room-from the pitch-onto
‘The fans applauded the footballers from the dressing room
to the pitch.’

It is obvious that *tapsol* ‘applaud’ or its perfect counterpart in combination with the perfectivizing particle *meg* is not a motion verb, see (13). However, when this verb is combined with *ki* ‘out’, the resulting PVC will receive a source-goal semantic dimension, which can only be the contribution of the particle.[3]

(B) In certain elliptical-looking imperative contexts, a directional particle is *the* predicate with an optional subject, with an obligatory oblique argument and it has a source-path-goal semantic geometry. Consider the examples in (14) and (15).

(14) *(Mindenki) Ki az öltöző-ből (a pályá-ra)!*
everybody.NOM out the dressing.room-from the pitch-onto
‘(Everybody) Out of the dressing room (to the pitch)!’

(15) a. *Le a sapká-t!*
down the cap-ACC
‘Down with the cap!’
b. *Le a sapká-val!*
down the cap-WITH
‘Down with the cap!’

[3] The analysis of such constructions is a complex issue, which we leave for future research. Our main point here is that, whatever the details of a feasible account are, the semantic contribution of the particle along the source-goal line is unquestionable.

The reason why we assume that examples like (14) are only elliptical-looking is that if one thinks about the meaning of such an imperative sentence their conclusion can naturally be that the sentence is not terribly elliptical. Its main message is that the speaker demands that *x* should undergo a change of location such that *x* should get from *y* to *z*, and the actual mode (manner of motion) of this change of location is unimportant (it can be walking, running, crawling, etc.). (15a) contains a similar example. Both (14) and (15a) are constructions in which a suitable verb can be inserted (from a range of verbs of motion) and the result will be a complete PVC with approapriate argument structural and syntactic properties, including the number, types and forms of arguments. Of course, this fact supports the potentially elliptical nature of these constructions. However, even in this light, we have every reason to assume that in (14) and (15a) the main predicate of the construction, namely the particle, *is* present, and what has been ellipted is one of its arguments, namely the verb.[4] Moreover, in this domain, there are constructions with particles and without verbs in which no verb can be felicitously inserted, because there is no PVC that would require or allow the actual form of the oblique argument. In this respect, compare (15a) and (15b). In the former we can insert several verbs and the result will be a well-formed PVC, as shown in (16a). By contrast, (15b) rejects any completion along these lines, see (16b). Thus, the only logical conclusion is that *le* 'down' in this use is the main predicate without any verbal argument, and the oblique argument in instrumental case is solely its own argument.

(16)	a.	*Ve-dd*	/	*Te-dd*	*le*	*a*	*sapká-t!*
		take-IMPER.2SG	/	put-IMPER.2SG	down	the	cap-ACC
		'Take off the cap!	/ Put down the cap!'				
	b.	**Ve-dd*	/	**Te-dd*	*le*	*a*	*sapká-val!*
		take-IMPER.2SG	/	put-IMPER.2SG	down	the	cap-INSTR
		'Take off the cap!	/ Put down the cap!'				

Once we have established the main-predicate—argument relationship between the particle and the verb in the productive use of the PVC,[5] the

[4] We would like to make two remarks here. (A) Our analysis of this particle type as the main predicate is, in a significant sense, the mirror image of É. Kiss's (2006) approach, in which *all* Hungarian particles (including this type) in *all* their uses are secondary (resultative) predicates. (B) In this paper, we do not explore the possibility of including a subject in the argument structure of the particle and its consequences.

[5] Forst-King-Laczkó (2010) simply assume this semantic pattern without any justification, and they refer the reader to Stiebels (1996). They only give the following German example.

(i)	*Lauf*	*dem*	*Glück*	*nicht*	*länger*	*hinterher!*
	run.IMP.2SG	the.DAT	happiness	not	longer	after
	'Don't run after happiness any longer!'					

following two questions arise. (A) What LFG/XLE device/operation should we use to formally capture this relationship? (B) In which component of our grammar should we apply this device/operation?

As regards question (A), given that the verb is taken to be an argument, one classical LFG solution to explore would be to assume that the verb heads an (XCOMP) propositional argument. However, on closer inspection it soon turns out that the (XCOMP) funtional control device as we know it cannot be employed here. The reason for this is twofold. On the one hand, it stands to reason that the verb brings along its core (subject and object) arguments into the PVC overtly, and, thus, it cannot qualify as the head of an (XCOMP), which, by definition, has to be an open propositional function with a covert (and functionally controlled) subject. On the other hand, our current view of the semantics of the particle is that it contributes the source-goal dimension and it takes the verb as one of its arguments, but it has no core argument.[6] On the basis of these considerations, we subscribe to Forst-King-Laczkó's (2010) approach, which assumes that predicate composition takes places in such a way that the verb, with its argument structure, becomes a semantic argument of the particle without bearing any grammatical function assigned by the particle. The device used for this purpose is XLE's restriction operator, which, in our analysis of the phenomena at hand, deranks the verb (makes it an argument of the particle) and restricts out its oblique argument. The first procedure is necessary in order to prevent the verb from functioning as the co-head of the PVC, because this would violate the principle that requires

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It is interesting to note that the direct Hungarian counterpart of the German PVC would simply be the verb *fut* 'run' taking an oblique argument expressed by a PP headed by *után* 'after'. In addition, *után* 'after' is an inflecting postposition that, under certain circumstances, can be used as a particle. We call the relevant construction type *inflecting, possessive postpositional PVC*, see (1D), and we analyze it in Rákosi-Laczkó (this volume).

[6] See our remark (B) in Footnote 4. In addition, even if we assumed that the particle also had a subject argument (denoting the entity undergoing the change of location expressed by the particle), an (XCOMP) analysis would only be available in cases in which the PVC contains an intransitive verb. Compare the following examples.

(i)	*Ki*	*gurul-t*	*a*	*labda*	*a*	*szobá-ból.*
	out	roll$_{\text{INTR}}$-PAST.3SG	the	ball.NOM	the	room-FROM

'The ball rolled out of the room.'

(ii)	*János*	*ki*	*gurít-ott-a*	*a*	*labdá-t*	*a*	*szobá-ból.*
	John.NOM	out	roll$_{\text{TR}}$-PAST-3SG.DEF	the	ball-ACC	the	room-FROM

'John rolled the ball out of the room.'

It is only in the case of (i) that we could postulate that the ball is the overt subject of the particle, which functionally controls the covert subject of the (XCOMP) headed by the verb. Obviously, no similar (acceptable) (XCOMP) analysis would be available in the case of (ii).

that if there is more than one funcional head, only one of them can have a PRED feature. The second procedure is necessary for XLE-internal reasons: as we pointed out at the beginning of this section, the architecture of XLE only admits one oblique argument per (complex) predicate, and we need this single oblique argument status for the oblique introduced by the particle.

As far as question (B) is concerned, again, we follow Forst-King-Laczkó (2010) in assuming that this special predicate composition via restriction takes place in the syntactic component of the grammar. Their main motivations for this choice are as follows. (A) The particle and the verb are fully independent syntactic elements. (B) In the productive case, the composition of the PVC is highly regular and predictable. (C) It is a very important advantage from a theoretical, and (especially) from an implementational, perspective that complex predicates can be created, and they can also be analyzed as created, on the fly; that is, new combinations can be readily and straightforwardly parsed. (D) It is a further advantage that the lexical component is not at all burdened with all the necessary lexical forms for these absolutely productive PVCs, which would be inevitable if this restriction operation was assumed to take place in the lexicon. (E) Finally, at the end of this section it will turn out to be an additional favourable aspect of this approach that in this way we can neatly compartmentalize the treatment of our PVCs: productive cases are handled in the syntax, while the crucial aspects of non-productive cases are handled in the lexicon.

Given the strongly lexicalist architecture of LFG, predicate composition in the syntax considerably deviates from the classical view according to which any process affecting argument structure has to be lexical in nature. There are, however, LFG practitioners who propose that under clearly definable circumstances such a deviation is justified and the necessary technical apparatus can be developed in a principled manner (see restriction, for instance). From the foregoing discussion it should be obvious that we also adopt this view. For an interesting and edifying debate bearing on the locus of the treatment of complex predicates based on several independent phenomena from various languages, see Ackerman-LeSourd (1997), Alsina (1997) and Butt (1997), all three in Alsina et al. (1997).

Let us now present the details of our analysis of the productive use of non-inflecting adverbial PVCs. Consider the following example.

(17)	*A*	*rák*	*ki*	*mász-ott*	*a*	*folyó-ból.*
	the	crab.NOM	out	crawl-PAST.3SG	the	river-from
	'The crab crawled out of the river.'					

In this use, the particle and the verb have the following XLE-style lexical representations.

(18) *ki* PRT XLE (↑PRED) = 'out < %ARG1 (↑OBL) >'.

(19) *mászik* V XLE (↑PRED) = 'crawl < (↑SUBJ) (↑OBL) >'.

The particle has a special syntactic status: adopting Toivonen's (2001, 2002) proposal for Swedish, we assume that it is a non-projecting word, and its category is PRT; also see a similar XLE treatment of German, English and Hungarian particles in Forst-King-Laczkó (2010). In this paper, we do not have space to argue extensively for non-projecting categories, so we confine ourselves to presenting the following brief considerations.

(A) Particles having the PRT category cannot have phrasal projections to begin with.

(B) In our analysis they are the main (functional) heads but they are clearly not verbal categorially.

(C) It seems that there is an independent need in Hungarian, too, for a non-projecting category to be associated with a verbal element. The clearest case, we believe, is manifested by the conditional particle *volna*. Consider the following examples.

(20) a. János megérkez-ett.
John.NOM arrive-PAST.3SG
'John arrived.'

b. János megérkez-ett volna, ha...
John.NOM arrive-PAST.3SG COND if
'John would have arrived if...'

As (20b) illustrates, the combination of *volna* (COND) with the past tense form of the verb expresses the counter-factual past conditional mood in Hungarian. This element in this use is clearly a non-projecting function word,[7] and it must occur immediately after the verb in the past tense, except that in certain idiolects, at least, *is* 'too' can intervene between the verb and *volna*. We claim that *volna* is another candidate for the PRT status.[8]

In the argument structure of *ki* 'out' in (18), %ARG1 is a special notation. Practically speaking, it prepares this predicate for the "incorporation" of the verb with its own argument structure as its first argument. In (19) the verb has an ordinary lexical form.[9] As has been pointed out above, in our analysis this special predicate composition takes place in the syntax. Consider (21). This is the crucial part of the structure of the VP when the (non-projecting) PRT occupies its specifier position. PRT and V' are functional co-heads. The

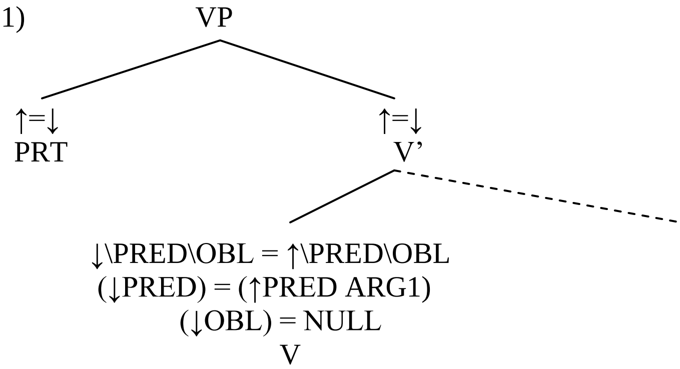
[7] This element can also be used as the (irrealis) conditional form of the copula *van* 'be'.

[8] We also think that the Hungarian yes-no question morpheme *-é* can most appropriately be analyzed along the same non-projecting PRT lines. We leave this to future research.

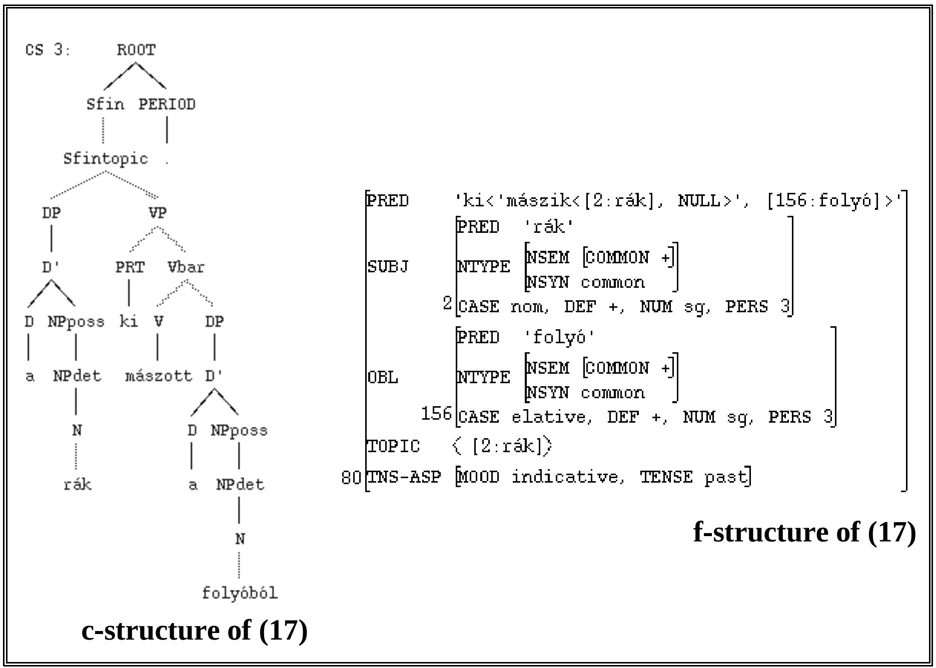
[9] In a fully developed treatment, it also has to be encoded in the lexical form of a predicate like *mászik* 'crawl' that it is a motion verb. Furthermore, it has to be constrained in the lexical form of a particle like *ki* 'out' that its first argument has to be a motion verb. We have not implemented this aspect of the analysis in our Hungarian XLE grammar yet.

functional annotations associated with V encode the essential aspects of syntactic predicate composition via restriction. The \ symbol is the restriction operator itself. In the first equation it restricts out the (OBL) argument of the verb and licenses the (OBL) argument of the particle. The second equation turns the verb into the first argument of PRT. The third equation “nullifies” the (OBL) function of the verb’s second argument.

(21)



The c-structure and f-structure representations provided by our HunGram XLE analysis of (17) are given in Figure 1.



f-structure of (17)

c-structure of (17)

Figure 1

The relevant parts of the c-structure are straightforward.[10] As regards the f-structure, the crucial part is the representation of the PRED attribute. As a result of the restriction operation, a composite argument structure is created: the particle is the main PRED with two arguments. Its first argument is the verb with its own argument structure, and its second argument is a (source) oblique. The subject argument of the verb is, at the same time, the subject of the composite predicate, the particle's oblique is the composite predicate's oblique argument, and the verb's second argument receives the zero grammatical function, as it has been restricted out. The subject also has the topic discourse function.

Let us now turn to non-compositional PVCs containing *ki* 'out'. Consider the following example.

(22) *Az* *elnök* *ki* *mász-ott*
the president.NOM out crawl-PAST.3SG
a *kellemetlen* *helyzet-ből*.
the unpleasant situation-from
'The president got himself out of the unpleasant situation.'

At first sight, it seems that this sentence can be straightforwardly analyzed in the same way as (17), because it contains exactly the same PVC and the same number and types of constituents. However, as the translation in (22) shows, here the meaning, although quite transparent metaphorically, is not fully compositional, and thus, this PVC does not conform to the productive pattern.[11] Therefore, the syntactic predicate composition via restriction analysis cannot be applied to it, and we have to have recourse to a different approach: concatenation.

The essence of our analysis, in the spirit of Forst-King-Laczkó (2010), is as follows. We use two distinct lexical forms for the particle and the verb just like in the case of the the compositional PVC. Consider (23) and (24).

(23) *ki* PRT XLE (↑PRT-FORM) =c ki
(↑CHECK _PRT-VERB) =c +.

---

[10] Two general remarks: (i) we assume that Hungarian noun phrases are DPs; (ii) *Sfintopic* is the sentential node that dominates a finite clause containing a topic constituent.

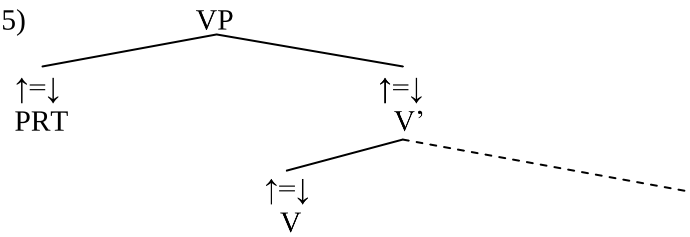
[11] This is also corroborated by the fact the while in the productive pattern it is always possible to optionally add a phrase expressing an endpoint, see (i), this is not possible in the case of (22). For instance, we cannot add to (22) the following constituent: *egy elviselhető helyzetbe* 'into a bearable situation'.

(i) *A* *rák* *ki* *mász-ott* *a* *folyó-ból* *a* *part-ra.*
the crab.NOM out crawl-PAST.3SG the river-from the bank-onto
'The crab crawled out of the river onto the bank.'

(24) *mászik* V XLE ($\uparrow$PRED) = ‘%FN < ($\uparrow$SUBJ) ($\uparrow$OBJ) >’
($\uparrow$CHECK _PRT-VERB) = +
($\uparrow$PRT-FORM) =c ki
@(CONCAT ($\uparrow$PRT-FORM) # mászik %FN).

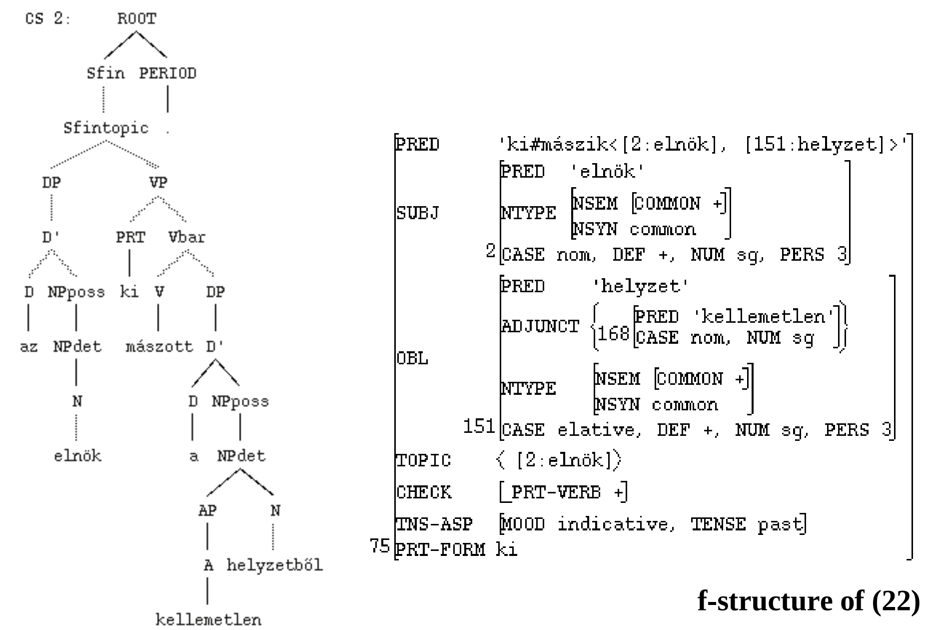
Given that this particle plus verb combination in this use is not compositional, we assume that the PRT has no PRED attribute: it only has a FORM feature. Furthermore, it has to be constrained that the PRT occurs in a PVC configuration. In the XLE system this is achieved by a CHECK feature. In the lexical entry of the simplex verb, we encode the meaning and argument structure of the particle plus verb combination. We also have to ensure that the given simplex verb obligatorily occurs in the syntax in a PVC configuration: this is the other side of the CHECK_PRT-VERB feature coin. Moreover, the simplex verb requires a designated PRT form, which also has to be encoded in its lexical entry. The last line in (24) invokes a hard-wired template in XLE. This template concatenates the particle form it finds in the syntax with the simplex verb form in the PRED attribute in f-structure. The (joint) argument structure comes from the lexical entry of the simplex verb. In the template, PRT-FORM stands for the particle, # is the symbol connecting the two concatenated elements, %stem represents the simplex verb form and %FN encodes the value of the PRED (without its argument structure) indicated in the lexical entry of the simplex verb form. In the case of this concatenation analysis the following functional annotational pattern is necessary in c-structure. This representation, just like (21), puts the PRT in [Spec,VP], but the PRT can also occur in several different syntactic positions (with the same functional annotation).

(25)



The most important point here is that the PRT and the V are functional co-heads, and they are concatenated by the template. The single PRED principle is respected here, too, because the PRT only carries a FORM feature and the PRED feature (for the PRT plus V combination) is contributed by the V.

The c-structure and f-structure representations provided by our HunGram XLE analysis of (22) are given in Figure 2.



c-structure of (22)

f-structure of (22)

Figure 2

As regards the c-structure, the only point to be emphasized (because functional annotations are not indicated in the XLE display) is that there is an important functional annotational difference between the restriction and the concatenation analyses. Here the verb is a functional co-head, while in the restriction treatment the verb is annotated with a battery of functional equations containing the restriction operator itself. As for the f-structure representation, the crucial part is again in the PRED attribute. The PRT form and the verb are concatenated, which is indicated by the hash mark. Note, however, that this concatenation template is just a formal device necessitated by the current representational convention in XLE: the meaning of a word is simply given by repeating the actual form of the word in inverted commas. Naturally, in this construction type, this "meaning indication" has to contain (the combination of) both elements, hence the concatenation device. If the meaning of a predicate was given in a more "sophisticated" (or realistic) manner, then there would be no need for this purely formal device, because, for instance, in the example at hand in the c-structure we would have the actual forms *ki* and *mászott*, and in the PRED attribute in the f-structure the meaning specification would take a different form. On such a scenario, the lexical entry would be as is shown in (26), as opposed to (24).

(26) *mászik* V XLE (↑PRED) = 'get out of < (↑SUBJ) (↑OBL) >'
(↑CHECK _PRT-VERB) = +
(↑PRT-FORM) =c ki.

There is no concatenation template and the value of the PRED (without the argument structure) is given by an entirely different form, for simplicity's sake here we use an English word. From all this it follows that although we refer to this treatment of non-compositional PVCs as the concatenation approach, the really essential parts of the analysis are all the other aspects: two distinct lexical entries and the successful cross-referencing by the help of appropriate constraining equations and check-features. The design of XLE makes this alternative account available, but the current general practice (including ours) is along the concatenation template lines.

It is important to note that this PVC constrains the case form of it oblique argument: it has to be elative, which must be encoded in the lexical form of the verb. This constraint can be naturally associated with the PRT. Recall that in its compositional use, this PRT does not impose a similar formal constraint on its (own) oblique argument. This additional contrast lends further independent support to treating the compositional and non-compositional uses of *ki* 'out' differently.

4.3. The non-inflecting, case-assigning postpositional PVC

As regards the analysis of this PVC type, we are in a favourable position. From the perspective of this paper, the sole significant difference between this type and the non-inflecting adverbial type discussed in the previous section, or, more precisely, the only property this type has and the other lacks, is that in this type the PRT, even in its compositional use, strictly constrains the form of its oblique argument. Consider the following example.

(27) *János* *át* *lép-ett* *a* *kerítés-en.*
John.NOM across step-PAST.3SG the fence-on
'John stepped over the fence.'

The relevant lexical forms are as follows.

(28) *át* PRT XLE (↑PRED) = 'across < %ARG1 (↑OBL) >'
(↑OBL CASE) =c superessive.

(29) *lép* V XLE (↑PRED) = 'step < (↑SUBJ) (↑OBL) >'.

The example in (27) is directly comparable to that in (17). The two lexical entries in (28) and (29), again, are directly comparable to (18) and (19), respectively. The difference between the two PVC types is captured by the constraining equation in (28).

It is also noteworthy that in this PVC type, too, we find the same kinds of non-compositionality as in the former PVC type. Without any further elaboration, we invite the reader to verify that (30) is straightforwardly comparable to (22). Consequently, (30) allows and requires the same sort of analysis.

(30)	*János*	*át*	*lép*-*ett*	*a*	*problémá*-*n.*
	John.NOM	across	step-PAST.3SG	the	problem-on
	'John got over the problem.'				

5. Conclusion

In this paper, motivated by Forst-King-Laczkó (2010), we have proposed an LFG-XLE analysis of two types of non-inflecting spatial PVCs in Hungarian: the adverbial type and the postpositional case-assigning type. We covered both compositional and non-compositional uses. We proposed that, in the productive cases, syntactic predicate composition takes place via XLE's restriction operator. We treated the non-productive cases by employing appropriate specifications in the (distinct) lexical entries of verbs and particles in combination with XLE's concatenation template. We demonstrated that the case-assigning postpositional type has the sole additional property, as compared to the adverbial type, that in the compositional use the PRT also imposes a case constraint on the expression of its oblique argument.

We believe that it is one of the merits of this approach[12] that it covers both compositional and non-compositional cases in a principled manner, and it does so by compartmentalizing their treatment in a justifiable way. It is a further advantage that it employs an LFG-XLE apparatus which can handle the syntactic separability property of PVCs in a theoretically plausible fashion. The attested implementability of the account provides further support for its feasibility. It is to be noted, though, that in this paper, due to space limitations, we could not discuss derivational issues: as is well-known, particle plus verb combinations readily and productively serve as input to (lexical) derivational processes. We leave addressing such issues in the context of our analysis to another forum.

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[12] Naturally, these general advantageous properties have been "inherited" from Forst-King-Laczkó (2010).

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MANDARIN RESULTATIVE COMPOUNDS: A FAMILY OF LEXICAL CONSTRUCTIONS

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Abstract

This paper presents a novel analysis of certain Mandarin resultative compounds whose interpretations have provided a challenge to traditional assumptions regarding argument-function mapping. We argue that the peculiarities associated with these compounds point to the need to recognise constructional effects in grammar. In contrast to previous analyses, which make essentially *ad hoc* modifications to mapping theories in order to accommodate the facts, we propose that the various interpretations associated with a given compound arise from differing event structure templates, each with its own distinct mapping alignments. Mandarin resultative compounds, on this account, constitute a family of lexical constructions. Our analysis permits us to retain conventional mapping assumptions, while at the same time accounting for the specific characteristics associated with the relevant interpretations.

1 Introduction[1]

Mandarin resultative compounds have been and continue to be an area of extensive research in Chinese linguistics. This is partly because the interpretations of these compounds pose serious challenges for conventional assumptions of argument realisation: in some instances a single clausal combination of words involving a resultative compound can permit up to three different interpretations. Consider the compound *zhui-lei* 'chase-tired' in (1).[2]

(1) Taotao zhui-lei-le Youyou le (Y. Li 1995: 256)
 chase-tired-PERF CRS

a. 'Taotao chased Youyou and as a result, Youyou got tired.'
b. 'Taotao chased Youyou and as a result, Taotao got tired.'
c. 'Youyou chased Taotao and as a result, Youyou got tired.'

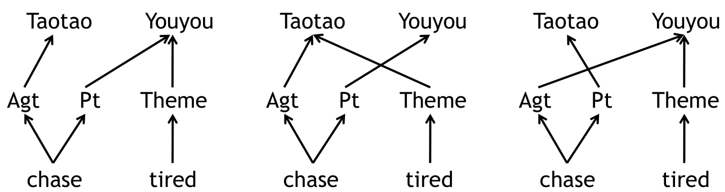

Figure 1: (left to right) argument mappings for (1a), (1b), and (1c).

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[1] We thank the participants of the LFG11 conference for their generous feedback.

[2] Following Li and Thompson (1981), we gloss sentence final *le* as Currently Relevant State (CRS).

On the interpretation in (1a), the SUBJ *Taotao* and the OBJ *Youyou* are respectively the agent and patient of 'chase'. At the same time, the OBJ is also understood as the theme of 'tired'. On the interpretation in (1b), while the SUBJ and OBJ are again respectively the agent and patient of 'chase', it is the SUBJ that is associated with the theme of 'tired'. On the last interpretation in (1c), the SUBJ is associated with the patient of 'chase', while the OBJ is understood as both the agent of 'chase' and the theme of 'tired'. Thus, the reading in (1c) seems to involve a non-canonical correspondence between semantic roles and syntactic arguments, violating standard mapping assumptions: the agent-like participant is realised as the OBJ, while the patient-like participant maps onto the SUBJ. Given this seemingly odd configuration, it is perhaps unsurprising that the unexpected interpretation in (1c) is the least readily accessible of the three available interpretations to native speakers. In response to data like (1c), many researchers have proposed analyses that involve the modification of standard mapping assumptions within various frameworks (e.g. Huang & Lin 1992, Y. Li 1995, Her 2007, Shibagaki 2009, *inter alia*).

In contrast, this paper adopts a different approach. Rather than alter standard correspondences between thematic roles and function assignments largely in *ad hoc* ways to simply re-describe the facts, we follow Goldberg and Jackendoff's (2004) analysis of English resultatives and propose treating Mandarin resultative compounds as a family of related constructions. On our analysis, each available interpretation of a compound is associated with a distinct event structure, which is realised as a V-V compound with its own distinct mapping alignments. We motivate each of the event structures and show how the patterns of argument-function assignment can be accounted for straightforwardly in terms of Dowty's (1991) proto-property theory and LFG's lexical mapping theory (LMT). By paying detailed attention to the lexical semantics of these complex predicates, we build conservatively on extant theories of argument linking, while grounding evident departures in event structure templates that characterise the family of Mandarin resultatives.

The remainder of this paper proceeds as follows. In section 2, we question if the preverbal NP should be treated as a SUBJ on interpretations such as (1c). We then present a recent LFG analysis of the phenomenon by Her (2007) as an exemplar of an analysis that modifies the mapping theory in order to account for data like (1c), while highlighting the shortcomings of this approach. Section 4 presents our construction-theoretic analysis, and section 5 concludes the paper.

2 Subjecthood of the preverbal NP

Before presenting any analyses, we must first ascertain if the preverbal NP is indeed a SUBJ on all interpretations of the compound. Whereas the question of SUBJ status of the preverbal NP on interpretations (1a-b) involving canonical mapping does not arise, the same cannot be said for the reading in (1c). In the former set, argument realisation patterns are consistent with common mapping expectations: given a predicate that selects for both a SUBJ and an OBJ, the more agentive participant is realised as SUBJ, while the more patientive participant maps onto the OBJ. In contrast, as noted earlier, the interpretation in (1c) appears to violate the semantic role-grammatical relation mapping as it has been developed in most familiar formal syntactic frameworks. As such, it would be legitimate to question the SUBJ status of the preverbal NP on such readings. For this, we appeal to subjecthood diagnostics developed in Tan (1991). In an extended study of subjects in Mandarin, Tan argues that reflexive binding, imperatives, and adjunct control can be used as diagnostics for grammatical subjecthood in Mandarin.[3] All three tests distinguish SUBJs from the other grammatical and discourse relations, while the first two tests also distinguish grammatical SUBJs from logical subjects. For ease of exposition, we shall refer to readings that appear to involve non-canonical argument-function mapping as 'inverted readings'.

Tan provides evidence showing that a reflexive can only be bound by the grammatical SUBJ in the same or dominating clause (Tan 1991: 26-27). If we apply this to the compound *zhui-lei* 'chase-tired', we see that the preverbal NP can indeed bind a reflexive on all three interpretations:

(2)	[na-zhi	gou]$_i$	zhui-lei-le	ziji$_i$	de	zhuren
	that-CL	dog	chase-tired-PERF	REFL	POSS	owner

a. 'That dog chased its owner, causing the owner to be tired.'
b. 'That dog got tired by chasing its owner.'
c. 'That dog got its owner tired, by its owner chasing it.'

Therefore, the reflexive test diagnoses the preverbal NP as the SUBJ of the clause, even for the inverted reading in (2c).

Imperatives provide another test for subjecthood: "The addressee of the imperative sentence in Chinese, like in other languages, has to be the subject, expressed or omitted" (Tan 1991: 30). Applying this diagnostic to the compound *zhui-lei*, the omitted addressee in (3), which otherwise would have to occur in the preverbal position, is the SUBJ.

(3)	∅	bie	zai	zhui-lei	waipo	le
	(you)	not	again	chase-tired	maternal.grandma	CRS

Mother to child:
a. 'Stop chasing grandma and making grandma tired.'
b. 'Stop making grandma tired by having grandma chase you.'

[3] Tan also provides possessor relativizing as another test for subjecthood. However, it turns out that this is independently unacceptable with all resultative compounds. The reason for this is beyond the scope of this paper.

Hence, according to this test, the preverbal NP is the SUBJ, even on the inverted reading in (3b).

Unlike the previous two tests, the adjunct control test does not uniquely pick out the grammatical SUBJ: "either subjecthood or agentiveness legitimates control" (ibid.). The judgements here are mixed: while all speakers allow an agent to control an adjunct, only some also allow the non-agentive preverbal NP to control the adjunct on the inverted reading. Consider (4):

(4)	na-ge	xiaohai	guyi	zhui-lei-le	waipo
	that-CL	child	intentionally	chase-tired-PERF	maternal.grandma

a. 'That child chased grandma with the intention of making her tired.'
b. ?'That child intentionally got grandma tired by having grandma chase him/her.'

For all speakers, the sentence in (4) is acceptable on the interpretation in (4a), where the agent *na-ge xiaohai* 'that child' controls the adjunct *guyi* 'intentionally'. However, only some find the sentence in (4) to be acceptable on the interpretation in (4b), where the controller of the adjunct (the child) is not the agent (it is grandma who is the chaser). Since the adjunct control test does not discriminate between a grammatical SUBJ and logical subject, the marginality of (4b) is not crucial: given that the preverbal NP is not the logical subject on the desired interpretation, the fact that some speakers allow the adjunct to be controlled by this NP implies that the preverbal NP must be a grammatical SUBJ on the interpretation in (4b).

Since all three tests converge on the same inference, we conclude that the preverbal NP of a resultative compound is the SUBJ of the clause on the inverted reading.

3 A recent LFG treatment: Her 2007

Having confirmed the SUBJ status of the preverbal NP, we now examine a recent treatment of the phenomenon within the LFG framework. Her (2007) proposes that resultative compounds are formed by the operation in (5), which binds the single thematic role of V_2 (V_{res}) with either of the two roles of V_1 (V_{caus}), as indicated by the hyphen. The rules in (5i-iv) pertain to compounds formed with a transitive V_1, while those in (v-vii) are relevant for compounds that have an intransitive V_2. Shaded variables represent arguments that have been suppressed in order to fulfil the ARGUMENT-FUNCTION BIUNIQUENESS PRINCIPLE. [caus] (cause) and [af] (affectee) are causative properties that are assigned to argument roles according to the principle in (6). There are two implicit assumptions in (6). First, only argument roles that originate from $V_{2/res}$ can receive [af] while only argument roles that originate from $V_{1/caus}$ can receive [caus]. Second, the two causative properties must be assigned together; one cannot be assigned in the absence of the other.

(5) Lexical rules for resultative compounding (Her 2007: 237)

$V_{caus}< x , y > + V_{res}< z > \rightarrow V_{caus}V_{res}< \alpha , \beta >$,

where $< \alpha , \beta > =$
(i) $< x , y\text{-}z >$
(ii) $< x[caus] , y\text{-}z[af] >$
(iii) $< x\text{-}z , y >$
(iv) $< y[caus] , x\text{-}z[af] >$

$V_{caus}< x > + V_{res}< z > \rightarrow V_{caus}V_{res}< \alpha , (\beta) >$,

where $< \alpha , (\beta) > =$
(v) $< x\text{-}z >$
(vi) $< x\text{-}z >$
(vii) $< x[caus] , z[af] >$

(6) Causativity Assignment in Resultative Compounding (Her 2007: 234)
An unsuppressed role from V_{res} receives [af] iff an unsuppressed role from V_{caus} exists to receive [caus].

To illustrate the interaction between the rules in (5) and the principle in (6), consider (5i-ii). In both argument structures, the second argument of $V_{1/caus}$ is bound with the sole argument of $V_{2/res}$ to form a composite role. On Her's interpretation, only one of the two composing roles in the composite role can receive syntactic assignment in order to fulfil argument-function biuniqueness. For this to happen, the argument role that does not receive function assignment is suppressed. In (5i), it is the argument originating from $V_{2/res}$ that is suppressed, while in (5ii) the argument originating from $V_{1/caus}$ is suppressed. In (5i), even though the *x* role that originates from $V_{1/caus}$ can receive [caus], the *z* role originating from $V_{2/res}$ cannot receive [af] as it has been suppressed. Since the two properties must be assigned together, the *x* role is not assigned [caus]. In (5ii) on the other hand, the *z* role originating from $V_{2/res}$ has not been suppressed and thus is eligible to receive the [af] assignment, as the condition in (6) is met.

The fact that not all of the resulting argument structures in (5) contain the causative properties [caus] and [af] reflects the intuition that not all resultative compounds are 'causative' (Wang 1958; Huang 1988; Gu 1992; Cheng and Huang 1994; Cheng et al. 1997; Y. Li 1995, 1999; *inter alia*). To use the example in (1), only the interpretations in (1a) and (1c) are considered causative, for semantic and syntactic reasons. Semantically, although the basic meanings of the three interpretations are always that *Taotao* chased *Youyou* and as a result one of them became tired, it is only on the interpretations in (1a) and (1c) that there is a strong sense in which *Taotao* is responsible for the state that *Youyou* is in. On the other hand, no such additional meaning of causation is associated with (1b). Syntactically, (1a) and (1c) but not (1b) are compatible with the *ba-* and *bei-* constructions, which have been argued to be diagnostic of causativity (Li and Thompson 1981; Huang 1992; Zou 1993; Y. Li 1995; Bender 2000; Ziegeler 2000; *inter alia*). On Her's analysis, only those compounds formed with argument structures containing [caus] and [af] bear these semantic and syntactic properties of causativity.

Like many other researchers who adapt the standard mapping theory of their adopted framework in order to account for the distribution of the data, Her makes modifications to the LMT. First, *only* patients/themes receive intrinsic classification (IC):

(7) Intrinsic classification of argument roles for functions (Her 2007: 228)
pt/th → [-r]

Second, mapping follows the UNIFIED MAPPING PRINCIPLE (UMP) in (8), which applies to all syntactic functions alike.

(8) Unified Mapping Principle (Her 2007: 229)
Map each argument role, from the most prominent to the least, onto the highest compatible function (CF) available. (A function is compatible iff it is not linked to a role.)

These changes allow him to account for the various interpretations associated with resultative compounds, including, crucially, the inverse readings. For instance, consider the sentence in (9), which has the inverse reading: even though the eater is more agentive than the eatee, the eatee is realised as SUBJ.

(9)	zhe	zhong	yao	hui	chi-si	ni	(Her 2007: 224)
	this	kind	drug	will	eat-dead	you	

'Eating this kind of drug will kill you.'

Her shows that the acceptability of (9) is predicted by (5iv) and the modified LMT:

(10)	(5iv):	<	y[caus] ,	x-z[af]	>	(*y* = 'drug', *z* = 'you')
	IC		[-r]	[-r]		
	CF		S/O	S/O		
	UMP		S	O		

Since *y*, originally the second argument of *chi* 'eat', and *z*, the sole argument of *si* 'dead', both represent patient/theme roles, both arguments receive the intrinsic classification [-r] in accordance with (7). Given the feature decomposition of functions in LFG, both arguments are compatible with either SUBJ or OBJ. The inverse mapping results from the assignment of the causative property roles. Her writes:

> It has been well-established since Dowty (1991) that [caus] is a prototypical property associated with the AGENT role and [af] is associated with the prototypical PATIENT and that the former is more prominent than the latter. (Her 2007: 235)

According to the UMP then, the argument associated with [caus] takes precedence in mapping onto the highest compatible function. Therefore, *yao* 'drug' is realised as the SUBJ, while *ni* 'you' maps onto the OBJ, giving the mapping that is associated with the inverse reading.

Even though the analysis put forth by Her provides an explanation for the otherwise unexpected inverse reading, it is not without its problems. First, Shibagaki (2009) points out that Her's analysis incorrectly predicts (11) to be grammatical.

(11)	*ni	hui	chi-si	zhe	zhong	yao	(Shibagaki 2009: 6)
	you	will	eat-dead	this	kind	drug	
	Intended: You will die from eating this kind of drug.						

(12)	(5iii)	<	x-z	, y	>	(x = 'you', y = 'drug')
	IC			[-r]		
	CF		S/O/...	S/O		
	UMP		S	O		

Given (5iii), (11) should be well-formed, as shown in (12). *z*, which represents the sole argument of 'dead', has been suppressed, and since *x* represents the agent of 'eat', it does not receive any intrinsic classification according to (7). On the other hand, *y*, as the theme of 'eat', is assigned [-r]. Since agents are more prominent than themes, the UMP maps *x* onto the SUBJ and *y* onto the OBJ, predicting incorrectly that the sentence in (11) is grammatical.[4]

Furthermore, in spite of his invocation of Dowty in the quote above, Her's analysis effectively factors causativity out of Dowty's proto-property theory: if [caus] is indeed a prototypical property of AGENT and [af] that of PATIENT, then should it not be the case that the arguments that have been assigned [caus] and [af] be treated as AGENT and PATIENT respectively? This is evidently not the case in (10), where *y[caus]* is treated as a theme and receives the intrinsic classification [-r].

More broadly viewed, analyses, such as Her's, that modify standard mapping assumptions give the appearance of being largely *ad hoc* solutions to attested deviations from predictions associated with the original

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[4] It is worth pointing out here that even if we assumed the intransitive use of *chi* 'eat', (5vii) would also incorrectly predict (12) to be grammatical. The relevance of this point will become clear in section 4.3.

formulation. For instance, the consequences of Her's modifications to the LMT are unclear with regard to the analyses of other phenomena in other languages. Clearly, if more conservative assumptions about mapping can be maintained in the face of these challenging data, this is to be preferred.

4 A construction-theoretic analysis

Like Her, other analyses that modify the mapping theory of their favoured framework do so in order to accommodate the rather extraordinary inverse reading (e.g. Huang & Lin 1992, Y. Li 1995, Shibagaki 2009, *inter alia*). Rather than alter standard correspondences between thematic roles and function assignments, reflected in the basic LFG mapping operations, we argue that this peculiarity calls for the need to recognise constructional effects in grammar. Following Goldberg and Jackendoff's (2004) analysis of English resultatives, we propose treating Mandarin resultative compounds as a family of related constructions. As will become apparent, positing distinct constructions permits us to maintain conventional mapping assumptions, even for the inverse reading, while at the same time accounting for the specific characteristics associated with each interpretation. To do this, we first need to pay greater attention to the lexical semantics of these complex predicates.

4.1 Causativity

Let us begin by considering the simple verbs that combine to form a compound. Recall that the example in (1) contains the resultative compound *zhui-lei* 'chase-tired'. (13-14) illustrate the prototypical uses of each component verb: *zhui* 'chase' is a transitive verb, while *lei* is intransitive.

(13) Taotao zhui-le Youyou
chase-PERF
'Taotao chased Youyou.'

(14) Taotao lei-le
tired-PERF
'Taotao has become tired.'

It is important to note that between the two verbs, only *lei* 'tired' can be used causatively as well:

(15) *Taotao zhui-le Youyou (Zhangsan)
chase-PERF
Intended: Taotao caused Youyou to chase (Zhangsan).

(16) zhe-jian shi lei-le bu shao ren (Wang 2010: 138)
this-CL matter tired-PERF NEG few people
'This matter caused quite a few people to become tired.'

The two uses of *lei* 'tired' in (14) and (16) thus constitute an inchoative-causative alternation, such that the SUBJ of the inchoative occurs as the OBJ of the causative when an external causer argument is introduced as the SUBJ. Using more or less standard notation, the lexical semantics of the two uses of *lei* 'tired' can be represented as in (17), where the difference between the two lies in the introduction of the semantic predicate CAUSE and a causer argument in the causative use of the verb.

(17) a. Inchoative *lei* 'tired': [BECOME **tired'**(*x*)]
b. Causative *lei* 'tired': [*x* CAUSE [BECOME **tired'**(*y*)]]

In contrast, since *zhui* 'chase' is simply an activity predicate, its lexical semantic representation is (18):

(18) *zhui* 'chase': [**chase'**(*x, y*)]

Unlike the non-causative use of *lei* 'tired', the lexical semantic representation of *zhui* 'chase' does not contain BECOME, i.e. it does not have the representation of an achievement/accomplishment predicate. This is because unlike *lei* 'tired', *zhui* 'chase' is not a telic or change-of-state predicate. Independent evidence for the aktionsart class of the two predicates can be adduced from the placement of durational phrases encoded as NPs. In Mandarin, durational phrases can either occur preverbally or postverbally. Tan (1991: 153-159) shows that their preverbal placement is only permitted with telic predicates. This is illustrated in the contrast between (19) and (20).

(19) John yi xiaoshi jiu xie-wan-le yi feng xin(Tan 1991: 155)
one hour only write-finish-PERF one CL letter
'John wrote a letter in only one hour.'

(20) John (*yi xiaoshi jiu) tui-le che (Tan 1991: 158)
one hour only push-PERF cart
'John pushed the cart (*in an hour).'

(19) contains the phase compound *xie-wan* 'write-finish', which indicates the completion of the action. As such, *xie-wan* 'write-finish' is necessarily a telic predicate. Since it is a telic predicate, the preverbal placement of the durational phrase is permitted. On the other hand, the activity predicate *tui* 'push' does not have an inherent end point and is not a telic predicate. As (20) shows, a durational phrase cannot occur before the activity predicate.

Returning to our example *zhui-lei* 'chase-tired', (21-22) show that while *lei* 'tired' permits a preverbal durational phrase, the same is not true for *zhui* 'chase'.

(21)

Taotao	yi	xiaoshi	jiu	lei-le
	one	hour	only	tired-PERF

'Taotao became tired in only one hour.'

(22)

Taotao	(*yi	xiaoshi	jiu)	zhui-le	Youyou
	one	hour	only	chase-PERF	

'Taotao chased Youyou (*in only one hour).'

Therefore, the placement of durational phrases confirms the hypothesis that while *lei* 'tired' is a change-of-state predicate, *zhui* 'chase' is not.

Given these observations regarding the aktionsart class of the two verbs, and the fact that only *lei* 'tired' can be causativised, we hypothesize that only predicate structures that are headed by a change-of-state predicate can be causativised. This can be represented as in (23):

(23) Causative formation
[*x* CAUSE [BECOME **pred'**(*y*)...]]

According to (23), causativisation is a process that introduces, by way of the semantic predicate CAUSE, a causer argument to an event structure headed by a change-of-state predicate.

4.2 Complex event structure

Having considered the lexical semantic properties of simple verbs, we now turn our focus back to compounds. Since a resultative compound is formed by the concatenation of two independent verbs, this entails that the event structure of the complex predicate is composed of the event structures associated with the two simple verbs. On the other hand, this raises the possibility that resultative compounds may be associated with distinct composite event structures: the event structures of the combining predicates may display different relations to one another. In fact, semantic analyses of English resultatives have proposed that there are essentially two types of event structures for resultatives, shown in (24):

(24) a. [[*x* DO-SOMETHING] CAUSE [*y* BECOME STATE]]
b. [[*y* BECOME STATE] BY [*x* DO-SOMETHING]]
(adapted from Levin and Rappaport Hovav 1995: 75-83)

(24a) represents a complex event structure in which the two subevents are related by the semantic predicate CAUSE: the event denoted by the activity predicate causes the second event. On the other hand, (24b) involves an 'adjunct interpretation' of the event denoted by the activity predicate, which is the event BY which the change-of-state occurs (Dowty 1979, Jackendoff 1990, Goldberg 1995, Levin and Rappaport-Hovav 1995). The structures in (24) then provide us with different means of relating the two events denoted by the two verbs that constitute a Mandarin resultative compound. We argue that both are relevant for Mandarin resultative compounds, and show that it is possible to remain faithful to standard mapping assumptions, even for the inverse reading, by assuming an 'adjunct interpretation' for some resultatives, as has been proposed for English.

Recall the example in (1), repeated here for the readers' convenience.

(1)	Taotao	zhui-lei-le	Youyou	le	(Y. Li 1995: 256)
		chase-tired-PERF		CRS	

a. 'Taotao chased Youyou and as a result, Youyou got tired.'
b. 'Taotao chased Youyou and as a result, Taotao got tired.'
c. 'Youyou chased Taotao and as a result, Youyou got tired.'

As pointed out earlier, it has been noted in the literature that unlike (1b), (1a) and (1c) involve an additional meaning of causation. In particular, Y. Li's characterisation of (1c) is that "the sentence means that by behaving in certain ways (e.g., not letting *Youyou* catch him), *Taotao* was responsible for *Youyou*'s becoming tired" (Y. Li 1995: 256-266). In other words, *Taotao* is the cause for *Youyou*'s becoming tired, suggesting that *lei* 'tired' is being used causatively here, rather than as an inchoative. Thus, the structure in (25) must be part of the event structure of (1c). For the sake of convenience, we have abbreviated the two names.

(25) [*T* CAUSE [BECOME **tired'**(*Y*)]]

Assuming an 'adjunct interpretation' for (1c), we can represent the event structure of the resultative event as in (26):[5]

[5] Given the two ways of relating two events presented in (24), (i) is a logical alternative for the event structure representation of (1c).

(i) [[**chase'**(*Y, T*)] CAUSE [*T* CAUSE [BECOME **tired'**(*Y*)]]]

We have not encountered in the literature predicate decompositions such as (i), which involves the embedding of one CAUSE immediately under another. While the possibility of this is worth looking into, we will not pursue this issue here, and simply assume that predicate decompositions do not permit the embedding of one CAUSE directly under another.

(26) [[*T* CAUSE [BECOME **tired'**(*Y*)]] BY [**chase'**(*Y, T*)]]

The event structure in (26) can be paraphrased as 'Taotao caused Youyou to become tired by way of Youyou's chasing Taotao', which coincides with Y. Li's intuitions regarding the meaning of the clause. Not only does the event structure reflect the intended interpretation of the clause, it also allows us to account straightforwardly for the argument-function mapping associated with the inverse reading in terms of Dowty's (1991) proto-property theory and the LMT: even though *Taotao* is the theme of 'chase', s/he is also a causer in (26). As correctly pointed out by Her, being a causer is a prototypical property of agents. On the other hand, *Youyou*, despite being the agent of 'chase', is also a causally affected argument — a prototypical property of patients. Therefore, in the calculation of proto-properties, *Taotao* is the proto-agent, while *Youyou* is the proto-patient. These attributions of proto-property roles to the arguments in turn determine intrinsic classifications: the proto-agent is assigned [-o], while the proto-patient is assigned [-r] (Ackerman 1992; Ackerman and Moore 1999, 2001; Joshi 1993; Zaenan 1993). Once the intrinsic classifications are established, standard LMT applies to give the correct argument-function assignments: since *Taotao* is assigned [-o] and is the proto-agent/logical subject, it maps onto SUBJ, leaving *Youyou* to map onto OBJ. Therefore, by paying due attention to the intricate lexical semantics involved, the event structure in (26) permits us to arrive at the argument-function mapping that characterises the inverse reading, without having to modify existing mapping mechanisms. Furthermore, unlike Her, we do not factor causativity out of proto-properties: indeed, causation plays a crucial role in our analysis by ensuring the correct assignment of proto-properties and its consequences for subsequent argument-function mapping.

When *lei* 'tired' is not used causatively, we have the event structure in (27), which is responsible for the interpretation in (1b).

(27) [[BECOME **tired'**(*T*)] BY [**chase'**(*T, Y*)]]

(27) can be paraphrased as 'Taotao became tired by way of Taotao's chasing Youyou', which is precisely the state of affairs in the interpretation in (1b). Here, *Youyou*, as the theme of 'chase' possesses only proto-patientive properties, whereas *Taotao*, despite being the theme of 'tired', is also the agent of 'chase', and therefore possesses some proto-agentive properties. Hence, *Taotao* is the proto-agent and is assigned [-o], while *Youyou* is the proto-patient and is assigned [-r]. Once again, standard LMT procedures will ensure that *Taotao* maps onto the SUBJ, while *Youyou* maps onto the OBJ, giving us the correct argument-function assignments.

We now turn our attention to the interpretation in (1a). Now, it is possible to derive the state of affairs associated with this interpretation simply by switching the identity of the argument of [BECOME **tired'**( )] in (27). That is, the event structure for (1a) could be represented as in (28):

(28) [[BECOME **tired'**(*Y*)] BY [**chase'**(*T, Y*)]]

On this analysis, the difference between the interpretations in (1a) and (1b) is a superficial one that lies merely in the identity of the argument of the 'become tired' event. On the other hand, one could also appeal to the event structure in (24a), which depicts a different relationship between the two events. On this latter analysis, the interpretation in (1a) has the event structure in (28'), which can be paraphrased as 'Taotao's chasing Youyou caused Youyou to become tired':[6]

(28') [[**chase'**(*T, Y*)] CAUSE [BECOME **tired'**(*Y*)]]

Unlike (28), (28') suggests a more fundamental difference between the interpretations in (1a) and (1b) that goes beyond simply the identity of the argument of the 'become tired' event: the two interpretations relate the two sub-events in different manners. In both (28) and (28'), *Taotao* is the proto-agent, while *Youyou* is the proto-patient. Therefore, both event structures provide us with the argument-function mappings required for (1b). How then can we decide between these two alternatives?

Now, recall that unlike (1b), (1a) and (1c) involve an additional meaning of causation. This implies that the semantic difference between (1a) and (1b) cannot merely be an issue of the identity of a variable. Thus, if we accept that (27) is the correct event structure for (1b), then selecting (28') as the event structure representation for (1a) provides a transparent way of stating this semantic difference. The welcome consequence of this analysis is that we are able to capture, with our representations, the intuition that, unlike (1b), (1a) and (1c) involve an additional meaning of causation: while the event structures for (1a) and (1c) (i.e. (28') and (26) respectively) contain the semantic predicate CAUSE, the event structure for (1b) in (27) does not. In this way, besides providing the bases for the correct argument-function assignments, the event structures that we have posited also directly reflect the semantics associated with each of the interpretations.

To summarise, each of the interpretations of (1) has a distinct event structure. Each event structure is independently associated with a V-V compound, forming three distinct lexical constructions, each with its own mapping alignments. Yet, all three event structures comprise of essentially the same independently motivated parts, reflecting the basic construction-

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[6] Notice in fact, that if we changed the identity of the argument of [BECOME **tired'**( )] in (28'), we would arrive at the state of affairs associated with the interpretation in (1b).

theoretic perspective that independently motivated constructions present in a grammatical system can be re-used in different ways for different purposes. In the case of Mandarin resultative compounds, the simple event structures associated with two independent verbs can be concatenated in different ways, giving rise to different interpretations of the same compound.

4.3 The puzzle of *chi-si* 'eat-dead'

Let us now consider if our proposal can account for the ungrammaticality of (11), which Shibagaki observed is incorrectly predicted by Her to be grammatical. The relevance of this example is striking when considered in the context of (9): both (9) and (11) contain the compound *chi-si* 'eat-dead', yet why is it that (9) is grammatical, whereas (11) is ungrammatical? Given conventional mapping assumptions, we would expect (11), rather than (9), to be grammatical. We repeat the examples for the readers' convenience.

(9) zhe zhong yao hui chi-si ni (Her 2007: 224)
this kind drug will eat-dead you
'Eating this kind of drug will kill you.'

(11) *ni hui chi-si zhe zhong yao (Shibagaki 2009: 6)
you will eat-dead this kind drug
Intended: You will die from eating this kind of drug.

The ungrammaticality of (11) is perhaps even more surprising given the grammaticality of (29), also involving the compound *chi-si* 'eat-dead'. Like (11), the eater is realised as the SUBJ in (29). Yet, in the absence of an OBJ, (29) is grammatical, in contrast to (11).

(29) Taotao chi-si-le
eat-dead-PERF
'Taotao died from eating.'

Just as we had to be sensitive to the lexical semantic properties of the individual verbs that comprise the compound *zhui-lei* 'chase-tired', here too the properties of the simple verbs appear to matter crucially. In particular, we suggest that *chi* 'eat' in the compound *chi-si* 'eat-dead' is being used intransitively, as exemplified in the mini-dialogue in (30).

(30) Q: ni chi-le mei?
you eat-PERF NEG
'Have you eaten?'

A: chi-le
eat-PERF
'(Yes, I) have eaten.'

Like its counterpart in English, *chi* 'eat' can be used intransitively without any special morphological marking. If we assume that it is the intransitive *chi* 'eat' that is participating in the compound *chi-si* 'eat-dead', then the reason for the grammaticality of (29) on the one hand and the ungrammaticality of (11) on the other hand is straightforward: since both *chi* 'eat' and *si* 'dead' are intransitive, the OBJ in (11) does not correspond to a semantic participant of either of the component verbs that make up the compound. In other words, just like its component verbs, the compound *chi-si* 'eat-dead' is intransitive, thus rendering (29) grammatical while (11) is ungrammatical.

Given the two possible ways of relating the simple events that comprise a resultative event structure, there are two logical event structure representations for (29), shown in (31).

(31) a. [[**eat'**(*T*)] CAUSE [BECOME **dead'**(*T*)]]
b. [[BECOME **dead'**(*T*)] BY [**eat'**(*T*)]]

How do we decide between the two options? To answer this, we need look no further than (9). Since *chi-si* 'eat-dead' is, as we have argued, an intransitive compound, and presumably requires its sole semantic participant to be animate, what licenses the presence of *zhe zhong yao* 'this kind of drug'? Just as the inverse reading in (1c) involved a causer interpretation of the SUBJ, the same is true for the inverse reading in (9): *zhe zhong yao* 'this kind of drug' is interpreted as the cause of your becoming dead should you eat it. Therefore, *zhe zhong yao* 'this kind of drug' is an external cause argument introduced by the process of causativisation. Given the formulation of causative formation in (23), repeated below, it is constrained to only operate on event structures that are headed by a change-of-state predicate. This means that of the two representations in (31), only (31b) can be causativised in order to accommodate the inverse reading in (9). Hence, we propose that (31b) is the proper representation for (29), and that the event structure for the inverse reading in (9) is that in (32).

(23) Causative formation
[*x* CAUSE [BECOME **pred'**(*y*)...]]

(32) [*drug* CAUSE [[BECOME **dead'**(*you*)] BY [**eat'**(*you*)]]]

Unlike the inverse reading of *zhui-lei* 'chase-tired' in (1c), where a causativised simple verb was used in a resultative compound, the inverse reading of *chi-si* 'eat-dead' in (9) involves the causativisation of the entire compound. We see therefore that the basic elements of our analysis apply in a principled manner to account for the distribution of *chi-si* 'eat-dead'.

5 Concluding remarks

In this paper we have presented an analysis of Mandarin resultative compounds that extends to cover multiple readings and certain puzzling grammaticality distributions associated with them. An important difference between our analysis and previous approaches such as Her (2007) is that by paying close attention to lexical semantics, we build conservatively on extant theories of argument linking, while grounding the evident departures in event structure templates that characterise the family of resultative compounds. The uniqueness of each event structure template in turn motivates the need to recognise constructional effects in grammar. In the case of Mandarin resultatives, these constructional effects are located in semantics, rather than form, since the same V-V compound can be associated with more than one event structure. By grounding the constructional effects in the semantics, we make the prediction that besides being encoded as V-V compounds, there might be other possible encodings of these event structure templates. Indeed, Mandarin also contains phrasal resultatives that parallel the resultative compounds. For instance, (33) shows that the three-way ambiguity exhibited by some resultative compounds can also be found with phrasal resultatives.

(33) zhe haizi zhui-de wo zhi chuanqi (Huang 2006: 10)
this child chase-de me straight pant

a. 'This child chased me to the point that he panted unceasingly.'
b. 'This child chased me to the point that I panted unceasingly.'
c. 'This child caused me to chase to the point of (me) panting unceasingly.'

On our analysis, the three interpretations of the phrasal resultative in (33) share the same event structure templates that are responsible for the three interpretations of the resultative compound in (1) and differ only in the formal encoding of those semantics. By focusing on semantics, rather than form, we see the potential of making comparisons of and generalisations across cross-linguistic resultative constructions, while retaining the basic distinction between lexical and phrasal constructions.

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NORWEGIAN POSSESSIVE PRONOUNS: PHRASES, WORDS OR SUFFIXES?

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Abstract

In Norwegian, possessive pronouns can be prenominal (***min*** *bil* 'my car') or postnominal (*bilen* ***min*** 'car.DEF my'). In the Principles and Parameters literature, the standard assumption is that possessive pronouns are prenominal in underlying structure, while the postnominal position is a result of N-movement. This paper takes a different approach. The focus is the grammatical differences between the positions. They motivate an analysis in which prenominal and postnominal possessive pronouns do not realize one underlying position. Lexical Functional Grammar makes it possible to implement this kind of analysis in a simple way. The basic properties of prenominal and postnominal possessive pronouns follow from the theory of strong and weak pronouns. There is evidence, however, that the dialect of Western Oslo has a group of suffixal possessives.

1. Introduction[1]

Norwegian possessive pronouns can be prenominal or postnominal, as shown in (1)—(2).

(1) **min** bil
my car
(2) bilen **min**
car.DEF my

The noun has indefinite morphology with prenominal possessives, and definite morphology with postnominal possessives. This is a general rule for all possessive expressions, as shown in (3)—(4).

(3) Johns bil / *bilen
John.GEN car / car.DEF
'John's car'
(4) bilen / *bil til John
car.DEF / car of John
'John's car'

[1] For input and discussion, I would like to thank the audience at the LFG11 conference, especially Joan Bresnan and Ash Asudeh. Thanks also to the anonymous reviewers, the proceedings editors, and to my colleagues Jan Terje Faarlund, Kjell Johan Sæbø, Andreas Sveen, Hans-Olav Enger, and Marianne Hobæk Haff.

Some possessive pronouns agree with the noun in number and gender, like *min* 'my' in (1)—(2), while others only have one form, for example *hans* 'his'. Some nominal phrases only allow a prenominal possessive (Lødrup forthcoming), for example when the noun lacks a definite form, as in (5), when the noun is silent, as in (6), and in many fixed expressions, such as (7).

(5) **hans** pårørende
his relatives
(6) **våre** fattige
our poor
(7) på **min** måte
in my way

In spoken Norwegian, the postnominal possessive pronoun is the more frequent option. In the written language, there is a tendency that prenominal possessives are more frequent, especially in non-colloquial style.

There are some dialectal differences within Norwegian concerning the data to be discussed. The focus here will be on urban east Norwegian. It could also be noted that Norwegian differs from the other Mainland Scandinavian languages. Danish and Standard Swedish only have prenominal possessives (but some Swedish dialects also have postnominal possessives). Faroese and Icelandic have both prenominal and postnominal possessive pronouns (Delsing 1993:155—58, Sigurðsson 2006).

Scandinavian nominal phrases have been an important research topic the last two decades.[2] In the Principles and Parameters literature, the standard treatment of possessive pronouns is the following: In underlying structure, possessive pronouns are prenominal. Postnominal possessives are a result of N-movement upwards in the syntactic tree (Taraldsen 1990, Delsing 1993:149—75, Vangsnes 1999:124—27, Julien 2005:159—95). Prenominal possessives move to the left to their final position (see e.g. Julien 2005:201—4).

This paper takes a different approach. The focus is the grammatical differences between the two positions, which have never received much attention in the literature. They motivate an analysis in which prenominal and postnominal possessive pronouns do not realize one underlying position. Prenominal and postnominal possessives can be treated as strong and weak pronouns. This is the topic of section 2 and 3. Section 4 discusses a mismatch between topicality and linear position shown by Norwegian possessives. Section 5 takes up the question if (some) postnominal possessives could be suffixes.

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[2] For the Scandinavian Principles and Parameters tradition, see Taraldsen (1990), Delsing (1993), Vangsnes (1999), Julien (2005). For alternatives, see Börjars (1998), Hankamer and Mikkelsen (2002), Börjars and Harries (2008).

2. Strong and weak pronouns
2.1 General

The distinction between strong and weak pronouns is a traditional one (Kayne 1975, Cardinaletti 1998, Cardinaletti and Starke 1999, Bresnan 2001a). This distinction is also relevant to possessive pronouns. Cardinaletti (1998) shows that Italian has strong and weak possessive pronouns. The strong ones are postnominal, while the weak ones are prenominal. It will be shown that Norwegian also has strong and weak possessive pronouns, but their distribution is different: The strong ones are prenominal, while the weak ones are postnominal. Section 2.2 discusses the properties that distinguish strong and weak possessives in Norwegian. The term weak will be taken to mean 'not strong' (Cardinaletti's 'deficient').

2.2 Properties of strong and weak possessive pronouns
2.2.1 Position

The prenominal possessive precedes prenominal modifiers, as in example (8). It can only be preceded by a universal quantifier. The postnominal possessive follows the noun, and there can be no linguistic material between the noun and the possessive, not even a complement that is selected by the noun. An example is (9).

(8) **min** nye analyse av diktet
my new analysis of poem.DEF
(9) den nye analysen **min** av diktet / * av diktet **min**
the new analysis.DEF my of poem.DEF / of poem.DEF my
'my new analysis of the poem'

2.2.2 Phrasality

A prenominal possessive can in some cases be a part of a possessive phrase, while a postnominal possessive cannot. This will be shown using examples with coordination and adjunction, and the genitive marker *sin*.

— Coordination: The prenominal possessive can be coordinated, while the postnominal possessive cannot, as shown in (10).

(10) [**mitt** og **hennes**] hus — *huset [**mitt** og **hennes**]
my and her house — house.DEF my and her
'my and her house'

— Adjunction: Certain adverbs can adjoin to prenominal possessives, but not to postnominal possessives. In (11), a focus adverb is adjoined.

(11) Dette er bare **mitt** hus — *huset bare **mitt.**
this is only my house — house.DEF only my
'This house is mine only'

— The genitive marker *sin*: The genitive marker *sin* is an alternative to the bound *-s*. Colloquially, this marker can be used with a pronoun, but only prenominally, as shown in (12).

(12) **han sin** bil — *bilen **han sin**
he GEN car — car.DEF he GEN
'his car'

2.2.3 Stress and reference

The Norwegian literature mentions contrast and stress as important factors for choosing a prenominal possessive pronoun (e.g. Western 1921:486—87, Faarlund et al. 1997:265). Knudsen (1967:55) says that when the possessive is postnominal, it is usually unstressed, and the possessive relation is backgrounded; it is taken to be given information or self evident.

In colloquial Norwegian, a topical possessive is normally postnominal. A prenominal topical possessive is usually very strange, as shown in (13).

(13) John var rasende. — Noen hadde stjålet bilen **hans** / ??**hans** bil.
John was furious — somebody had stolen car.DEF his / his car
'John was furious. Somebody had stolen his car.'

This is not equally clear in writing, however. It should also be noted that a prenominal possessive is the only option in some cases (see (5)—(7) above).

It is possible to stress a postnominal possessive, as in (14).

(14) Først ble bilen **MIN** stjålet, og nå er bilen **DIN** stjålet.
first was car.DEF my stolen and now is car.DEF your stolen
'First, MY car was stolen, and now, YOUR car is stolen.'

This option is not necessarily an argument that the possessive is strong. Cardinaletti and Starke (1999) show that uncontroversial weak forms can be stressed under certain circumstances, giving French examples like (15). Their generalization is that this is possible if the pronouns refer to something that is already prominent in the discourse (Cardinaletti and Starke 1999:153—4).

(15) A: Je te casserai la gueule!
I you break.FUTURE the face
'I will break your face!'
B: Ah ouais? Tu veux dire que je TE casserai la gueule!
oh yeah? you will say that I YOU break.FUTURE the face
'Oh yeah? What you want to say is that I will break YOUR face!'

2.2.4 Morphological forms

The sets of prenominal and postnominal possessives are not identical. Second person singular *din* can be realized with initial *r-* in colloquial speech, but only postnominally, as shown in (16). This does not follow from regular phonological rules (Kristoffersen 2000:333—335). Furthermore, the third person singular neuter *dets* does not occur postnominally, as shown in (17).

(16) boka **ri** — ***ri** bok
book.DEF your — your book
'your book'
(17) **dets** faste plass — *den faste plassen **dets**
its regular place — the regular place.DEF its
'its regular place'

A more radical difference between the sets of prenominal and postnominal forms can be found in the dialect of Western Oslo, which will be discussed in section 5.2.[3]

2.2.5 Elliptical and predicative forms

The weak possessive is never the only word in a nominal phrase. In elliptical phrases such as (18), the possessive is strong, as can be seen from the fact that a coordination is possible.

(18) (Hvem sitt hus er det ?) **Mitt** (og **hennes**) __
who GEN house is that my and her
'Whose house is that? Mine and hers.'

[3] Some dialects have postnominal possessives with different properties than urban east Norwegian. When a proper name is a possessor, some dialects allow, or require, it to be realized after the noun, preceded by a possessive pronoun, as in (i). This construction is mostly found in rural dialects (Julien 2005:141).
(i) katta **hennes** Kari (Julien 2005:142)
cat.DEF her Kari
'Kari's cat'

In predicate expressions, the possessive also has the properties of the strong form. (There is no special form for use without a noun, such as English *mine*.) Again, a coordination is possible, as in (19).

(19) Huset er **mitt** (og **hennes**).
house.DEF is my and her
'The house is mine and hers.'

3. Analysis
3.1. State of the art

The differences between prenominal and postnominal possessive pronouns have never received attention in the rich Scandinavian literature on noun phrase structure. It was mentioned above that Principles and Parameters analyses assume that possessive pronouns are prenominal in underlying structure, and that the postnominal ones are a result of N-movement upwards in the syntactic tree

The alternative option of generating the possessive pronoun in the postnominal position and moving it to the prenominal position has not been discussed. This analysis is assumed for Italian in Cardinaletti (1998), and motivated as clitic movement. This motivation cannot be transferred to Norwegian, which is different with respect to the clitic position. Clitic movement is movement upwards, as is all movement in Principles and Parameters theory. When the clitic position is the postnominal position, the movement required cannot be clitic movement.

The standard N-movement analysis of Norwegian is motivated by theory internal considerations of Principles and Parameters theory. Taraldsen (1990:423) points out that a postnominal possessive can bind a reflexive, as in (20), which requires that it c-commands the reflexive at some level of representation.

(20) beskrivelsen **hans**$_i$ av seg selv$_i$
description.DEF his of REFL SELF
'his description of himself'

However, Taraldsen also points out that a possessive PP can bind a reflexive, as in (21).

(21) beskrivelsen til Per$_i$ av seg selv$_i$
description.DEF of Per of REFL SELF
'Per's description of himself'

Taraldsen, like for example Julien (2005:145—46), assumes that the possessive PP is also prenominal in underlying structure. The motivation for this move is weaker, however, because a prenominal PP is ungrammatical. The binding facts in (20)—(21) should rather be taken as an argument for an approach to binding in which prominence is defined on the basis of grammatical relations. In Lexical Functional Grammar (LFG), both the possessive pronoun and the possessive PP have the grammatical relation POSS, which is high on the relational hierarchy.

Taraldsen (1990) also motivates N-movement with the problems that a base generated postnominal possessive would create for traditional X' theory. First, in a phrase like (20) above, base generation of the possessive would make it impossible to assume the expected X' constituent consisting of the noun head and the complement, but excluding the possessive. Second, a base generated postnominal possessive could not have the expected head position in a DP. These considerations do not carry over to LFG. First, a complement does not necessarily form a constituent with its head. Second, the head of the phrase with a postnominal possessive is not necessarily the possessive, as will be shown in section 3.2.

3.2. A weak pronoun analysis

The postnominal possessive pronoun is often a clitic, as pointed out already in Western (1921:486). However, it does not have to be a clitic, as shown in example (14) above. In this paper, the postnominal possessive is referred to as a weak pronoun, to stress the grammatical (as opposed to phonological) nature of the difference between prenominal and postnominal possessives. The central property of a weak pronoun is that it does not project a phrase, and this property is in principle independent of the question whether the weak pronoun is phonologically dependent on another word (following Toivonen (2003:41—50), see also Sells (2001:90—93)).

The structure of noun phrases with postnominal possessives will now be discussed. The proposal to be given is based upon insights from lexicalist work, especially Sells (2001) and Hankamer and Mikkelsen (2002). It is first necessary to consider the syntactic position of definite nouns, because postnominal possessives require definite morphology. Hankamer and Mikkelsen (2002) argue that definite morphology in Danish is assigned by a lexical rule that converts an N to a D. The phrase *bilen* 'car.DEF' is then simply a DP consisting of a D. For Swedish and Norwegian, Hankamer and Mikkelsen (2002) propose that the lexical class conversion is optional, because a definite determiner can co-occur with a definite noun (this is often called 'double definiteness'). The analysis of *den nye bilen* 'the new car.DEF' is then as in (22).

(22)
```
        DP
       / \
     D   NP
   den   / \
       AP  NP
       nye  |
            N
          bilen
```

The question is what the structure is when a postnominal possessive is added. A comparison to weak object pronouns is enlightening. Sells (2001:54) discusses the Swedish sentences (23)—(24).

(23) Anna såg den inte.
Anna saw it not
'Anna didn't see it.'
(24) Såg Anna den inte?
saw Anna it not
'Didn't Anna see it?'

Sells points out that while the verbs are in different positions, there is no evidence that the object pronouns are in different positions. Sells assumes that (23) is an IP with the object pronoun adjoined to I. This is not a morphological analysis; the verb and the pronoun are still two words. Sentence (24), on the other hand, is a CP with the finite verb in C. This means that I only dominates the pronoun in (24).

Consider examples (25)—(26) with postnominal possessives.

(25) den nye bilen **min**
the new car.DEF my
(26) bilen **min**
car.DEF my

A natural assumption would be that the postnominal possessive is adjoined to N in (25). In (26), on the other hand, the noun is in D, and N only dominates the possessive. The structures are as in (27) and (28).

(27)
```
        DP
       / \
     D   NP
   den   / \
     AP   NP
     nye   |
           N
          / \
        N  PronWeak
      bilen   min
```

```
(28)            DP
               / \
             D   NP
          bilen   |
                  N
                  |
             PronWeak
               min
```

The constituent structure (28) corresponds to the functional structure (29) (in which the feature DEFINITE-FORM reflects the morphological form of the noun, while DEFINITE is the standard definiteness feature that can have various sources).

```
(29) |POSS     |PRED 'PRO'                      ||
     |         |INDEX         | PERSON 1       |||
     |         |              | NUMBER SG      |||
     |         |CONCORD       | GENDER M       |||
     |         |              | NUMBER SG      |||
     |DEFINITE-FORM  +                          |
     |DEFINITE +                                |
     |INDEX        | GENDER M    |              |
     |             | PERSON 3    |              |
     |CONCORD      | GENDER M    |              |
     |             | NUMBER SG   |              |
     |PRED    'bil <(↑POSS)>'                   |
```

The f-structure (29) uses INDEX and CONCORD features as proposed in Wechsler and Zlatic (2000) and Zlatic (2000). This division gives a convenient way to state the fact that possessive pronouns both have features that account for their reference, and features that account for their agreement with the noun. For example, the form *min* 'my' is singular in that it refers to the speaker, but it is also singular in a different way, in that it agrees with a singular noun. The features of postnominal *min* 'my' are as in (30).[4]

[4] The features of a prenominal possessive pronoun are rather similar. One difference is that the prenominal possessive requires the absence of the definite suffix. Another difference is that a prenominal possessive pronoun has to induce definiteness (which is not necessary for a postnominal pronoun, because it requires a definite noun).

I assume that a prenominal possessive pronoun is in Spec DP. This assumption is not important here. Another possibility is that the prenominal possessive pronoun is in D. It cannot be a co-head of the N, however, because it has a PRED. In Strunk (2005), the prenominal possessive pronoun in Low Saxon is a D projecting a POSS in f-structure.

(30) min PronWeak
(↑ PRED) = 'PRO'
(↑ INDEX PERSON) = 1
(↑ INDEX NUMBER) = SG
(↑ CONCORD GENDER) = M
(↑ CONCORD NUMBER) = SG
(↑ DEFINITE-FORM) = c +

4. Interlude: A topicality mismatch

Studies of pronominal systems show that weak forms are used for topical information, while strong forms are used for focal information (Cardinaletti and Starke 1999, Bresnan 2001a). This is also true of Norwegian possessive pronouns. It was mentioned above that a topical prenominal possessive is generally unacceptable in colloquial Norwegian (see example (13) above). The point to be discussed in this section is that Norwegian possessive pronouns show a mismatch between their information structural status and their linear position.[5]

From a general point of view, the prenominal position is more prominent than the postnominal position, because it precedes the postnominal position and is higher in the syntactic tree. The expectation is therefore that the prenominal position is the position that will associate with other prominent features, such as topicality, givenness, definiteness, and animacy. This expectation has been shown to be correct for English possessive expressions. It has often been observed that the prenominal genitive is topical, while the postnominal possessive PP is not (see e.g. Taylor (1996:ch 8)). Rosenbach (2002) shows that topicality is among the features that contribute to realizing a possessive expression as a genitive. The corresponding situation in Norwegian has never been investigated (but see Baron (1996) on Danish). However, the broad picture seems to be comparable to English concerning the relation between the genitive and the possessive PP. For example, (31) with an indefinite genitive is not good, as compared to the text example (32) with a possessive PP.

(31) ??fordi de ikke likte en annen skurks favoritt-TV-serie
because they not liked an other crook's favorite TV series
'because they did not like another crook's favorite TV series'

(32) fordi de ikke likte favoritt-TV-serien til en annen skurk
because they not liked favorite TV series.DEF of an other crook
'because they did not like the favorite TV series of another crook'

[5] This was mentioned in Julien (2005:203 note 3). The situation seems to be basically the same in Faroese and Icelandic.

English, of course, gives no material for comparison when it comes to possessive pronouns. However, Italian possessive pronouns have the expected distribution with respect to information structural status. Cardinaletti (1998:19) shows that a postnominal possessive is focused in an example such as *la casa **sua*** 'the house his/her'. Spanish and Catalan are like Italian in this respect (Bernstein 2001).

We see, then, that Norwegian possessive pronouns violate general principles of topic distribution. This could be viewed as a constraint conflict. The central weak pronouns of Norwegian are positioned immediately following heads: possessive pronouns relative to the noun, and object pronouns relative to the finite verb. This constraint conflicts with information structural requirements in the case of possessive pronouns — unlike weak object pronouns, which get a position that is more topical than the regular object position (in sentences corresponding to (23)—(24) above).

5. A suffix analysis

5.1 General

It is impossible to discuss Norwegian possessive pronouns without taking up the question of whether a suffix analysis is possible. This idea has been mentioned in the Norwegian literature (Johannessen 1989:141, Hagen 2000:382, Trosterud 2003:66), but never really discussed. Two neighbor languages of Norwegian have both syntactic and suffixal possessives, namely Saami and Finnish (Toivonen 2000). It is well known that a clitic pronoun can develop into an affix. Trosterud (2003:66) mentions the possibility that Norwegian might be in the process of developing suffixal possessives.

With the suffix analysis, a possessive pronoun is an incorporated pronoun, i.e. "a bound morpheme that specifies a complete pronominal f-structure" (Bresnan 2001b:144). A possessive suffix constructs a POSS in f-structure, in the same way as verbal morphology constructs a SUBJ in pro-drop-languages. If *bilen **min*** 'car.DEF my' is a word, its features are as in (33).

(33) bilen-min
 (↑ POSS PRED) = 'PRO'
 (↑ POSS INDEX PERSON) = 1
 (↑ POSS INDEX NUMBER) = SG
 (↑ DEFINITE-FORM) = +
 (↑ DEFINITE) = +
 (↑ CONCORD NUMBER) = SG
 (↑ CONCORD GENDER) = M
 (↑ INDEX NUMBER) = SG
 (↑ INDEX PERSON) =3
 (↑ PRED) = 'bil<(↑ POSS)>'

The suffix analysis accounts for the binding properties of the possessive in the same way as the weak pronoun analysis. In both cases, there is a POSS in f-structure. POSS shares an INDEX with the anaphor in (20) above, repeated as (34). In (35) with a reflexive possessive, it shares an INDEX with the binder.

(34) beskrivelsen **hans**$_i$ av seg selv$_i$
description.DEF his of REFL SELF
'his description of himself'

(35) John$_i$ mistet klokka **si**$_i$
John lost watch.DEF REFL.POSS
'John lost his watch.'

One important difference from the weak pronoun analysis concerns the account of the form of the possessive. In traditional terms, some Norwegian possessive pronouns agree with the noun in number and gender. This agreement motivated the CONCORD features on the pronoun; see (29) and (30) above. However, POSS in (33) does not have CONCORD features. If the possessive is a suffix, its form is not constrained through agreement, instead it is selected by the inflectional class of the noun.

This idea that postnominal possessives are suffixes has never been discussed thoroughly. It can hardly be the whole truth for all Norwegian dialects. The rural dialects mentioned in note 3 with phrasal postnominal possessives cannot have this analysis, at least not for all postnominal possessives. On the other hand, it will be shown in section 5.2 that the Western Oslo dialect has evidence for a suffix analysis which is not found in other dialects. Before discussing Western Oslo, other varieties of urban east Norwegian will be discussed more generally.

It was mentioned above that the postnominal possessive can be stressed, as in example (14) above. This is not necessarily an argument against the suffix analysis. There is a tradition for distinguishing contrastive stress and contrastive accent (Bolinger 1961, Zribi-Hertz and Mbolatianavalona 1999:167), and postnominal possessives could be assumed to show the latter. Contrastive accent may conflict with word stress; Bolinger (1961:83) gives this example (my underlining):

(36) 'This whiskey,' said O'Reilly, sampling spirits that claimed to be from his homeland, 'was not <u>ex</u>ported from Ireland; it was <u>de</u>ported.'

One argument for the suffix analysis is that the possessive always follows the noun immediately. This rule has no exceptions. (The possessive PP, as in example (4) above, also follows the noun immediately, but this rule could be violated by a heavy PP.) The possessive does not show the 'promiscuous attachment' that is typical of clitics; this is a case of the first criterion for distinguishing clitics and affixes in Zwicky and Pullum (1983:503):

"Clitics can exhibit a low degree of selection with respect to their hosts, [note deleted] while affixes exhibit a high degree of selection with respect to their stems." (Zwicky and Pullum 1983:503)

On the other hand, two arguments speak against the suffix analysis.

First argument against the suffix analysis: The suffix analysis predicts that there can be no postnominal possessive without a realized noun. This prediction is almost correct. However, there is one elliptical construction which falsifies it; an example is (37). This ellipsis requires an antecedent that is realized close to it; it seems to be a case of gapping (Jackendoff 1971).

(37) den nye bilen **din** og den gamle __ **min**
the new car.DEF your and the old my
'your new car and my old one'

The possessive in (37) does not have the properties of prenominal possessives; for example, it cannot be phrasal. This means that the possessive in (37) is in the postnominal position, without a realized noun preceding it. This is an important argument against the suffix analysis.[6]

Second argument against the suffix analysis: A much used criterion for an affix is that it must be repeated on every conjunct in a coordinate structure (Miller 1992). For example, the definite suffix cannot be left out as in (38) when each conjunct is to be understood as definite. However, it is not necessary to repeat a postnominal possessive on every conjunct, as shown in (39).

(38) bilen og båten — *bil og båten
car.DEF and boat.DEF — car and boat.DEF
'the car and the boat'

(39) bilen (**min**) og båten **min**
car.DEF (my) and boat.DEF my
'my car and my boat'

---

[6] It might be objected that ellipsis can affect a part of a word in some cases (Booij 1985). A Norwegian example is (i).

(i) hvetebrød og -boller
wheat.bread and -buns

However, this kind of ellipsis seems to have different properties from the one in example (37). For example, it requires that the elided part is adjacent to the conjunction (Booij 1985:148).

It must be mentioned that there are established cases in which an affix does not have to be repeated on every conjunct. This phenomenon is called suspended affixation; the standard example is Turkish (see e.g. Kabak (2007), Broadwell (2008)). However, suspended affixation is a marked phenomenon, which is not productive in any other cases of affixation in Norwegian. The option shown in (39) must therefore be considered an argument against a suffix analysis.

It seems, then, that it is difficult to argue for a suffix analysis for urban east Norwegian in general.

5.2 The 'West side story'

There is more evidence for a suffix analysis in the dialect of the west side of Oslo,[7] which will be called Western Oslo. Much of what is written in the Bokmål standard reflects this dialect in relevant respects, but the written language will not be considered here.

An argument for a suffix analysis (mentioned in Johannessen 1989:141 and Trosterud 2003:66) is based upon the premise that Western Oslo has two grammatical genders, unlike most other Norwegian dialects, which have three (see Fretheim 1985, Hagen 2000:382, Enger 2004:133—34, Lødrup 2011). Grammatical gender is standardly given a definition based upon agreement (Corbett 1991). Most Norwegian dialects have separate masculine and feminine and neuter forms of certain quantifiers and determiners in the singular. Western Oslo does not have separate feminine forms of agreeing categories. The only forms that might be suspected to be feminine are the possessives *mi* (1st person singular), *di* (2nd person singular), and *si* (3rd person reflexive). In three gender dialects, these are regular weak or strong feminine forms. In Western Oslo, on the other hand, these forms can only be weak, and their distribution is easy to describe: they can and must follow one of the suffixes for the definite singular, namely *-a*. In other positions, for example in the prenominal position and the predicate position, *mi*, *di* and *si* are ungrammatical, as shown in (40)—(41). This means that the possessive in a phrase such as *boka* ***mi*** 'book.DEF my' is a feminine form in the three gender dialects, but not in Western Oslo.

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[7] What is called Western Oslo might be thought of as 'Standard Norwegian'. However, I am only interested in the speech of those who have this dialect as their first language (for example myself). Western Oslo is spreading and influencing other dialects; this is shown for the phenomena discussed here in Lødrup (2011).

	Western Oslo	Three gender dialects
(40)	**min**/***mi** bok	**mi**/***min** bok
	my/my book	*my/my book*
(41)	Denne boka er **min** / ***mi**	Denne boka er **mi** / ***min**
	this book.DEF is my /my	*this book.DEF is my /my*

Some information about nominal inflection is needed at this point: In three gender dialects, the definite singular suffix is always different in the three genders, as shown in (42).[8] With feminines, the definite singular suffix is *-a* in the three gender dialects surrounding Western Oslo.

(42) Three gender dialects:
Masculine: bil<u>en</u> 'car.DEF'
Feminine: bok<u>a</u> 'book.DEF'
Neuter: hus<u>et</u> 'house.DEF'

Western Oslo also has a definite suffix *-a*, but this suffix has no relation to feminine gender (Fretheim 1985, Enger 2004:133—34, Lødrup 2011). It is not used as in the three gender dialects. It is obligatory with some nouns (such as *øy* 'island' and *jente* 'girl'), and optional with many other non-neuter nouns (such as *bok* 'book' and *klokke* 'watch'), alternating with *-en*. The suffix *-a* defines the only context in which the forms *mi*, *di* and *si* can and must be used in Western Oslo.[9]

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[8] This fact is a reflection of the historical origin of the definite suffix. It developed from a clitic determiner which agreed with the noun; see Faarlund (2009). Some researchers assume that the definite suffix is still a clitic (see Lahiri et al 2005), but the evidence against this analysis is overwhelming, see e.g. Börjars (1998:40—88), Hankamer and Mikkelsen (2002:153 note 19), and Faarlund (2009) (on Swedish, Danish and Norwegian, respectively).

[9] Some historical facts might be of interest here. Western Oslo represents a development of the 'Colloquial Standard' that was the daily speech of the educated class in the 19th century (Haugen 1966:31). This standard was a compromise between the urban dialect on the one hand, and a Norwegian reading pronunciation of Danish on the other hand. Danish does not have postnominal possessives. Even so, postnominal possessives must have been used to some extent in the Colloquial Standard (as they sometimes were in contemporary fiction, see Lundeby (1965:195—225)). From the point of view of Danish, a phrase such as *boka mi* 'book.DEF my' is unacceptable. (The Danish equivalent is *min bog* 'my book'.) Not only is the position of the possessive ungrammatical; Danish does not have the suffix *-a* or the form *mi*. (Danish does not have a feminine gender.) One could imagine that a phrase such as *boka mi* 'book.DEF my' was felt to be a borrowed unit in the Colloquial Standard.

An important point is that the noun with the -*a*-suffix must be phonologically realized. Even if Western Oslo follows other dialects in allowing postnominal possessives to occur with an elided noun, *mi*, *di* and *si* do not have this option. Examples are (37) above, repeated as (43), and (44)—(45).

(43) All dialects	den nye bilen **din** og den gamle __ **min**
	the new car.DEF your and the old my
	'your new car and my old one'
(44) Three gender dialects	den nye lua **di** og den gamle __ **mi** / ***min**
	the new hat.DEF your and the old my / my
	'your new hat and my old one'
(45) Western Oslo	den nye lua **di** og den gamle __ **min** / ***mi**
	the new hat.DEF your and the old my / my
	'your new hat and my old one'

These examples show that Western Oslo *mi*, *di* and *si* differ from all other postnominal possessives in requiring a phonologically realized noun.

The question is now how the distribution of *mi*, *di* and *si* in Western Oslo should be accounted for.[10] If they are considered suffixes, a natural account follows. As suffixes, they have no agreement features (see (33) above); *mi*, *di* and *si* are the possessive suffixes used in the inflectional class of common gender nouns that takes -*a* in the definite singular. The fact that they only occur with a phonologically realized noun follows by itself.

If *mi, di* and *si* are the only possessive suffixes in Western Oslo, there would be possessive suffixes for one inflectional class only. This might be considered a marked situation. However, it is possible for a language to express the same grammatical information in different ways through a paradigm. For example, Irish has verbal paradigms in which some forms are 'synthetic', realizing person and number through verbal morphology, while others are 'analytic', requiring independent personal pronouns. This kind of situation represents in itself no problem for LFG (Andrews 1990).

There is one argument against the suffix analysis. The second argument against the suffix analysis in section 5.1 applies to all possessives in Western Oslo. Like other dialects, Western Oslo does not have to repeat a possessive

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[10] It should be mentioned that the choice of *mi*, *di* and *si* is not phonologically conditioned in Western Oslo. To see this, consider the colloquial (i).

(i) kjære Anna **min**/***mi**
dear Anna my / my

In (i), a first person singular possessive follows a proper name. With a woman's name, three gender dialects use the form *mi*. In Western Oslo, only *min* can be used. It is not relevant if the proper name ends in -*a*, which shows that it is not the phonology, but the grammatical status of -*a* that is decisive.

on every conjunct in a coordinate structure; this is also true of *mi*, *di* and *si*. An example is (46).

(46) buksa (**mi**) og lua **mi**
trouser.DEF (my) and hat.DEF my
'my trousers and hat'

This argument gives evidence against the suffix analysis for all possessive forms in Western Oslo. On the other hand, it is the only empirical argument that goes against the suffix analysis for *mi, di* and *si*. What conclusion can be drawn from this? Two options present themselves.

The first option is to let the affix repetition argument be decisive, and give up the suffix analysis. *Mi*, *di* and *si* must then be considered weak pronouns, and the rule for their distribution must make reference to the inflectional class of the preceding noun. This would be a strange rule without parallels in grammar. Inflectional class is known to be a 'pure' morphological property (Aronoff 1994), which does not play a part in syntax. Another reason to reject this option is that the rule would have to stipulate that the noun is not elided (see example (45) above). The other postnominal possessives do not have this requirement (see example (43) above).

The second option is to give less priority to the affix repetition argument, and still consider *mi*, *di* and *si* suffixes. To me, this seems to be the better option, because it seems to be the only way to give a natural account for the distribution of *mi*, *di* and *si* — both the fact that they only occur after the definiteness suffix *-a*, and the fact that they differ from all other postnominal possessives in requiring that the preceding noun is not elided. This is not to deny that the affix repetition argument is a real argument. However, it was mentioned at the end of section 5.1 that there are established cases in which an affix does not have to be repeated on every conjunct, so-called suspended affixation. Even if suspended affixation is not productive in other areas of Norwegian morphology, it has the advantage of being an independently established option in grammatical theory.

6. Conclusion

Prenominal and postnominal possessive pronouns provide a situation where two positions contribute the same information, while there are grammatical differences between them. The architecture of LFG makes it possible to handle this type of situation in an enlightening way. The basic properties of Norwegian possessive pronouns can be accounted for by assuming that the prenominal ones are strong, while the postnominal ones are weak. There is evidence, however, that the dialect of Western Oslo has a group of suffixal possessives.

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ṚGVEDIC CLITICS AND ‘PROSODIC MOVEMENT’

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Abstract

In this paper I develop an LFG account of second position clitic placement in Ṛgvedic Sanskrit. Clitic phenomena in this language are both more complicated and more ambiguous than (supposedly) in Serbian/Croatian/Bosnian, whose second position clitic data were recently treated by Bögel et al. (2010). I develop a formal treatment of clitic 'movement' which partly builds on Bögel et al.'s approach but which differs in certain fundamentals of formalism, maintaining a strict division between the syntactic and prosodic components of the grammar.

1 Introduction

There has been increasing interest in the interaction between prosody and syntax in recent years; recent work within LFG includes Butt and King (1998), Mycock (2006), and Bögel et al. (2009, 2010). One of the most problematic issues in the prosody-syntax interface is that of second position clitics, whose position in the clause, apparently determined at least partly by prosodic factors, cannot easily be accounted for under ordinary assumptions about syntactic constituency. An analysis of clitics within an LFG framework has recently been undertaken by Bögel et al. (2010); in this paper I consider the complex clitic data of Ṛgvedic Sanskrit and develop an alternative method of modelling the misalignment between syntax and prosody which this data reveals.

1.1 Ṛgvedic Clitics

The *Ṛgveda* is the earliest surviving text in the oldest Indo-Aryan language, Sanskrit; it is a collection of c. 1000 'hymns', metrical texts which originally had a ritual function and were composed c. 1500–1200 B.C. Ṛgvedic syntax is remarkably free: all possible orderings of V, S, and O are found, and word order is based on information structure (Viti, 2010); in fact word order patterns are very similar to those established for Ancient Greek by Dik (1995, 2007). Nevertheless there are clear syntactic rules and tendencies which provide evidence for structure within clauses; this is most apparent near the start of a clause, in particular in the position and ordering of clitic sequences.

According to Wackernagel's Law (Wackernagel, 1892), formulated specifically for ancient Indo-European languages like Ṛgvedic Sanskrit, unaccented elements

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occur in second position in the clause. However this is an over-simplified analysis of what is in fact a complex set of data. Exx. (1, 2) fit Wackernagel's pattern, but exx. (3, 4) apparently do not (clitics are underlined).

(1)

imáṃ	*ca*	*no*	*gavéṣaṇaṃ*	*sātáye*	*sīṣadho*	*gaṇám*
this	and	our	cow-seeking	for_victory	direct	company

'And direct this our cow-seeking company to victory.' (6.56.5ab)

(2)

mó	*ṣú*	*naḥ*	*soma*	*mṛtyáve*	*párā*	*dāḥ*
not=and	indeed	us	Soma	to_death	away	give

'And do not hand us over to death, Soma.' (10.59.4a)

(3)

utá	*vā*	*yó*	*no*	*marcáyād*	*ánāgasaḥ*
also	or	who	us	would_harm	innocent

'or also who would harm us innocent ones.' (2.23.7a)

(4)

divyā́	*ā́po*	*abhí*	*yád*	*enam*	*ā́yan*
divine	waters	to	when	him	came

'When the divine waters came upon him' (7.103.2a)

Note that not all enclitics are unaccented, and not all unaccented words are enclitic.[1] Several enclitics are accented, e.g. *hí* (in ex. 20 below), *sú* (in ex. 2), *nú*.[2] The major category of words in the *Ṛgveda* which is unaccented but not syntactically enclitic is finite verbs in main clauses, as *sīṣadho* in ex. (1) and *dāḥ* in ex. (2). Besides 'second position' clitics appearing to occur considerably later than second in the clause, there are other complications in the Ṛgvedic data which will be discussed below.

There have been two contrasting analyses of Ṛgvedic word order and in particular clitic placement in recent decades. A non-theoretical and largely descriptive 'Phonological Template' approach was developed by Hock (e.g. 1982, 1996), followed by Schäufele (1996). A transformational (GB) approach was developed by Mark Hale (e.g. 1987, 1996, 2007). The only attempt to analyse Ṛgvedic word order in a non-transformational theoretical framework is Schäufele's (1991) LFG-based asessment of RV syntax; but he did not adequately account for the positioning of clitics.

I will analyse the problems raised by the Ṛgvedic clitic data in §3, before developing my formal treatment of clitic misalignment in §4. Before that (§2) I will discuss the most recent approach to second position clitics in LFG, that of Bögel et al. (2010).

[1] Ṛgvedic accent was tonal, main word accent correlating with a high tone; the high tone is indicated with an acute in the transliteration.

[2] This is paralleled for example in Ancient Greek, where some second position clitics are accented and some are not, e.g. *ge*, *te* but *dé*, *oûn*.

2 Clitic Sequences in LFG

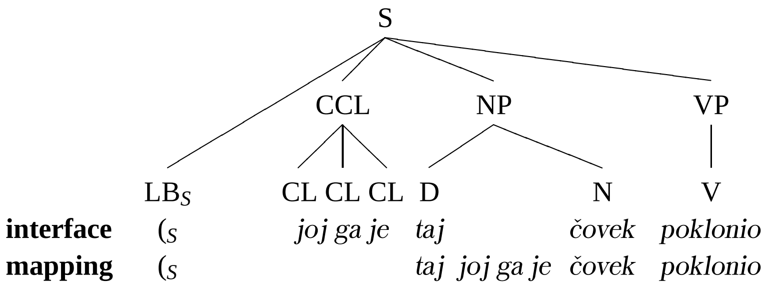
The most recent treatment of second-position clitics in LFG is by Bögel et al. (2010), building on a new method of modelling the interaction between prosody and syntax presented in Bögel et al. (2009).[3]

Bögel et al. (2010) discuss problematic clitic phenomena in Serbian/Croatian/ Bosnian (SCB), in which sequences of clitics (clitic clusters) appear within syntactic constituents. They explain this by assuming that clitic clusters can be generated in the c-structure at the left edge of a clause but cannot stand there in the prosody.

(5) *taj*	*joj*	*ga*	*je*	*čovek*	*poklonio*
that	her	it	AUX	man	presented

‘That man presented her with it.’ (Bögel et al., 2010, ex. 12a, p.112)

(6) C-Structure for ex. 5 (Bögel et al., 2010, ex. 26, p.118)

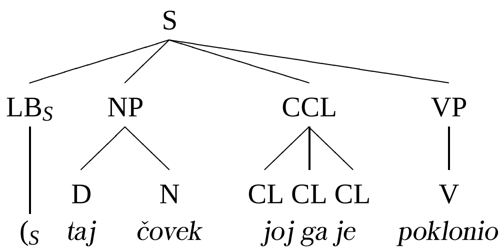


The clitic cluster *joj ga je* cannot stand in first position and so ‘moves’ to the right of the first accented element, the ‘movement’ equivalent to Halpern’s (1995) Prosodic Inversion to account for second position clitics. In SCB the clitic sequence can also appear in syntactic second position, in which case it can be accounted for straightforwardly in the syntax.

(7) *taj*	*čovek*	*joj*	*ga*	*je*	*poklonio*
that	man	her	it	AUX	presented

‘That man presented her with it.’ (Bögel et al., 2010, ex.11a, p.112)

(8) C-Structure for ex. 7 (Bögel et al., 2010, ex. 39, p.123)



[3]Compare also Bögel et al. (2008) and Bögel (2010). The most important alternative approach to clitics is within the Lexical Sharing theory of Wescoat (2002, 2005, 2007, 2009), which I do not have space to discuss in detail; for a critical analysis of this theory in regard to clitic placement see Bögel (2010, p. 97–100).

In order to constrain the movement of clitic sequences, Bögel et al. (2010) introduce into the PS-rules and thereby the c-structure reference to prosodic boundaries, here the left edge of a clause (LB_S). They also introduce the CCL ('clausally-scoped clitic cluster') into the PS-rules such that it is generated next to the left edge of the clause, or as the second syntactic element in the clause. In order to control the 'phonological flip' they introduce an 'Interface Mapping Rule' which roughly states that a CCL clitic sequence can be placed one word further to the right in the prosodic output than it is in the syntax, so long as in the syntax it is directly to the right of a prosodic left boundary (and vice versa).

In my treatment I will adopt some of Bögel et al.'s fundamental assumptions; I will make use of the category CCL for some but not all clitics, and I share their intuition that the CCL can be generated at the start of a clause even if the clitics within it 'surface' in the prosody one word further to the right. However I will not adopt the more formal aspects of their approach. The projection of LB_S and RB_S in the c-structure significantly changes the nature of c-structure by allowing it to represent more than just the position and constituency of words. In their approach this is necessary, however, because the interface mapping rule needs to make reference to prosodic boundaries.

Moreover Bögel et al.'s interface mapping rule makes reference to clitic sequences appearing in the CCL such that phonological movement can only take place where the c-structure projects a CCL. In my view the 'movement' governed by the interface mapping rule is governed rather by the interaction of more general constraints on c-structure and p-structure formation which do not therefore require a special rule referring specifically to clitic groups appearing in a particular syntactic context. This also permits more complicated clitic data, such as that found in R̥gvedic Sanskrit, to be accounted for without having to add to the formal architecture.

A third feature of the architecture formulated by Bögel et al. (2010) is the difference between prosodic and syntactic second position. Following Halpern (1995) they assume that Prosodic Inversion should be treated as a last resort: if the position of clitics can be accounted for in the syntax, then do so. SCB is usually taken as one of the best examples of a language in which the clitics *cannot* be positioned syntactically, because NPs such as *taj čovek* cannot otherwise be discontinuous.[4]

If, however, we have accepted the principle of phonological movement, it is questionable whether we can always treat it as a last resort. If it is a genuine linguistic possibility, then it may occur even when a fully syntactic account is equally valid. In particular, if the first syntactic constituent of a clause consists of a single prosodic word, then the difference between syntactic and prosodic second position

[4]The SCB data is more ambiguous than Bögel et al. (2010) and many earlier authors assume; see now Ćavar and Seiss (2011) and references therein. Nevertheless if such examples did not constitute a problem for syntactic analysis they would not have become so widely discussed; moreover the basic facts assumed for SCB by Bögel et al. (2010) are uncontroversially found in other languages such as Ancient Greek, Gothic, and possibly Warlpiri.

is neutralized.[5] In a language such as Ṛgvedic Sanskrit, where there is considerable freedom for discontinuous constituents, certain enclitics only ever occur after the first phonological word. Even where this appears to result in the enclitic 'interrupting' an intial constituent, it cannot be proven that we are not dealing with two discontinuous constituents with the clitic in second *syntactic* position, as in the following example.

(9)	*imáṃ*	*ca*	*no*	*gavéṣaṇaṃ*	*sātáye*	*sīṣadho*	*gaṇám*
	this	and	our	cow-seeking	for_victory	direct	company

'And direct this our cow-seeking company to victory.' (6.56.5ab)

Here it is tempting to take *imáṃ gavéṣaṇaṃ* 'this cow-seeking (thing)' as a single constituent, interrupted by two enclitics; however it is always possible in contexts like this to take the first word, here *imáṃ* 'this', as a separate constituent from the second non-clitic word. In other words there are contexts in which we cannot prove one way or another whether we are dealing with syntactic or prosodic second position. The assumption that syntax always takes priority over prosody has no absolute basis and cannot be used as a valid means of deciding a given case. If phonological movement is possible, this possibility should be independent of the syntax, i.e. it should be equally possible (within its own, phonological, constraints) in languages or contexts where our syntactic architecture can in principle permit a fully syntactic account of surface word order as it is in contexts where it cannot.

3 Clitics in Ṛgvedic Sanskrit

3.1 Clitic 'movement' in Ṛgvedic Sanskrit

Ṛgvedic Sanskrit, like many other languages, has a class of enclitic conjunctions which always follow the first non-enclitic (phonological) *word* of their domain, even where this entails interrupting what appears to be a syntactic constituent. As stated above, the considerable freedom for discontinuity of constituents means that it is hard to prove syntactic constituency and therefore clitic 'movement' in Ṛgvedic Sanskrit. But given the evidence for phonological movement in other languages, we do not necessarily *need* to prove syntactic constituency before we can assume movement.

3.2 Clitic conjunctions

We will begin our survey of Ṛgvedic clitics by looking at clitic conjunctions. Descriptively, clitic conjunctions always appear in the output one word to the right of where they might be expected to be in the c-structure. According to Bögel et al. (2010, p.121, on Russian *li*) this involves a CCL, but one which can only appear in

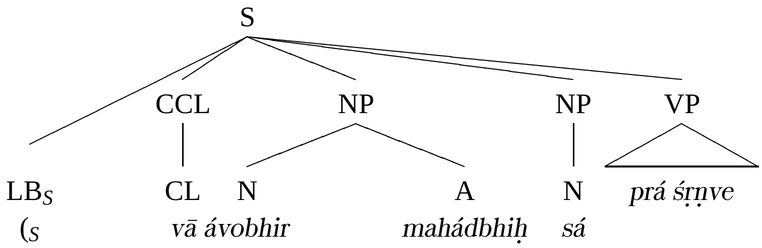
[5] At least in terms of the output word order; there could potentially be prosodic differences between the two.

prosodic second position, not in syntactic second position. If their approach were applied to Ṛgvedic clitic conjunctions, the passage given in ex. (10) would have the c-structure given in ex. (11).

(10)	*ávobhir*	*vā*	*mahádbhiḥ*	*sá*	*prá*	*śṛṇve*
	with_assistance	or	with_great	this	PRVB	is_famed

‘or through your great assistances this one is famed.’ (4.41.2d)

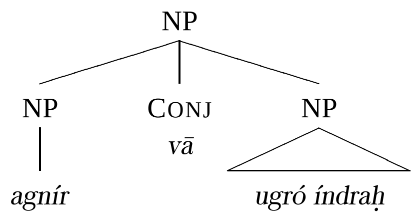
(11) C-Structure for RV 4.41.2d (ex. 10)



However in terms of linear order this is effectively the same position as for a ‘normal’, non-enclitic conjunction, i.e. directly preceding the first element of the conjoined S. In other words the CCL demanded by Bögel et al. (2010) to account for the position of enclitic conjunctions is in this case structurally in exactly the same position as the normal functional position of such conjunctions, CONJ.[6] It therefore makes more sense to treat the enclitic conjunctions as generated in CONJ rather than a CCL. The necessity of the CCL as a category will be discussed below, but we should follow the principle that as a non-standard X-bar category the CCL should be reserved only for clitics whose syntactic positioning cannot be treated under any ordinary syntactic category.

Enclitic conjunctions, of course, can also conjoin NPs, APs and PPs within clauses. We cannot suppose that a ‘clausally-scoped clitic cluster’ could appear within such constituents, rather the clitic conjunction appears in its regular position (CONJ). So for a simple NP conjunction such as *agnír ugró vā índraḥ* ‘Agni or fierce Indra’, the c-structure will be as follows.[7]

(12)



[6]This is not the case for Russian *li* which is the (subordinating) conjunction discussed by Bögel et al. (2010), but by extension would apply to conjunctions which are found in CONJ. Russian *li* can be generated in its syntactically expected position, C (cf. King, 1995, §10.2, p.232–238).

[7]This example from Hale (2007, p.205).

3.3 CCL Clitics

While clitic conjunctions always appear to the right of the phonological word corresponding to the terminal node which they directly precede in c-structure, other clitics, namely clitic pronouns and particles, have a variety of possible positions.

Firstly clitic pronouns and particles can occur cliticized to a governing word within a VP, NP or even PP; in these positions the clitics can be unproblematically generated under the appropriate syntactic node in the c-structure and no 'movement' need be assumed. This clitic position will therefore not be considered further. Such clitics can also appear near the start of a clause in a 'clitic cluster'. Descriptively, the start of any Ṛgvedic clause consists of a series of elements ordered according to a template of the following kind.

(13) (Conj) (XP) (XP) (Prvb) (Dem./Rel. Prons) (Pcls) (Prons)

All elements in the 'initial string' are in principle optional. The first possible element is a conjunction which cannot be preceded by any other element of the clause (assuming it is a clausal, not phrasal, conjunction); if the conjunction is enclitic it will follow the first word as discussed above. Then follow two positions which can be filled by any XP from the clause; these are usually considered to be topicalization/focus positions, and will be discussed in more detail below. Following this a preverb can occur, if it is not proclitic or enclitic on its verb; following this we find the regular position of the demonstrative and relative pronouns *sá-*, *syá-* and *yá-*. Then come enclitic sentence particles and finally enclitic pronouns. Since it is rare for more than one of the first five elements of the initial string to be filled, these enclitic words often appear in 'second position' in the clause. Following this initial string will be the rest of the sentence.

Previous analyses of the 'initial string' have taken the last two elements, the sentence particles and enclitic pronouns, as the only clitic categories (besides clitic conjunctions). However there is also evidence that preverbs and demonstrative/relative pronouns should also be treated as clitic categories when appearing near the start of the clause (and not topicalized or focused). As this has not been previously recognized I will discuss this briefly before developing my analysis of CCL clitics.

3.3.1 Relative and Demonstrative Pronouns

Relative and demonstrative pronouns (including subordinating conjunctions which historically evolved from the former such as *yád* 'when, because') often occur in first position in the clause, in which case they can usually be interpreted as topical elements, i.e. descriptively in one of the XP slots in the initial string 'template'. However they can also appear following a different topicalized XP in which case they cannot be so analysed.

Evidence from sandhi phenomena suggests that in non-initial position demonstrative and relative pronouns were not infrequently enclitic. This, together with the fact that descriptively such pronouns directly precede the traditional 'clitic cluster', suggests that in fact these pronouns should likewise be analysed within the clitic cluster.[8]

Sanskrit has internal and external sandhi rules. The latter govern the phonological interactions between independent phonological words which appear next to one another in the clause. Internal sandhi applies within phonological words, and for these purposes clitics do not count as independent phonological words, but part of the preceding or following word. This should give us a clear criterion for determining whether a given word is clitic or not in a given context; unfortunately internal and external sandhi differ in only a few details, so often we cannot be sure which we are dealing with. So for example the first segment of the relative pronoun *yá-* is not affected by sandhi and itself causes no distinct internal sandhi phenomena. The first segments of the demonstrative pronouns *sá-/tá-* and *syá-/tyá-*, on the other hand, are affected by internal sandhi rules. Specifically an *s* can be retroflexed according to the so-called 'ruki' rule, when one of the four segments *r*, *u*, *k*, *i* directly precedes it in the same phonological word. There are many examples of internal sandhi affecting the first segment of these demonstrative pronouns, which proves that, despite being accented in our texts and often occurring in initial position in the clause, these pronouns are, in these instances at least, enclitic on the preceding word. So we have *ṣá* for *sá* in ex. (14), *ṭáj* for *táj* in (15).

(14)	*prá*	*sú*	*ṣá*	*víbhyo*	*maruto*	*vír*	*astu*
	before	PTC	that	from_birds	Maruts	bird	let_be

'Let that bird be before (all other) birds, O Maruts.' (4.26.4a)

(15)	*níṣ*	*ṭáj*	*jabhāra*	*camasáṃ*	*ná*	*vṛkṣā́d*	*bṛ́haspátir*
	out	that	brought	ladle	like	from_wood	Bṛhaspati

'Bṛhaspati brought that out like a ladle from wood.' (10.68.8cd)

Although there is no sandhi evidence for the clitic status of the relative pronoun, there is evidence that related relative pronouns in other Indo-European languages were at least optionally enclitic. This is suggested by the positioning of relative pronouns in Old Irish (Watkins, 1963, p.29) and Ancient Greek (Fraser, 2001, p.141), the development of the definite adjective declension in Balto-Slavic possibly from a postposed relative construction (Vaillant, 1942), and the development of the ezafe construction from a relative pronoun in Iranian languages (Haider and Zwanziger, 1984; Haig, 2011).

We must therefore distinguish clitic and non-clitic variants of these words, the former generated under the appropriate XP nodes in cases of topicalization or focus, the latter generated in the 'clitic cluster' where not topicalized or focused.[9]

[8]Hale, among others, considers interrogative pronouns to be syntactically parallel to these relative and demonstrative pronouns but this is not in fact justified: interrogative pronouns can only ever be preceded by a single constituent while the others can be preceded by up to two constituents; by my analysis this means that interrogative pronouns must be topical elements filling the second optional XP of the clause (see above).

[9]The other enclitic pronouns also have non-clitic variants which are likewise used in contexts of

3.3.2 Preverbs

Further support for this position of relative and demonstrative pronouns comes from the positioning of preverbs. Preverbs are adverbial elements which can occur either near the front of the clause, or else directly preceding (proclitic on) the verb. Descriptively 'initial string' preverbs occur directly before the clitic cluster as formulated thus far, often first, or second following a 'topicalized' element (Hale, 1996, p.183–186).

Preverbs at or near the start of a clause are usually treated as topicalized or focused elements. There are two competing justifications for this: either the preverb itself is focused, or the preverb serves to focus or topicalize the verb with which it is associated.

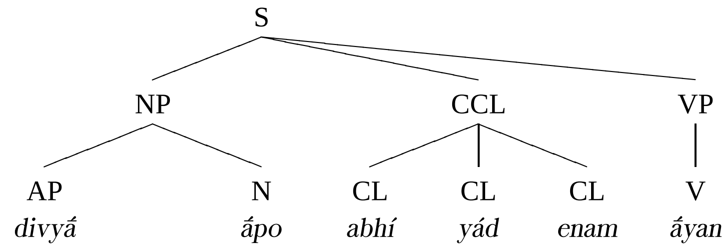
In some cases it is possible to treat the preverb as topicalized. However preverbs appear in their 'initial string' position in between 40–50% of their occurrences (depending on the particular preverb), and it is unlikely that directional adverbs would be topicalized or focused so frequently. Moreover statistical evidence shows that these initial string preverbs cannot (always at least) be serving to topicalize/focus the verb. For example there are c. 200 clauses with *yám* (accusative singular masculine relative pronoun) where the verb has no preverb - the verb precedes the relative pronoun (ie. it is topicalized/focused) in 3.5% of them; there are c. 70 clauses with a preverb - the preverb precedes the relative pronoun in 28.3% of them.[10]

We are left with preverbs in the initial string, directly preceding the clitic cluster, not topicalized or focused, words which in other contexts (when adjacent to the verb) are clearly (pro)clitics. If we assume that the CLL can host not just enclitics, but also proclitics, then the position of the preverbs can be easily explained.

(16)	*divyā́*	*ā́po*	<u>*abhí*</u>	<u>*yád*</u>	<u>*enam*</u>	*ā́yan*
	divine	waters	to	when	him	came

'When the divine waters came upon him.' (7.103.2a)

(17) C-Structure for RV 7.103.2a (ex. 4=16)



topicalization and focus, but with these the difference is marked by the respective presence or lack of accent. Cf. also Selkirk (1995) on function words with accented and unaccented variants.

[10] I have taken statistics from clauses with relative pronouns since the topicalization/focus position before the pronoun is unambiguous, unlike in many other contexts.

This provides further evidence for the position of relative and demonstrative pronouns within the CCL, since in examples such as (4=16) the pronoun manifestly appears between CCL elements.

As proclitics, there is no restriction against preverbs occurring in clause-initial position: therefore it is possible for the elements of a CCL to remain in first position in a clause if the first element of the CCL is a proclitic. The CCL sequence of proclitic followed by one or more enclitics forms a single phonological word, within which internal sandhi rules apply regularly.[11]

3.4 The CCL

As argued in the previous section it is not always necessary to posit a CCL to host clitics which undergo prosodic inversion. However in other contexts this *is* justified. This is most clear, as in SCB, where more than one clitic of different lexical categories appear together in a particular position in the clause which cannot be justified on the basis of their lexical categorization. The same is true in Ṛgvedic Sanskrit, where clitic clusters in second position can include preverbs, sentence particles and enclitic pronouns.

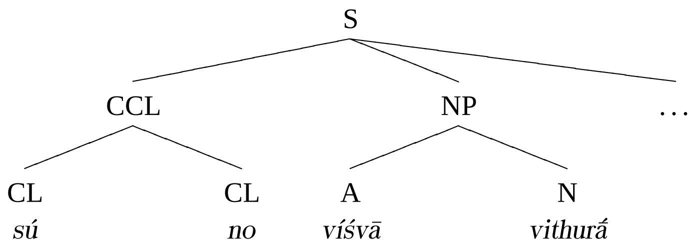
The syntactic treatment of clitic clusters is a problematic issue. Clitics which appear in clitic clusters are positioned on the basis of their clitic status rather than for any other syntactic reason. While clitic clusters often function as syntactic units (see e.g. Halpern, 1995, p.191–222 with references), there is no traditional XP category which can adequately dominate the varieties of clitics involved. The syntactic constituency of the CCL (and the fact that we have a CCL rather than a series of independent CLs) can only be based on the fact that the clitic cluster cannot be broken up by any other element of the clause. On the other hand clitic clusters could often be treated as single lexical items but do not seem to be formed in the lexicon according to normal morphological processes. Simpson and Withgott (1986) deal with clitic clusters by a process of 'template morphology' in the lexicon; the CCL utilized by Bögel et al. (2010) is an alternative, syntax-based approach. What both approaches share is the recognition that the syntactic constituency of clitic clusters cannot be accounted for by traditional X-bar theoretic rules. I will make use of the CCL here, but this approach could easily be adapted to alternative methods of treating clitic clusters.

(18) *víśvā* *sú* *no* *vithurā́* *pibdanā́* *vaso* *'mitrā́n*
all indeed for_us unstable firm good enemies
suṣáhān *kṛdhi*
easy_to_conquer make
'Indeed, make everything which is unstable firm for us, O good one, (and make) our enemies easy to conquer.' (6.46.6cd)

[11] Note that there is no constraint against a single phonological word having more than one accent: cf. lexical words such as *gnā́spáti-*, *bṛ́haspáti-* etc. The formation of single phonological words from proclitic plus enclitic is paralleled in Ancient Greek, with e.g. *eí te* > *eíte* etc.

When the CCL appears within another syntactic constituent, as in ex. (18), we can follow Bögel et al. (2010) and assume that in c-structure we in fact have a CCL at the start of the clause, which then undergoes 'movement' to after the first phonological word.

(19) C-Structure for ex. (18)



Sometimes a clitic pronoun or sentence particle (but not a conjunction) appears after the first *constituent*; again we can follow the principles proposed by Bögel et al. (2010) and generate the CCL in *syntactic* second position. The c-structure for the following example will then be exactly parallel to that given in ex. (8), but without the LB_S.

(20) *mahé kṣatrā́ya śávase hí jajñé*
to_great to_dominion to_might for was_born
'For he was born to great dominion (and) might.' (7.28.3c)

It is not necessary to utilize a PS-rule of the kind assumed by Bögel et al. (2010), involving optionality, to account for the variation between second prosodic and second syntactic position. Although the precise details for the Ṛgvedic Sanskrit are uncertain, I would rather assume a generic PS-rule such as the following, where the first optional XP in the clause is marked for focus or topicalization, meaning that the CCL appears in first position in the c-structure when nothing fills this first XP slot.[12]

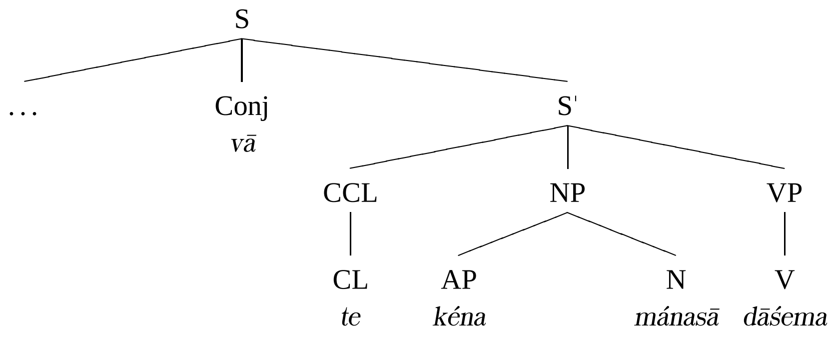
(21) S $\rightarrow$ (XP) (CCL) (XP)...

The following example shows both an enclitic conjunction, generated in CONJ, and an enclitic pronoun, generated in the CCL, which both undergo phonological movement to within the first constituent of the clause.

(22) *kéna vā te mánasā dāśema*
with_what or you with_attitude we_should_do_service
'or with what attitude should we do service to you?' (1.76.1d)

[12] In some passages it appears that the clitic cluster is positioned not in relation to the start of the clause but in relation to metrical boundaries such as line breaks and caesuras (see in particular Hock, 1996); this has been used to support a purely prosodic account of clitic placement in the *Ṛgveda*. However all such examples can be explained syntactically by assuming either dislocated topics or second syntactic position of the CCL, or both.

(23) C-Structure for RV 1.76.1d (ex. 22)



4 An OT analysis of ‘movement’

Previous approaches to clitic ‘movement’ involve addition to or alteration of the formal framework of LFG, whether this means adding further layers of structure as in Wescoat’s (2009) lexical sharing, or introducing prosodic brackets into c-structure as in Bögel et al.’s (2010) approach.

However it would be preferable to be able to deal with the positioning of clitics without arbitrarily adding to our theory.[13] We will see that the problem of clitic positioning can be resolved simply in an OT-LFG framework.

The positioning of clitics is a c-structure problem with a prosodic (p-structure) origin: the particular prosodic features of clitics which result in their appearance within constituents causes a problem when we try to account for their position in c-structure terms. In order to account for the position of clitics, then, we need a direct relation between c-structure and some kind of prosodic structure. A direct relation between c-structure and p-structure has been widely accepted since Butt and King (1998), found recently, for example, in Mycock’s (2010, p.292) schematic representation of the LFG projection architecture. A slightly different view is taken by Dalrymple and Mycock (2011) who assume only an indirect relation between c-structure and p-structure, mediated by the string of lexical items. But even such an indirect relation should be reconcilable with the OT-based account of ‘movement’ detailed here.

(24) Correspondence relations in the projection architecture (fragment)

$$\underset{\text{P-structure}}{\bullet} \xrightarrow{\quad\rho\quad} \underset{\text{C-structure}}{\bullet} \xrightarrow{\quad\phi\quad} \underset{\text{F-structure}}{\bullet}$$

If we assume a relation between p-structure and c-structure, we can annotate c-structure nodes with their respective relations to p-structure. This does not mean that every c-structure node directly corresponds to a p-structure node, though some

[13] Admittedly the CCL c-structure category is an addition to the traditional set of X-bar categories, but something special is required for the clitic cluster in any framework.

will. For the purposes of treating clitics, we require reference primarily to the level of the Prosodic Word, and for simplicity I will ignore other levels here.[14] Annotations in the c-structure can include the following.

(25)
- $\downarrow_\rho = \omega$: the corresponding element in the p-structure forms a phonological word.
- $\downarrow_\rho \subset \overrightarrow{\omega}$: the corresponding element in the p-structure forms a phonological word with the phonological word directly to its right.
- $*({}_\omega\downarrow_\rho$: the corresponding element in the p-structure cannot stand at the start of a phonological word.

4.1 The OT constraint system

I assume that all structures in the grammar may be analysed according to their own set of OT constraints. In each case the GEN will be the rules of formulation of that structure, e.g. in the case of c-structure it will be the particular PS-rules of a language. All possible outputs from these structure-specific rules will form the input to the OT constraint systems. Assuming a direct mapping between c-structure and p-structure on the one hand, and c-structure and f-structure on the other, any OT approach to the c-structure will require coherence and faithfulness between the c-structure and the structures related to it.[15] Any given c-structure must in general correspond to coherent, possible, f- and p-structures, but more specifically it must always correspond to either a particular f-structure or a particular p-structure. That is, if we are parsing a given utterance, the c-structure must correspond to the particular, given, p-structure corresponding to that utterance, while if we are generating a sentence with a given meaning, the c-structure must correspond to the particular f-structure which corresponds to that meaning.

The clitic problem arises at the interface between the c-structure and the p-structure. Therefore if we have a given meaning (i.e. we are generating) and therefore f-structure, the c-structure will be generated on the basis of the f-structure without problem; the 'movement' of clitics will have to be accounted for in the inverse mapping from c- to p-structure (ρ^{-1}). If we are parsing, the p-structure will be given, and the 'movement' of clitics must be accounted for in the p- to c-structure mapping (ρ). I assume that the 'movement' is due to the interaction of competing prosodic and syntactic features which can best be represented in terms of OT tableaux.

For any given c-/p-structure pair, there will be one set of syntactic constraints governing the c-structures competing to represent a given p-structure (i.e. for ρ),

[14] I assume that, at least at this level of prosodic representation, the Strict Layer Hypothesis (Selkirk, 1984, p.26; Nespor and Vogel, 1986, p.7) is to be understood as a violable set of constraints (as per Selkirk, 1995). In particular, Phonological Words can be recursively formed, following e.g. Peperkamp (1996, 1997) and like Selkirk's (1995) 'affixal clitic' structure.

[15] Cf. Bresnan's (1996) 'C- to F-structure alignment' constraint.

and a different set of (phonological) constraints for the different p-structures competing to represent a given c-structure (i.e. for ρ^{-1}). I will not deal with the p-structure constraints here since they are a matter of phonology.

4.1.1 C-structure constraints

As stated above, the most basic constraints on c-structure involve faithfulness and coherence in relation to f- and p-structure. Faithfulness to f- and p-structures can be broken down into parts, e.g. FILL and PARSE, which penalize the addition and omission of input information, but for our purposes we can treat them as single constraints, which we will label F-ALIGN and P-ALIGN respectively, except that for explanatory clearness we will separate one particular sub-constraint of P-ALIGN and treat it separately.

(26)
- F-ALIGN: the c-structure is coherent with a possible/given f-structure.
- P-ALIGN: the c-structure is coherent with a possible/given p-structure.

The sub-constraint that we will treat separately is part of the requirement for coherence between c-structure and a given p-structure, namely that the integrity and order of phonological words be preserved in the mapping from p-structure to c-structure.

(27)
- ω-ALIGN: preserve the order and integrity of phonological words.

A similar constraint requires that the order of lexical items in the c-structure be the same as that in the corresponding p-string. I assume that s-forms are called into the c-structure by corresponding p-forms via the lexicon.[16]

(28)
- S-ORD: preserve the order of lexical items as found in the p-string.

All these constraints are high level constraints on competing c-structures which can be independently motivated and are not hypothesized purely to account for clitic 'movement'. The final constraint used here is likewise independently motivated. It is a constraint requiring economy of expression: see Morimoto (2001, p.171–172) for a discussion of contraints of this type. Morimoto's ECONOMY (derived from Bresnan's "Economy of Expression") constraint penalizes every XP and X^0 node in the c-structure; I follow his definition below.[17]

(29)
- ECONOMY: Economical structure is preferred (every XP and X^0 is penalized).

[16] The reference to linear adjacency required in this constraint could be formalized along the lines of Asudeh (2009), e.g. requiring that $\forall *.N(\rho(*)) = \rho(N(*))$ where ρ represents the mapping between p-structure and c-structure and N the next word according to linear sequence.

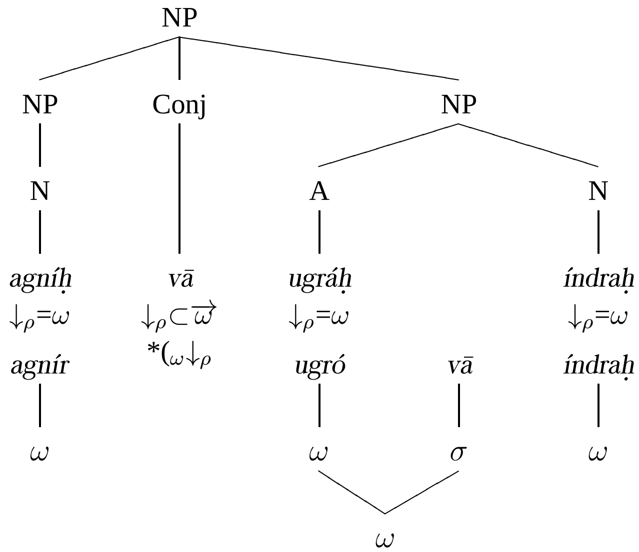
[17] Wescoat (2007, p.456) makes use of exactly the same constraint but labels it *PROJ.

Since all these constraints are independently motivated, this approach to clitic positioning does not add anything arbitrary to the grammar just to deal with a small group of problematic forms. Moreover, this approach is based on the given c-structure rules of a language. In principle this means that if the c-structure rules of a given language come to be more accurately understood such that ‘movement’ no longer need be assumed (this has happened with Warlpiri, for which the prosodic flip was once accepted) or indeed if an entirely new approach to c-structure is adopted in which clitic ‘movement’ is not a problem, the theoretical basis of this treatment is in no way invalidated or rendered superfluous. What it permits us to do is deal with the problematic positioning of clitics within the context of our current understanding of c-structure (in general and of given languages) without having to arbitrarily augment our theory.

4.2 Examples

We will take as the first example the NP *agnírugróvéndraḥ* ‘Agni or fierce Indra’ (ex. 12). To look at it first from the point of view of generation, and assuming a single rule for conjunction in Ṛgvedic Sanskrit, XP → XP (Conj) XP, we can draw the c-structure with annotations as below. Given the requirements of F-ALIGN it would be impossible to draw a tree in which *vā* followed *ugráḥ* which preserved the meaning ‘Agni or fierce Indra’, since if *ugráḥ* preceded *vā* it would have to be a modifier of Agni. The annotations on the lexical items in the c-structure permit the p-structure, drawn below, to be constructed. The annotations on the s-forms define their prosodic classification in the p-structure.

(30) *agnírugróvéndraḥ* (ex. 12)



(31) *agnírugróvéndraḥ* (ex. 12)

agníḥ ugráḥ vā índraḥ	F-AL.	P-AL.	ω-AL.	ECON.	S-ORD.
☞ a. *a. v. u. í.*				6	*
b. *a. u. v. í.*		*!		6	

When we build the c-structure on the basis of the p-structure derived from the output, we make use of the OT constraints as shown in the tableau.[18] Candidate (b) as given in the tableau preserves the order of lexical items as attested in the p-structure, while candidate (a) violates this constraint. Both candidates violate ECONOMY six times, so are not distinguished in this respect. However candidate (b), while preserving the order of lexical items, does not correspond to the given p-structure, since on the basis of the prosodic specifications of *vā* it would, in that c-structure position, have to be forming (and not be at the start of) a phonological word with *índraḥ* rather than *ugráḥ*. Since the constraint P-ALIGN is ranked more highly than S-ORD, candidate (a) is the winner, even though this c-structure does not match the order of lexical items.

From this it should be clear that the constraint system is set up to require that the c-structure preserve the order of lexical items as found in the p-structure (and vice-versa) except in the very constrained context of clitics where there is no better option available.

In the following tableau, the ECONOMY constraint, being ordered before S-ORD, ensures that the preferred c-structure candidate is one in which neither clitic is treated in its s-string position even though it would be possible to leave *te* in its output position by assuming a discontinuous constituent.[19] The c- and p-structure trees are given in ex. (33).

(32) *kénavātemánasādāśema* (ex. 22)

kéna vā te mánasā	F-AL.	P-AL.	ω-AL.	ECON.	S-ORD.
☞ a. *v. t. k. m.*				7	**
b. *v. k. t. m.*				8!	*
c. *v. k. m. t.*			*!	7	**

[18]Syntactic information has been omitted from the candidates in the tableau due to space restrictions; they should be read as follows:

a. [NP [NP [N *agníḥ*]] [CNJ *vā*] [NP [A *ugráḥ*] [N *índraḥ*]]]

b. [NP [NP [N *agníḥ*] [A *ugráḥ*]] [CNJ *vā*] [NP [N *índraḥ*]]].

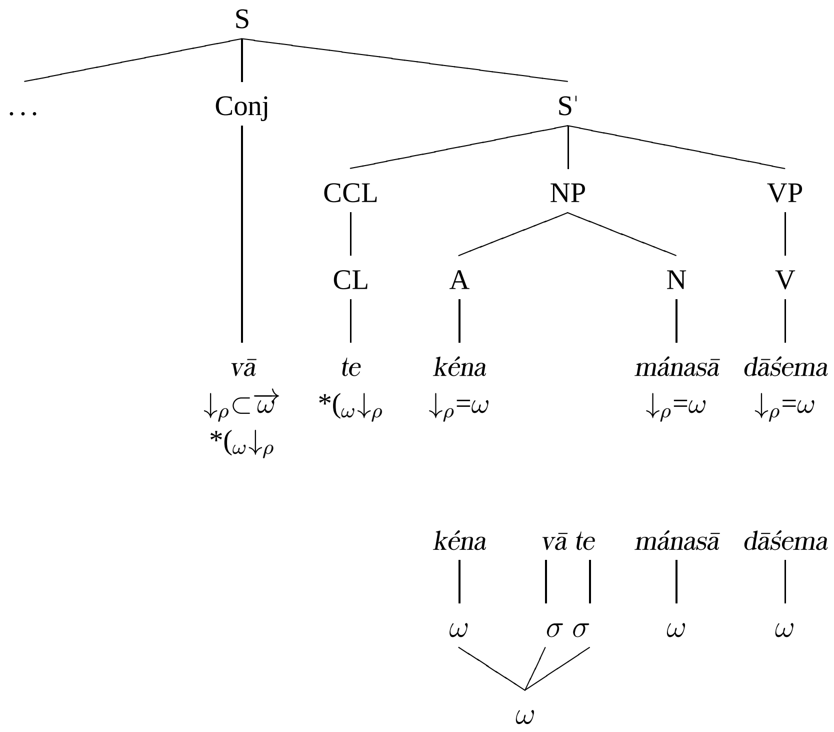
[19]Again the candidates have been abbreviated in the tableau; read as:

a. …[CNJ *vā*] [S [CCL *te*] [NP *kéna mánasā*]…]

b. …[CNJ *vā*] [S [NP *kéna*] [CCL *te*] [NP *mánasā*]…]

c. …[CNJ *vā*] [S [NP *kéna mánasā*] [CCL *te*]…].

(33) *kénavātemánasādāśema* (ex. 22)



5 Conclusion

In this paper I have explored the clitic data of Ṛgvedic Sanskrit. I have adopted the CCL c-structure node from Bögel et al. (2010), but have shown that in the *Ṛgveda* not all clitics are generated in the CCL: clitic conjunctions are generated in their expected syntactic position. I have shown that contrary to traditional analyses preverbs and non-initial relative and demonstrative pronouns can be treated as clitics generated within the clitic cluster. My formal treatment of these clitic phenomena accounts for the apparent prosodic 'movement' of clitics in the interface between the c-structure and p-structure; OT constraints on the formation of both these structures govern the order of words in the respective structures and allow for the positional disjunction of clitics. The advantage of this analysis over that of Bögel et al. (2010) or Wescoat's lexical sharing hypothesis is that it works with minimal addition to the LFG architecture and unlike Bögel et al. (2010) it preserves the modularity of the grammar by keeping prosodic information out of the syntax.

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AN LFG APPROACH TO WORD ORDER FREEZING

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Abstract

Word order freezing is a linguistic phenomenon by which normally free word order is frozen in the absence of disambiguating case information. It has been said to exist in Russian, Dutch, Korean, and many other languages. Word order freezing has received increasing scholarly attention in recent years, and it is often claimed that the phenomenon should be treated as part of processing or as purely stochastic. Others maintain that it should be treated syntactically, but it has received relatively little attention in LFG. Indeed, word order freezing presents unique challenges within LFG since it resists a purely monotonic structural description. Using a notion of case indeterminacy as in Dalrymple et al. (2009), in this paper I propose a novel analysis of the phenomenon that I believe to be the first full account of word order freezing in a pure LFG framework. I will also compare it to a more intuitive account that I have developed, which uses LFG modified with a single OT constraint.

1 Introduction to word order freezing

The main goal of this paper is to present an LFG account of word order freezing alongside an account that uses LFG in conjunction with Optimality Theory (OT). Before we can do that, however, it is first necessary to give a brief introduction to word order freezing, the phenomenon by which normally free word order is frozen in the absence of disambiguating case information. Word order freezing has received increasing attention cross-linguistically in recent years. Bouma (2008, 2011) notes that in languages like Russian and Dutch, word order can vary freely unless case is ambiguous, at which point word order then steps in to determine how the clause should be interpreted. Tily (2010) discusses the phenomenon at length and points to Lee (2001) for Korean, Potts (2007) for Japanese, and Bouma (2011) for Dutch. I have argued elsewhere (Mahowald, 2011) that it may exist in Old English. That said, word order freezing is a tricky phenomenon to isolate, even in living languages, and it is difficult to conclude with certainty whether it indeed exists in Old English.

Let's take a look at how word order freezing works in Russian. Consider the below examples from Jakobson (1963) and repeated in Bloom (1999). In the examples in (1), both nominals are clearly marked. *Mama* is unambiguously nominative, and *papu* accusative. Thus, it is unproblematic for the object to be topicalized, as in (1b). It remains clear that *mama* is the subject despite the lack of SVO order.

[†]I gratefully thank my supervisor Mary Dalrymple as well as Louise Mycock, Ash Asudeh, the members of the Oxford Syntax Working Group, and the participants at LFG11 in Hong Kong.

(1) (nominals morphologically distinct)

(a) *Mama* *ljubit* *papu.*
Mother-NOM loves father-ACC
'The mother loves the father.'

(b) *Papu*$_{[TOPIC]}$ *ljubit* *mama.*
Father-ACC loves mother-NOM
'The mother loves the father.'

In (2), however, both nominals are ambiguous between nominative and accusative. As a result, the word order "freezes." The only possible reading is SVO, and (2), with its topicalized object, is said to be impossible.

(2) (all nominals morphologically ambiguous between NOM and ACC)

(a) *Mat'* *ljubit* *doč'.*
Mother loves daughter
'The mother loves the daughter.'

(b) *Doč'* *ljubit* *mat'.*
daughter loves mother
'The daughter loves the mother.'

(c) **Doč'*$_{[TOPIC]}$ *ljubit* *mat'.*
Daughter loves mother.

Although this offers a general overview of how word order freezing works, it may be an oversimplification. King (1995), for instance, notes that precisely the type of supposedly ungrammatical reading shown in (2c) is obtainable given the proper context. Similar context dependence is manifested in Dutch. While Bouma (2011) and others see word order freezing as a clear effect, others have suggested that it does not exist at all or exists only very weakly. Conversation with native Dutch speakers suggests that Bouma's examples referenced in (11) can be easily "unfrozen" through certain intonations much in the same way that a sentence like "Pizza Tom ate" is grammatical in English only in a very specific context with a very specific intonation. For example, imagine that sentence coming as a response to the question "Did Tom eat pizza?" If Tom ate a ton of pizza and the intonation is right, "Pizza Tom ate" would be perfectly grammatical. In a totally unmarked situation, however, it seems quite odd. Similarly, only when Bouma's examples are read with a "hat" intonation pattern is the freezing effect noticeable.

The apparent weakness of the constraint, combined with the fact that word order freezing seems to show up cross-linguistically, has led some to suggest that word order freezing is not a syntactic constraint at all but rather an effect that should be handled stochastically or merely as a processing constraint. Fundamentally, however, it has to do with syntax, and as such Bouma (2011) presents an interesting problem: "One needs to be able to model word order that is driven by IS [information structure] rather than by grammatical function, but at the same time this freedom has to be taken away when not obviously IS-related syntactic phenomena such as agreement and case are in a certain configuration." Indeed, while we must recognize that word order freezing is not black and white, it is a phenomenon that a theory of syntax should at least attempt to handle. And that is what I will set out to achieve here in an LFG framework.

One of the things that makes word order freezing difficult to analyze in LFG is the monotonicity requirement, as described in Bresnan (2001) and Dalrymple (2001). The function that maps the c-structure onto the f-structure can only accumulate. Thus, resultant f-structures become more and more specific as we add constraints. Ideally, we would want our rules to say that a word order becomes restricted, perhaps to SVO or SOV, only when both the prospective subject and prospective object have ambiguous case, as in $\{(\uparrow\text{CASE}) = \text{NOM} \mid (\uparrow\text{CASE}) = \text{ACC}\}$. LFG and the rules of logic, however, require that only one side of the disjunction can be accepted. At that point, the information that there was ever an ambiguity is lost. As we will see, the notion of case indeterminacy can help us solve the problem.

In proposing an LFG analysis of this complicated phenomenon, I will offer and compare two novel approaches: one within the traditional LFG framework and one that requires a variant of Optimality Theory within LFG in order to explain these phenomena. While the former has a certain appeal in its consistency with the basic tenets of LFG, including monotonicity, I argue that the latter is more elegant.

2 Russian word order freezing in LFG

2.1 Bloom's account

Before offering my own analysis, it will be useful to understand Bloom (1999) and its implications for Russian—as well as why the analysis is not adequate for other languages. Russian allows quite free word order in transitive sentences since objects can be topicalized and since Russian word order is more related to information-structural categories rather than grammatical function, as in English. Recall the examples from (1) and (2). Bloom assumes that in sentences (1a-b), which have clearly marked case, there is a rule for constructive case attached to each nominal. In Bloom's analysis for 1a, *Mama* would have (SUBJ ↑) and *papu* would have (OBJ ↑). That is, the former states "I am a subject" and the latter "I am an object." Moreover, Bloom also attaches a (↑GF) = SUBJ rule to unambiguously nominative nominals and a (↑GF) = OBJ rule to unambiguously accusative ones. He claims that this is necessary to account for agreement, as in Nordlinger (1998).

So Bloom's lexical entry for an unambiguously accusative noun *papu* 'father' is as below:

(3) papu N (↑PRED) = ‘FATHER’
(↑GEND) = MASC
(↑NUM) = SG
(↑PERS) = 3
(↑CASE) = ACC
(↑GF) = OBJ
(OBJ ↑)

The c-structure rule for each NP states either that the GF or grammatical function is constructed internally, or it is specified structurally in the c-structure rules. The trees that Bloom gives differ from the one below in that the disjunction is not specified and he leaves out some of the lexical rules attached to each nominal. Having said that, given the information he presents elsewhere, I believe that these trees capture the intuition behind his approach.

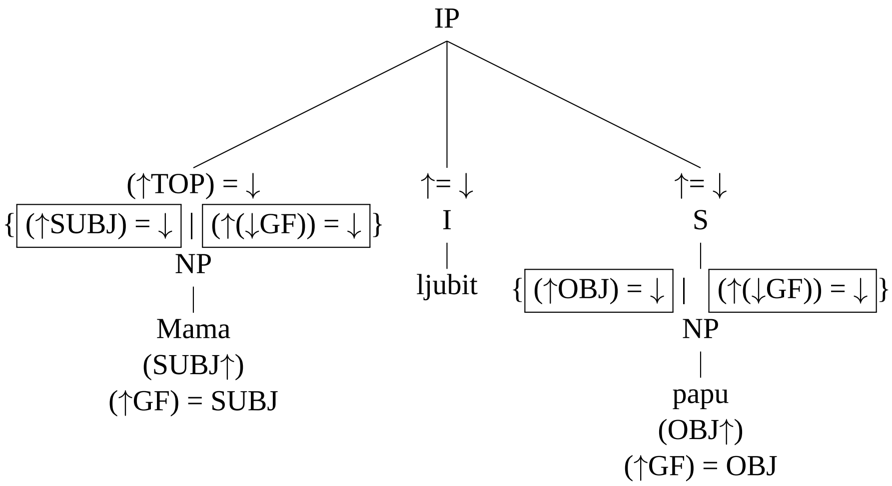
To understand how Bloom represents word order freezing in LFG, it will be useful to pursue the Russian examples along with their corresponding c-structures and f-structure in (4-7). The first two c-structures, (4a) and (5a), show the *differentiated* nominals for nominative and accusative. The rule {(↑SUBJ) = ↓ | (↑(↓GF)) = ↓} on the first nominal in the first two examples states “either I am my mother’s subject or “my daughter has transferred a GF upward and I am that GF for my mother.” So, in (4a), which is paired with (1a), *Mama* is unambiguously nominative and can thus declare itself a subject. Either side of the disjunction in {(↑SUBJ)= ↑ | (↑(↓GF))= ↓} can be taken with no difference in result. Likewise, *papu* is unambiguously accusative and declares itself an object. Again, either side of the disjunction {(↑OBJ)= ↑ | (↑(↓GF))= ↓} is permissible and a viable option without causing a contradiction.

In (1b), the order of subject and object is reversed. Nonetheless, *mama* still declares itself a subject (SUBJ↑) and *papu* declares itself an object (OBJ ↑). Thus, when faced with the disjunction {(↑SUBJ)= ↓ | (↑(↓GF))= ↓} for the NP headed by *papu*, it cannot be (↑SUBJ)=↓ because that would directly contradict (OBJ ↑). Therefore, the option taken must be (↑(↓GF))= ↓. In this case, (↓GF) = OBJ, so we get (↑OBJ) =↓ for the *papu* NP. A similar logic means that *mama* is still necessarily the subject even though it comes after the verb. All of this can be seen in (5).

Now, let us consider the word freezing instances in (2). *Mat’* and *doč’* are both ambiguous between nominative and accusative. Thus, they cannot project either (↑SUBJ) or (↑OBJ) via constructive case since it could just as easily project one as the other, and that would cause a contradiction. In other words, neither *Mat’* nor *doč* in the current system is able to mark itself as having any particular GF. Because no GF is passed up to the NP, the first respective options of the disjunctions {({(↑SUBJ)=↓ | (↑(↓GF))= ↓} and {(↑OBJ)=↓ | (↑(↓GF))= ↓} *must* be chosen since the second part is no longer an option. As a result, with these ambiguous instances in (2a) and (2b), the order is frozen as SVO. In (6), this works out fine. However,

(4) (Bloom, 1999, 65)

(a)

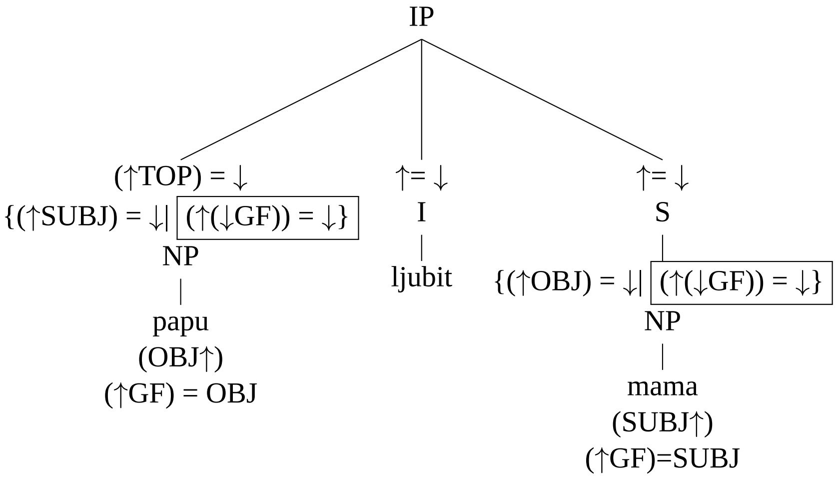


(b)

$$\left[\begin{array}{ll}
\textsc{pred} & \text{'LOVE}\left\langle\left(\uparrow\text{SUBJ}\right),\left(\uparrow\text{OBJ}\right)\right\rangle\text{'} \\
\textsc{tense} & \text{present} \\
\textsc{top} & [\;] \\
\textsc{subj} & \left[\begin{array}{ll}
\textsc{pred} & \text{'mother'} \\
\textsc{gend} & \text{fem} \\
\textsc{pers} & 3 \\
\textsc{num} & \text{sg} \\
\textsc{case} & \text{nom} \\
\textsc{gf} & \textsc{subj}
\end{array}\right] \\
\textsc{obj} & \left[\begin{array}{ll}
\textsc{pred} & \text{'father'} \\
\textsc{gend} & \text{masc} \\
\textsc{pers} & 3 \\
\textsc{num} & \text{sg} \\
\textsc{case} & \text{acc} \\
\textsc{gf} & \textsc{obj}
\end{array}\right]
\end{array}\right]$$

(5) (Bloom, 1999, 66)

(a)

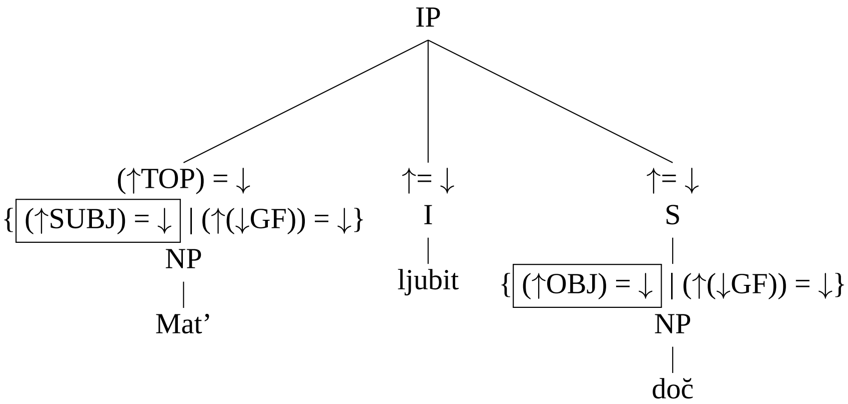


(b)

$$\begin{bmatrix} \text{PRED} & \text{'LOVE}\left\langle\left(\uparrow\text{SUBJ}\right),\left(\uparrow\text{OBJ}\right)\right\rangle\text{'} \\ \text{TENSE} & \text{present} \\ \text{TOP} & [\ ] \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'mother'} \\ \text{GEND} & \text{fem} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{CASE} & \text{nom} \\ \text{GF} & \text{SUBJ} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{'father'} \\ \text{GEND} & \text{masc} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{CASE} & \text{acc} \\ \text{GF} & \text{OBJ} \end{bmatrix} \end{bmatrix}$$

(6) (Bloom, 1999, 67)

(a)

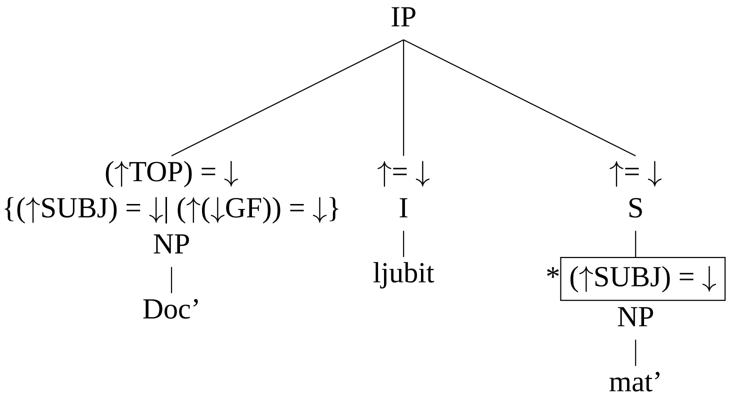


(b)

$$\begin{bmatrix} \textsc{pred} & \text{'LOVE}\left\langle\left(\uparrow\text{SUBJ}\right),\left(\uparrow\text{OBJ}\right)\right\rangle\text{'} \\ \textsc{tense} & \text{present} \\ \textsc{top} & [\ ] \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{'mother'} \\ \textsc{gend} & \text{fem} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \\ \textsc{case} & \left\{\text{nom, acc}\right\} \end{bmatrix} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{'daughter'} \\ \textsc{gend} & \text{fem} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \\ \textsc{case} & \left\{\text{nom, acc}\right\} \end{bmatrix} \end{bmatrix}$$

(7) (Bloom, 1999, 68)

(a)ungrammatical construction that arises when the second NP in this example is forced to act as the subject



(b)*

$$\left[\begin{array}{ll} \text{PRED} & \text{'LOVE}\left\langle\left(\uparrow\text{SUBJ}\right),\left(\uparrow\text{OBJ}\right)\right\rangle\text{'} \\ \text{TENSE} & \text{present} \\ \text{TOP} & [\;] \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'mother'} \\ \text{GEND} & \text{fem} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{CASE} & \left\{\text{nom, acc}\right\} \end{array}\right] \\ \text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{'daughter'} \\ \text{GEND} & \text{fem} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{CASE} & \left\{\text{nom, acc}\right\} \end{array}\right] \end{array}\right]$$

the c-structure paired with the f-structure in (7), in which the second nominal is the subject, is not possible since that would require taking the first option of the disjunction {(↑SUBJ)=↓ | (↑(↓GF))= ↓}, which we have already said cannot be done. In the c-structures that illustrate this, note that I have boxed the part(s) of the disjunction selected for each construction represented.

Bloom's analysis apparently works satisfactorily for Russian in which an ambiguously marked nom/acc object cannot appear pre-verbally in the topic position even when the other nominal element *is* unambiguously marked.[1] Consider (8a-c), also from Bloom (1999). In these examples, the object is ambiguous in case and, regardless of the subject's case status, it still cannot be topicalized unproblematically. The same cannot be said, however, for other languages. This lacuna will be returned to in Section 3.

(8) (a) *Mal'čik* *videl* *lošad'*
boy-NOM saw horse-nom/acc
'the boy saw the horse'

(b) ?*Lošad'*$_{[TOPIC]}$ *mal'čik* *videl.*
horse-nom/acc boy-NOM saw
? 'The boy saw the horse'

(c) ?*Lošad'*$_{[TOPIC]}$ *videl* *mal'čik.*
horse-nom/acc saw boy-NOM
? 'The boy saw the horse'

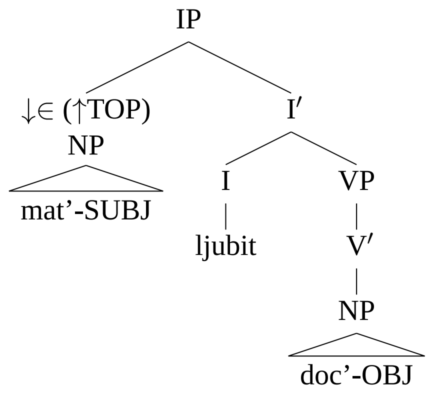
2.2 Information-structural account of Russian freezing

In personal communication, Louise Mycock has suggested that Bloom's analysis fails to give appropriate consideration to information structural factors. That is, she joins King (1995) in rejecting the idea that grammatical functions like SUBJ and OBJ even have structurally assigned positions in Russian c-structure rules. Rather, it is information-structural constraints on discourse functions that determine word order.

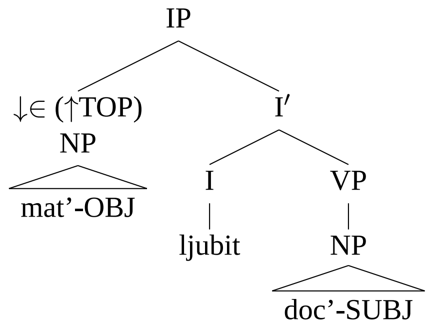
For King (1995), the default order for Russian is actually V-first. The fact that a nominal frequently appears pre-verbally is an artifact of there being a TOPIC position in Spec,IP that is marked ↓ ∈ (↑TOP) and (↑GF) = ↓. These rules suggest that the doubly ambiguous Russian sentences could receive trees as in (9) and (10), which are based on similarly structured trees for different sentences in King (1995, 206, 224).

[1]Again, note the exceptions pointed out in King's work.

(9) SVO



(10) OVS (assumes that the NP1 is marked by context as OBJ)



Contrary to what Bloom claims, the grammatical function in these trees is not determined by c-structure. Rather, particular c-structure positions are associated with particular discourse functions. This still allows a morphologically ambiguous sentence to be disambiguated. In a completely unmarked context in which it is not immediately clear which element is being used as a topic, Lambrecht (1994, 132) provides a way to tell. He posits both that topic followed by comment[2] is a default pragmatic ordering and that subjects are topics in an unmarked context. In Russian, we already know from King (1995) that the topic appears in Spec,IP. We add to that knowledge the fact that, cross-linguistically, topics are usually subjects. We then arrive at a way to disambiguate an ambiguous clause. That is, if it is not clear from context which of two nominals is acting as SUBJ, it can be assumed that it is the one that is also TOPIC. This analysis helps clear up an example like (9): it is natural that the first of the two ambiguous nominals will be taken to be both TOPIC and SUBJ, whereas the second NP will be taken to be the OBJ and part of the comment.

How then can we explain (10)? This is a structure that Bloom's analysis explicitly disallows. But, as King (1995, 2, fn. 2) points out, discourse effects can easily override the freezing effects. If indeed the first nominal is clearly an object from the context of the sentence, then we can conclude that it is both an OBJ *and* a TOPIC since it is in TOPIC position. Even though this is less common and less

[2] *Comment*, in effect, refers to that which is being said about the topic. See Lambrecht (1994).

canonical than a configuration in which the topic is a subject, this construction is perfectly legitimate provided that the context calls for it. There is no need to turn to c-structural GF assignment as in Bloom. But Lambrecht's idea that SUBJ and TOPIC are interwoven in this way makes it easy to see how Bloom comes to associate Spec,IP with (↑GF) = (↑SUBJ).[3]

3 Dutch word order freezing

Unlike with Russian, in Dutch only when *both* nominal arguments of a transitive verb are ambiguous for case *and* there is no other disambiguating information does the word order freeze. Let's examine the following Dutch sentences from Bouma (2011).[4]

(11) (a) *De Rode Duivels verslaan Oranje.*
The Red Devils.PL beat.PL Orange.SG
'The Red Devils beats the Dutch national football team.'

(b) *De Rode Duivels verslaat Oranje.*
The Red Devils.PL beat.SG Orange.SG
'The Dutch national football team beats the Red Devils.'

(c) *België verslaat Oranje.*
Belgium.SG beat.SG Orange.SG
'Belgium beats the Dutch national football team.'[5]
NOT: 'The Dutch national football team beats Belgium.'

Note that, while *De Rode Duivels* and *Oranje* are both themselves ambiguous for case, the distinction between (a) and (b) suggests that the mere presence of disambiguating verb agreement is enough to allow unambiguous meanings. In the case of (c), however, in which the verb is of no help in deciding what is the subject and what is the object, we see word order freezing. The SVO order is frozen.

Bouma (2011) handles this through a rather complicated bidirectional OT analysis. Still, it should be readily apparent that Bloom's LFG analysis cannot be applied to Dutch in the same way that we saw for Russian. Likewise, applying Bloom's c-structure and lexical rules to Old English or Dutch would cause freezing to occur where it need not: for instance, in a sentence with two nom/acc ambiguous nominals but in which verb agreement means that only one can be the subject. Fundamentally, we do not wish to enforce word order freezing only when we have ambiguous case. As I stated previously, this presents a challenge for a monotonic framework like LFG.

[3]See also Alsagoff (1992) for an LFG account of how SUBJ and TOPIC are linked in Malay.

[4]Bouma points out that he is assuming a "hat" (rising on the first nominal and falling on the second) intonation pattern for all three of these sentences. Without that intonation, the freezing effect will not necessarily be achieved.

[5]The Dutch national football team is known as The Orange.

4 Word order freezing in LFG

4.1 Case underspecification

So how can we handle this data in LFG? I will ultimately come down on the side of using a special variant of OT. First, though, I will explore how freezing could be handled in LFG without the use of OT constraints. In doing so, I will draw on Dalrymple et al. (2009), who reject a traditional account of case ambiguity and instead turn to indeterminacy by feature underspecification. That is, instead of representing an ambiguous nominal as {(↑CASE) = NOM | (↑CASE) = ACC}, they represent case by features. The Russian ambiguously nom/acc *mat'* 'mother' would have the features (↑CASE GEN) = − and (↑CASE DAT) = − and so on. The feature values for (↑CASE NOM) and (↑CASE ACC) would remain unspecified if and until other information came along to specify it. For instance, a nominative demonstrative could assign the values(↑CASE NOM) = + and (↑CASE ACC) = −.

If no such disambiguating features are present, then the noun would remain underspecified for case. With this proposal, Dalrymple et al. (2009) solve the so-called transitivity problem exemplified in German in (12). *Hilft* takes a dative object and *Papageien* is ambiguously acc/dat. The noun *Papageien* could meet the verb's dative requirement if its case was (↑CASE) = {ACC, DAT} *and* meet the determiner *die*'s accusative requirement with the same constraint (↑CASE) = {ACC, DAT}. This is problematic.

(12)	*Er*	*hilft*	**die/den*	*Papageien*
	he	helps	*the-ACC/the-DAT	parrots-ACC/DAT
	'he helps the parrots'			

The feature underspecification approach would state initially that *Papageien* is −GEN and −NOM, which would allow it to be either accusative or dative. The presence of a dative verb would then add the feature −ACC. Thus, the determiner in this example could not be *die*-ACC since that would make the nominal impossibly −ACC as well as +ACC. This approach also solves the second-order indeterminacy problem, whose details can be found in the 2009 paper.

4.2 Word order freezing rules

Through feature underspecification, it is possible to construct a series of rules that model word order freezing. For purposes of simplicity, I will address only nom/acc ambiguity in the examples below, but the rules could in theory be extended for any other type of case ambiguity. To summarize, each nominal can be either a) differentiated for case or b) ambiguous between nominative and accusative. We will assume that both nominals are morphologically negative for dative and genitive. Crucially, the freezing effect takes place only if both nominals match the number requirement imposed by the verb—a point we will return to below. A simplified version of the rules attached to a NOM/ACC verb appears in (13). Note that we could use GF1 and GF2 in these rules in place of SUBJ and OBJ, but it is equivalent and easier to explain the rules when we treat one GF as SUBJ and one as OBJ.

(13) $$\left\{ (\uparrow\text{SUBJ CASE acc}) =_c - \;\middle|\; \begin{array}{c} \neg(\uparrow\text{SUBJ CASE acc}) = - \\ \left\{ (\uparrow\text{OBJ CASE nom}) =_c - \;\middle|\; \begin{array}{c} \neg(\uparrow\text{OBJ CASE nom}) = - \\ \text{SUBJ} <_f \text{OBJ} \end{array} \right\} \end{array} \right\}$$

if-then form:
- if ¬(↑SUBJ CASE acc) = −
  - then if ¬(↑OBJ CASE nom) = −
    - then SUBJ $<_f$ OBJ

A bit of explanation will help clarify these rules. The first part of the first disjunction is (↑SUBJ CASE acc) = −. If this is true (and we are assuming that both nominals are negative for dative and genitive) for the first nominal (GF1), then the only thing that it can rightfully be without contradiction is the subject. This is an instance where there would be no ambiguity. That is, if the nominal represented by GF1 is negative for accusative case, the other disjuncts need not apply since there is no ambiguity possible even if the OBJ is ambiguous for case.

The second half of the main disjunction assumes that the SUBJ is not in fact negative for accusative.[6] That said, as long as (↑OBJ CASE nom) = − holds, we still escape ambiguity.

However, if it is not the case that (↑OBJ CASE nom) = −, we are forced to choose the right side of the smaller disjunction and the freezing effect occurs. When we have the two-way ambiguous condition, the SUBJ is stipulated through f-precedence as preceding the OBJ.[7]

Note, however, that this still does not solve the problem of how to ensure that the freezing effect obtains only when there is no other agreement information, like number, to disambiguate. By adding extra specifications to the rules, though, we can do just that. An example is shown in (14), where we assume that the rule is attached to a verb that is constrained to have a singular subject:(↑SUBJ NUM) $=_c$ sg.

(14) $$\left\{ (\uparrow\text{SUBJ CASE acc}) =_c \text{-} \;\middle|\; \begin{array}{c} \neg(\uparrow\text{SUBJ CASE acc}) = \text{-} \\ \left\{ (\uparrow\text{OBJ CASE nom}) =_c \text{-} \;\middle|\; \begin{array}{c} \neg(\uparrow\text{OBJ CASE nom}) = \text{-} \\ \left\{ (\uparrow\text{OBJ NUM}) =_c \text{pl} \;\middle|\; \begin{array}{c} (\uparrow\text{OBJ NUM}) =_c \text{sg} \\ \text{SUBJ} <_f \text{OBJ} \end{array} \right\} \end{array} \right\} \end{array} \right\}$$

---

[6]The negated construction ¬(↑SUBJ CASE ACC) = − is used rather than (↑SUBJ CASE ACC) = + because it is not necessary that a positive value be instantiated in order for ambiguity to occur. It only has to be not instantiated as negative. The only thing that can instantiate ACC = + is the verb, and the presence of other disambiguating factors, like an accusative demonstrative, would serve merely to eliminate all the case options except ACC.

[7]The notation used here indicates f-precedence. F-precedence is defined by Kaplan and Zaenen (2003) as follows: "For any f-structures *f* and *g*, *f* f-precedes *g*(written $f <_f g$) if and only if all the c-structure nodes that map to *f* precede all the c-structure nodes that map to *g*." F-precedence has important theoretical implications for LFG since left-to-right ordering rules typically apply only in the c-structure but not in the f-structure. The use of f-precedence allows ordering constraints to flow between the c-structure and the f-structure. See also Zaenen and Kaplan (1995).

Let's see how this works. For an example in which both nominals are unambiguous, like (1a), the left side of the disjunction applies and there is no freezing effect:

(15) *Mama* *ljubit* *papu*
Mother-NOM loves father-ACC
'The mother loves the father'

$$\left\{ \boxed{(\uparrow\text{SUBJ CASE acc}) =_c -} \;\Big|\; \left\{ (\uparrow\text{OBJ CASE nom}) =_c - \;\Big|\; \begin{matrix} \neg(\uparrow\text{SUBJ CASE acc}) = - \\ \neg(\uparrow\text{OBJ CASE nom}) = - \\ \left\{ (\uparrow\text{OBJ NUM}) =_c \text{pl} \;\Big|\; \begin{matrix}(\uparrow\text{OBJ NUM}) =_c \text{sg}\\ \text{SUBJ} <_f \text{OBJ}\end{matrix} \right\}\end{matrix} \right\} \right\}$$

What happens to our Dutch example where number agreement serves to block the freezing effect? Compare (16) and (17). In the former, we are forced to take the "ambiguous" options for SUBJ CASE and OBJ CASE. However, because the object satisfies the constraint $(\uparrow$OBJ NUM$) =_c$ pl (and we are dealing with a verb that requires a singular subject), the freezing effect does not obtain.

On the other hand, (17) shows a situation in which both nominals are ambiguous but in which $(\uparrow$OBJ NUM$) =_c$ sg is satisfied. As a result, the f-precedence freezing rule is in effect. In a similar way, any other sort of agreement, like person or animacy, can be taken into account by adding it into the rules.

(16) *De* *Rode* *Duivels* *verslaat* *Oranje.*
The Red Devils.PL beats.SG $\boxed{\text{the Orange.SG}}$
'The Dutch national football team beats the Red Devils.'

$$\left\{ (\uparrow\text{SUBJ CASE acc}) =_c - \;\Big|\; \left\{ (\uparrow\text{OBJ CASE nom}) =_c - \;\Big|\; \begin{matrix} \boxed{\neg(\uparrow\text{SUBJ CASE acc}) = -} \\ \boxed{\neg(\uparrow\text{OBJ CASE nom}) = -} \\ \left\{ \boxed{(\uparrow\text{OBJ NUM}) =_c \text{pl}} \;\Big|\; \begin{matrix}(\uparrow\text{OBJ NUM}) =_c \text{sg}\\ \text{SUBJ} <_f \text{OBJ}\end{matrix} \right\}\end{matrix} \right\} \right\}$$

(17) *België* *verslaat* *Oranje.*
$\boxed{\text{Belgium.SG}}$ beat.SG Orange.SG
'Belgium beats the Dutch national football team.'
NOT: The Dutch national football team beat Belgium.

$$\left\{ (\uparrow\text{SUBJ CASE acc}) =_c - \;\Big|\; \left\{ (\uparrow\text{OBJ CASE nom}) =_c - \;\Big|\; \begin{matrix} \boxed{\neg(\uparrow\text{SUBJ CASE acc}) = -} \\ \boxed{\neg(\uparrow\text{OBJ CASE nom}) = -} \\ \left\{ (\uparrow\text{OBJ NUM}) =_c \text{pl} \;\Big|\; \begin{matrix}\boxed{(\uparrow\text{OBJ NUM}) =_c \text{sg}}\\ \boxed{\text{SUBJ} <_f \text{OBJ}}\end{matrix} \right\}\end{matrix} \right\} \right\}$$

Of course, this could make the rules quite unwieldy. For instance, there can also be accusative/dative ambiguity. Thus, every verb that takes three arguments—a nominative subject, an accusative object, and a dative object—would have an extremely complicated set of rules attached to it. In the next section, I will show how OT can offer a more elegant solution.

It is worth noting here that this analysis is entirely consistent with the information-structural account of word order freezing presented for Russian as an alternative to Bloom (1999). For Russian, we can easily modify the rules to reflect that Spec,IP (which is typically where the first nominal is found) is not necessarily associated with (↑SUBJ) at all but is simply a TOPIC position. If we then accept the Lambrecht argument that SUBJ and TOPIC are linked by default, the "frozen" SVO order is no longer a mystery but is merely a by-product of the information-structural effect.

5 Word order freezing in LFG with OT

OT points the way to a simpler treatment. The OT that I implement here is not exactly Optimality Theory in the classical sense, as in Prince and Smolensky (2004). Rather, it is based on the XLE implementation of OT constraints. Crouch et al. (2008) describe the OT options in XLE as an instantiation of the "most common mechanism used in Optimality Theory."[8] For word order freezing, I propose that we institute a weak constraint for SUBJ $<_f$ OBJ that could be introduced and applied *only* in instances in which no unambiguous parse is derived for a given sentence. Although this arguably violates LFG's commitment to monotonicity, it is a far simpler way to explain word order freezing.

We can implement this constraint through a simple OT tableau.[9] For each sentence, we can imagine a tableau like the one shown in (18).

(18)

	Consistency	SUBJ $<_f$ OBJ
a		
b		

A and B represent parses of the same sentence. The first column represents the dominant constraint and stands for consistency in the LFG sense. The second column represents the less highly ranked constraint that SUBJ $<_f$ OBJ. In OT terms Consistency »» SUBJ $<_f$ OBJ. Thus, if consistency is violated at all in a given analysis, that analysis is immediately eliminated from contention. If consistency is satisfied for both parses, but one parse has SUBJ $<_f$ OBJ and the other has OBJ $<_f$ SUBJ, the optimal analysis is the one in which SUBJ $<_f$ OBJ.

Let's return to the examples and f-structures from the Dutch examples from above. For a sentence like (19) where number agreement can disambiguate the nominals, we get the two possible f-structures shown in (20). (20a) violates the SUBJ $<_f$ OBJ constraint that states that the subject should precede the object. The f-structure (20b), on the other hand, does indeed have SO order but violates consistency since its verb requries a singular subject but its subject is plural. This, of course, is a crucial violation. Thus, (20a) is accepted and (20b) is dispreferred.

[8]In another departure from traditional OT, XLE allows preference marks alongside dispreference marks.

[9]Besides Prince and Smolensky (2004), also see Kager (1999) for a general introduction and Kuhn (2003) for a specifically syntactic approach to OT.

(19) *De Rode Duivels verslaat Oranje.*
The Red Devils.PL beats.SG the Orange.SG
'The Dutch national football team beats the Red Devils.'

(20) (a) $\left[\begin{array}{ll} \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{'Orange'} \\ \textsc{case} & \text{nom} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \end{array}\right] \\ \textsc{pred} & \text{'beat}\left\langle\left(\uparrow\textsc{subj}\right)\left(\uparrow\textsc{obj}\right)\right\rangle\text{'} \\ \textsc{obj} & \left[\begin{array}{ll} \textsc{pred} & \text{'Red Devils'} \\ \textsc{case} & \text{acc} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{pl} \end{array}\right] \end{array}\right]$ (b) * $\left[\begin{array}{ll} \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{'Red Devils'} \\ \textsc{case} & \text{nom} \\ \textsc{pers} & 3 \\ {*}\textsc{num} & \text{sg/pl} \end{array}\right] \\ \textsc{pred} & \text{'beat}\left\langle\left(\uparrow\textsc{subj}\right)\left(\uparrow\textsc{obj}\right)\right\rangle\text{'} \\ \textsc{obj} & \left[\begin{array}{ll} \textsc{pred} & \text{'Orange'} \\ \textsc{case} & \text{acc} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{pl} \end{array}\right] \end{array}\right]$

(21)

	Consistency	SUBJ $<_f$ OBJ
☞(20a)		*
20b	*!	

(22) shows an altogether different situation. Here, there is no help given by number agreement since the verb and both nominals are singular. Neither f-structure in (23) violates consistency. But (22b) violates the SUBJ $<_f$ OBJ constraint since its object comes before the subject. Because there are no other violations, this becomes a crucial violation and we prefer (22a). This very simple OT analysis achieves what we otherwise need quite complex LFG constraints to handle.

(22) *België verslaat Oranje.*
Belgium.SG beat.SG Orange.SG
'Belgium beats the Dutch national football team.'

(23) (a) $\left[\begin{array}{ll} \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{'Belgium'} \\ \textsc{case} & \text{nominative} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \end{array}\right] \\ \textsc{pred} & \text{'beat}\left\langle\left(\uparrow\textsc{subj}\right)\left(\uparrow\textsc{obj}\right)\right\rangle\text{'} \\ \textsc{tense} & \text{present} \\ \textsc{obj} & \left[\begin{array}{ll} \textsc{pred} & \text{'Orange'} \\ \textsc{case} & \text{acc} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \end{array}\right] \end{array}\right]$ (b) * $\left[\begin{array}{ll} \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{'Orange'} \\ \textsc{case} & \text{nominative} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \end{array}\right] \\ \textsc{pred} & \text{'beat}\left\langle\left(\uparrow\textsc{subj}\right)\left(\uparrow\textsc{obj}\right)\right\rangle\text{'} \\ \textsc{tense} & \text{present} \\ \textsc{obj} & \left[\begin{array}{ll} \textsc{pred} & \text{'Belgium'} \\ \textsc{case} & \text{acc} \\ \textsc{pers} & 3 \\ \textsc{num} & \text{sg} \end{array}\right] \end{array}\right]$

(24)

	Consistency	SUBJ $<_f$ OBJ
☞(23a)		
(23b)		*!

6 Conclusion

Ultimately, the word order freezing data can be explained effectively through either the OT constraints in Section 5 or through the pure LFG description in Section 2. Nonetheless, questions remain as to whether word order freezing is a syntactic phenomenon at all. Bouma (2011) provides an overview of a debate between those who see it as syntactic and those who see it as a processing constraint. Those that view freezing as a processing constraint point to the fact that it can easily be overcome by prosodic and pragmatic factors. Indeed, it can be a relatively weak constraint. Bouma, however, notes that the effect manifests itself in language as soon as morphological case fails to disambiguate the reading. He proposes a bidirectional OT model of language by which both the speaker and the hearer conspire to avoid meaningful ambiguity. In brief, it more or less states that, given a free word order language, if the hearer does not have morphological or other information to disambiguate the clause, she will assume that the speaker is using word order cues. The speaker will make the same observation, and both parties will arrive at an unambiguous interpretation of the clause.

Tily (2010) provides experimental evidence for this process in Japanese. In a series of timed reading experiments, he finds that word order has little effect on clauses in which case is unambiguously marked. When case markings are removed, however, the reader slows down considerably when faced with a pre-subject object. I do not have space to do justice to the work, but the evidence strongly suggests that comprehenders turn to word order when and only when case marking is ambiguous. The OT approach that I have presented models this process in a way that is quite intuitive. That is, we could say that, only when comprehenders fail to encounter a crucial violation of consistency do they turn to the weaker subject-object constraint. If morphology fails to deliver the necessary information, the speaker and comprehender will turn to word order even during online processing. That said, as Sag and Wasow (2007) and others note, most psycholinguistic evidence favors a model-theoretic approach to language in order to account for the effects seen in online processing—an approach not consistent with the OT approach presented here. In that sense, the "pure" LFG approach is perhaps worth considering, even though it requires a much more complex set of constraints. Further work is needed to assess the two approaches in terms of both psychological reality as well as computational tractability.

Regardless of which treatment emerges as the most satisfactory, I believe that this paper has demonstrated the possibilities available for analyzing word order freezing syntactically in a way that is effective and easily implementable in parsing software like XLE.

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DERIVED ARGUMENTS

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Abstract

The distinction between arguments and adjuncts is fundamental to most linguistic theories, yet the distinction is not always clear. In addition to clear arguments and clear adjuncts, there are a number of unclear, in-between cases. These cases include passive agents, benefactives, directionals, and a number of other types of phrases. We argue that the in-between status of the unclear cases can be explained if they are analyzed as derived arguments; i.e., arguments that are added to verbs at the grammatical level of argument structure.

1 Introduction

The distinction between arguments and adjuncts is crucial in linguistics. Psycholinguistic studies indicate that the distinction is also psycho-linguistically real (see Tutunjian and Boland 2008). In LFG, the distinction is relevant throughout the grammar: In the lexicon and at a(rgument)-structure, the lexical entries contain information about arguments only. At f(unctional)-structure, the classification of functions is partly based on whether they are arguments or adjuncts. At c-structure, arguments are typically attached closer to the verb than adjuncts.

There are no universally agreed-upon definitions of arguments and adjuncts, even though the concepts are important to linguistic theory. However, the general intuition is that, roughly speaking, arguments are the central, necessary participants in the event, whereas adjuncts provide "extra" information about where, when and how the event occurred. Here are some representative definitions from syntax textbooks:

> "Adjuncts are always optional, whereas complements are frequently obligatory. The difference between them is that a complement is a phrase which is *selected* by the head, and therefore has an especially close relationship with the head; adjuncts, on the other hand, are more like 'bolt-on' extra pieces of information and don't have a particularly close relationship with the head." (Tallerman, 2005, 98)
> "This distinction between arguments and adjuncts is important, but not always easy to make. The basic difference is that arguments are closely associated with the meaning of the predicate itself, while adjuncts are not." (Kroeger, 2004, 10)
> "The arguments are the participants minimally involved in the activity or state expressed by the predicate." (Haegeman, 1994, 44)
> "Verbs and adjectives, and some nouns, express properties of things [...] or relationships between things [...]. The arguments are the phrases that denote the things that have such properties or are involved in such relationships." (Culicover, 1997, 16)
> "The entities (which can be abstract) participating in the [predicate] relation are called arguments." (Carnie, 2006, 51)
> "From a semantic perspective, subjects and complements share in common the fact that they generally represent entities directly involved in

> the particular action or event described by the predicate: to use the relevant semantic terminology, we can say that subjects and complements are **arguments** of the predicate with which they are associated. [...] An expression which serves to provide (optional) additional information about the time or place (or manner, or purpose etc.) of an activity or event is said to serve as an **adjunct**. (Radford, 2004, 3–4)

There is widespread agreement that the distinction between arguments and adjuncts is important, and the basic intuition behind this distinction is clear. However, there are certain types of phrases that fall in between proto-typical arguments and adjuncts. For example, Grimshaw (1990) notes that event nominal possessives (*the enemy's* destruction of the city) and passive agents (the city was destroyed *by the enemy*) are neither proto-typical arguments nor proto-typical adjuncts. She refers to these classes of phrases as *argument-adjuncts*.

Dowty (2003) points out that the distinction between complements (arguments) and adjuncts is fluid, and he argues for a dual analysis, where "virtually all" complements can be analyzed as adjuncts, and adjuncts can be analyzed as complements. He specifically discusses different uses of *to*-PPs and the agentive phrase in passives. He suggests that a dual analysis is what makes sense formally, and we should leave to psycho-linguistics to determine how the cases differ in "mental processing".

Hedberg and DeArmond (2009) argue that we need to distinguish between not two, but three types of categories: adjuncts, primary complements and secondary complements. They argue this based on two syntactic tests: pseudoclefting and preposition stranding.

Zaenen and Crouch (2009) discuss *semantically restricted* OBL*iques* in LFG and suggest that they be classified as adjuncts. LFG distinguishes between two types of OBL: idiosyncratically marked OBL and semantically marked OBL. Idiosyncratically marked OBLs are marked with a 'quirky' case marker or preposition; the marker is not (fully) semantically predictable. For semantically marked OBLs, the preposition or case marker is meaningful. An example of the former is the *in*-PP in *trust in NP*, and an example of the latter is the *to*-PP in *give NP to NP*. Zaenen and Crouch (2009) argue that idiosyncractically marked OBL can be classified as such, but semantic OBL should be classified as ADJ. One of the arguments they provide for collapsing the categories is that that classic tests for argumenthood often do not work unambiguously.

The authors listed above and others (e.g., Whaley 1993; McKercher 2001; Larson 1998; Croft 2001) have in common that they note the difficulties involved in distinguishing between arguments and adjuncts. Some authors suggest the distinction may not be useful at all, since it so unclear (e.g., McKercher 2001; Dowty 2003; Larson 1998), and others simply note that some types of phrases are difficult to classify. Certain cases do seem clearer than others. For example, time, place, manner and purpose modifiers such as the ones exemplified (1) are uncontroversial adjuncts:

(1) a. Susan graduated *last year*. (time)
b. Mandy read a book *in the park*. (place)
c. Lisa sings *very well*. (manner)
d. Sarah kicked the wall *in order to let out her aggressions*. (purpose)

Of course, time, place and manner phrases may be arguments as well, as in (2):

(2) a. The meeting lasted *for hours*. (time)
b. Jenna keeps her money *in the kitchen*. (place)
c. Sally behaved *impeccably*. (manner)

There are also some types of phrases that seem to be uncontroversial arguments; for example, agent subject NPs (such as *the woman* in (3)) and patient object NPs (such as *the steak* in (3)) of transitive verbs:

(3) The woman devoured the steak.

The following types of phrases are more difficult to classify: passive *by*-phrases, benefactives, *with*-themes, instruments, experiencers, directionals, and possessive phrases in event nominals. These cases are discussed in section 3, but first we present diagnostics that have been proposed in the literature to distinguish between arguments and adjuncts in section 2. Finally, we suggest in section 4 that phrases that fall in between clear arguments and clear adjuncts are derived arguments.

2 Argumenthood tests

This section briefly reviews a number of diagnostics that have been proposed for distinguishing between arguments and adjuncts. The most basic intuition behind the argument-adjunct distinction is that arguments denote core participants of an event, whereas adjuncts do not. This is a semantic test, as it refers to intuitions about the meaning of verbs. We call it the CORE PARTICIPANTS test. If we compare an eating event to a sleeping event, the eating event involves two entities (the eater and the eaten), but the sleeping event involves only one entity (the sleeper). The two verbs thus differ in how many participants are understood to be involved in the event. The events will also take place at some time in some location, but that is more generally true of events. This intuition of whether a participant is conceptually necessary is very basic, but it is not always useful. For example, an event described by the verb *saddle* involves three entities: the saddler, the saddle and the saddled (usually a horse). However, the verb only takes two arguments. Verbs like *saddle* have been discussed widely in the literature, see Bresnan 1982, Hale and Keyser 2002 and others.

The main problem that arises in connection with the core participants test can be solved if we consider the VERB SPECIFICITY test (Koenig et al., 2003). Even though an event normally takes place in some place at some time, time and place expressions are usually not arguments. What distinguishes true arguments from such expressions is that arguments are tied to specific verbs or verb classes. For example, only verbs that can be performed volitionally can take an agent argument. Time and place expressions, on the other hand, can be added to the description of any event; they are not tied to specific verbs or verb classes.

Another test concerns the semantic content of the preposition. The more semantically contentful the preposition is in the PP accompanying a certain verb, the more likely it is to mark an adjunct (Pollard and Sag 1987, 136; Wechsler 1991, 123; and others). On the other hand, if it is more difficult to see how the preposition used relates to its basic meaning, then the preposition is more likely to mark an argument. We call this the PREPOSITIONAL CONTENT test. Compare (4) to (5–6):

(4) Louise rested {in the forest/beside the big tree/on the lawn}.

(5) a. Kim trusted in her own abilities
b. * Kim trusted on her own abilities.

(6) a. Kim relied on her own abilities
b. * Kim relied in her own abilities.

The prepositions in (4) are semantically contentful, in the sense that *in, beside,* and *on* are used with their basic meanings, meanings that remain the same across a variety of contexts. This can be contrasted with the prepositions *in* in (5) and *on* in (6). The basic meanings of *in* and *on* do not seem relevant here. The PPs in (4) are adjuncts and the PPs in (5–6) are arguments. This test is not without problems. First, it is not always easy to determine what the basic meanings of prepositions are. Second, there are cases when those basic meanings are used, and the PP is still an argument:

(7) Martha lives {beside the train station/in France/on a mountain}.

The PPs in (7) seem to make use of the basic meanings of the prepositions *beside*, *in* and *on*, yet the PP is an argument as determined by other tests (e.g., the CORE PARTICIPANTS test). This is of course because *live* (in this sense) takes a location as its argument, and the prepositions in question can all mark locations.

The next test is related to the PREPOSITIONAL CONTENT test, and we call it the FIXED PREPOSITION test. If the verb asks for a specific preposition, the PP is an argument (Wechsler, 1991, 123). For example, *trust* and *rely* require *in* and *on*, respectively (5–6), and the PPs are arguments. The verb places no requirements on the preposition in (4), and the PP is an adjunct. The verb *live* in (7) does not require a specific preposition, but it does require a locative phrase; non-locative prepositions are not permitted. The preposition in (7) is therefore restricted, but not fixed.

The OPTIONALITY test is the most common test for distinguishing adjuncts from arguments: adjuncts are syntactically optional, arguments are not. Consider (8):

(8) Sammy destroyed my reputation last year.

The subject *Sammy* and the object *my reputation* are obligatory in (8), but the time expression *last year* is optional. *Sammy* and *my reputation* are arguments, but *last year* is an adjunct. However, some arguments are also optional:

(9) a. John likes to drink (tea).

b. Mandy ate (a pizza).

The direct objects in (9) are optional, even though they are arguments. Even though they are optional, they are semantically obligatory, in the sense that in an eating event, something must be eaten, and in a drinking event, something must get drunk (recall the CORE PARTICPANTS TEST). Given examples like (9), we can adopt a weaker version of the test: if a phrase is obligatory, it is an argument. However, this version of the test is also problematic, as there are expressions that seem to require an adjunct (Jackendoff, 1990):

(10) a. Selma elbowed her way into the crowd.

b. *Selma elbowed her way.

Example (10) illustrates the *way*-construction, which requires a PP adjunct, such as *into the crowd* in (10). There are also other examples of obligatory adjuncts, as discussed by Goldberg and Ackerman (2001). Since some arguments are optional and some adjuncts are obligatory, the OPTIONALITY test must be used with care.

According to the ITERATIVITY test, adjuncts can be iterated whereas arguments cannot. The following example is from Bresnan (1982):

(11) Fred deftly [Manner] handed a toy to the baby by reaching behind his back [Manner] over lunch [Temp] at noon [Temp] in a restaurant [Loc] last Sunday [Temp].

Example (11) shows that adjuncts with the same function (e.g., temporal) can be repeated. However, arguments are *unique*; there can only be one subject, one (direct) object, etc. Zaenen and Crouch (2009) point out that this test requires agreement of what counts as the same or different. They compare the following examples:

(12) I count on you, on your kindness.

(13) He lives in France, in a small village.

The phrase *on you* in (12) is an argument and *in France* in (13) is an adjunct. In (12), we must then analyze *on your kindness* as a parenthetical, whereas *in a small village* in (13) can be analyzed as a second instance of a locative adjunct. Apart from the assumption that arguments are unique, it is unclear what motivates this analysis. Even though the ITERATIVITY test is useful, we must conclude that it is problematic.

The following test is the ALTERNATION test. Arguments can alternate with subjects and objects, but adjuncts cannot. Note that the claim is not that all arguments can alternate, the claim is that if a phrase can alternate, then it is an argument. Consider the next examples:

(14) a. The garden swarmed with bees.

b. Bees swarmed in the garden.

(15) a. Mandy gave a present to Lisa.

b. Mandy gave Lisa a present.

The PP *with bees* alternates with the subject in (14), and *to Lisa* alternates with the object in (15). The PPs in (14–15) should therefore be analyzed as arguments, according to the ALTERNATION test. Although it seems reasonable to analyze *with bees* and *to Lisa* above as arguments, some cases are less clear:

(16) a. Linda wrote a poem for Kenny.

b. Linda wrote Kenny a poem.

The PP *for Kenny* does not seem to be an argument according to some of the previous tests mentioned; e.g., OPTIONALITY, PREPOSITIONAL CONTENT, and CORE PARTICIPANTS. Example (16) thus illustrates that it is unclear whether the ALTERNATION test works for separating arguments from adjuncts.

According to the PREPOSITION STRANDING test (Hedberg and DeArmond, 2009; Huang, 1982), arguments allow preposition stranding, whereas adjuncts do not:

(17) a. I rely on Mario.

b. Who do you rely on?

(18) a. I talked about Canada Day.

b. What day did you talk about?

(19) a. I saw her on Canada Day.

b. *What day did you see her on?

The preposition can be left behind in examples like (17–18), but not in (19), and we conclude that *on Mario* and *about Canada Day* in (17–18) are arguments but *on Canada Day* in (19) is an adjunct.

Another classic test is the VP ANAPHORA test: adjuncts may be added to ‘do so’ clauses, but arguments may not (Lakoff and Ross 1966; Baker 1978, and others):

(20) John ate the cake yesterday and Bill did so today.

(21) *John ate the cake and Bill did so the frosting.

In (20), *today* is added and contrasted with *yesterday*, and *yesterday* and *today* are adjuncts. By contrast, *the frosting* cannot be added to the *do so* clause in (21); *the cake* and *the frosting* are arguments. The assumption here is that *do so* refers to the verb and its complements, without necessarily including the adjuncts. Hedberg and DeArmond (2009) note that the grammaticality judgements are not always clear when this construction is used as an argumenthood test.

Adjuncts can occur after *do* in a VP-focussed pseudocleft, but arguments cannot:

(22) What Mia did in her room was sleep.

(23) *What Lara did at the monument was point.

The PP *in her room* in (22) is an adjunct, whereas the PP *at the monument* in (23) is an argument. Example (22) is grammatical, whereas (23) is not. This is the PSEUDO-CLEFT test (Hedberg and DeArmond, 2009).

Another argumenthood diagnostic that involves *do* is the VP-PREPOSING test. Arguments must move with the verb in VP-preposing, but adjuncts can be left behind:

(24) *Kylie wanted to draw a picture and draw she did a picture.

(25) Kylie wanted to leave on Monday and leave she did on Monday.

Finally, we will consider the WH-WORD CONJUNCTION test. Two *wh*-words that refer to arguments with different semantic roles cannot be conjoined:

(26) Sam showed Kim the picture.

(27) *What and who did Sam show?

However, two adjuncts with different semantic roles can be conjoined:

(28) Jolanda met a friend in Minneapolis on Friday.

(29) Where and when did Jolanda meet a friend?

When using this test it is important to keep in mind that an argument *wh*-word cannot be conjoined with an adjunct *wh*-word:

(30) Linda read a book last Friday.

(31) *What and when did Linda read?

In (30), *last Friday* is an adjunct even though it cannot be conjoined in (31). This is because *a book* is an argument, not because the adjunct status of *last Friday* is unclear.

This section has reviewed diagnostics for argumenthood previously proposed in the literature. The following ten tests were presented and illustrated: (1) the core participant test, (2) the verb specificity test, (3) the prepositional content test, (4) the fixed preposition test, (5) the optionality test, (6) the iterativity test, (7) the alternation test, (8) the preposition stranding test, (9) the VP anaphora test, (10) the VP preposing test, (11) the pseudocleft test, and (12) the *wh*-word conjunction test. This section has focused on phrases that are reasonably clear arguments or adjuncts. Nevertheless, most of the tests have some weaknesses and must be used with care.

3 Unclear cases

The diagnostics reviewed in the previous section work fairly well for classifying clear adjuncts and clear arguments. However, there are also less clear cases, and we will discuss a number of such cases in this section, from an English language perspective. We will not evaluate each according to every test discussed in the previous section. Instead, we will focus on data that has already been reported in the literature, and some new data where the judgements seem clear.

3.1 The passive *by*-phrase

The understood subject of passive verbs (the phrase which would be the subject of the corresponding active sentence) is in English expressed with a *by*-phrase:

(32) The letter was signed by Lottie.

The passive *by*-phrase is often but not always an agent. In *the letter was received by Lottie*, for example, *Lottie* is not an agent. The passive *by*-phrase displays mixed argumenthood properties: it is an argument by the CORE PARTICIPANTS test, but the phrase is nevertheless syntactically optional.

The standard LFG treatment of passive is formulated in Lexcial-Mapping Theory (LMT; Levin 1986; Bresnan and Kanerva 1989; Alsina and Mchombo 1989). In the passive, the highest role of a verb is "suppressed". In LMT, this means that the highest role is stripped of its association with argument function features (the features *r* and *o*) (see section 4). Stripped of its argument features, the phrase must be realized as an ADJ(UNCT) at f-structure, if it is realized at all (Bresnan and Zaenen 1990, 50, Bresnan 2001, 310). However, many LFG researchers nevertheless analyze the passive *by*-phrase as an OBL(IQUE) (i.e. oblique argument) at the f-structure (Bresnan 2001, 21; Cook 2006). The intuition that the demoted phrase in the passive is an argument presumably comes from the argument-like characteristics of the phrase. In addition to the fact that it is a core participant of the clause, it may also participate in binding and control in an argument-like way, as discussed by Cook (2006) for German.

3.2 Possessive phrases of event nominals

Grimshaw (1990) calls subjects of nominal predicates argument-adjuncts. She points out that they are always optional, like passive *by*-phrases:

(33) the enemy's destruction of the city

(34) the destruction of the city

The optionality indicates that *the enemy's* in (33) is an adjunct. However, it is a core participant of the event, and in that sense, it is like an argument.

3.3 Benefactives

Benefactive *for*-phrases can sometimes but not always alternate with objects in the double object construction:

(35) a. Robert baked a cake for Christa.
b. Robert baked Christa a cake.

(36) a. Robert washed his hair for Linda.
b. *Robert washed Linda his hair.

The fact that some benefactives alternate with objects indicates that they are arguments, by the ALTERNATION test. Benefactive phrases such as the ones illustrated in (35–36) are always optional, and they do not seem to be core participants of the verb. These characteristics indicate that benefactives are adjuncts. However, benefactives allow preposition stranding, which indicates that they are arguments:

(37) a. Who did Robert bake a cake for?
b. Who did Robert wash his hair for?

Like the passive *by*-phrase, benefactives are neither clear arguments nor clear adjuncts. However, benefactives differ from displaced passive agents in that there seem to be different types or classes of benefactives. Fore example, note the difference between (35) and (36): some benefactive *for*–PPs alternate with direct objects and some do not. There also seem to be different interpretations of benefactives, one which implies transfer of the object and one which does not. In (35), Robert is likely to give the cake to Linda. However, (36) has no such interpretation, Robert is simply washing his hair for Linda's general benefit. That interpretation is also possible for (35); perhaps Linda was supposed to bake a cake for Tom's birthday, but she got sick and Robert helped Linda out by baking a cake to give to Tom. It seems like only the transfer examples allow the double object construction, which indicates that those examples are more argument-like.

3.4 Displaced themes

The type of displaced theme under discussion here is the English *with*-phrase theme. The argument status of English *with*-themes are investigated in detail by Lewis (2004). Examples of *with*-themes are given in (38–39):

(38) We loaded the truck with furniture.

(39) The garden swarmed with bees.

Lewis (2004) notes that many *with*-themes are argument-like, since they can alternate with subjects and objects, and they are sometimes obligatory. A comparison of (38) and (40) shows that *with*-themes can alternate, and (39–41) show that *with*-themes can be obligatory.

(40) We loaded furniture onto the truck.

(41) *The garden swarmed.

Lewis (2004) shows that there are several classes of *with*-themes, and they vary in how they fare in tests of argumenthood. However, she concludes that none of the *with*-themes are clear arguments or adjuncts.

3.5 Instruments

Instrumental *with*-PPs are optional:

(42) I opened the door (with a key).

Potential exceptions to the generalization that instruments are optional are verbs that can take an instrument as a subject or an object:

(43) The key opened the door.

(44) The nurse used a key to open the door.

However, note that instruments cannot be added freely to any event; instruments are only added to agentive verbs (Reinhart, 2002). By the VERB SPECIFICITY test, they should be classified as arguments, since they are only allowed with a specific class of verbs.

On the basis of different types of examples with instrumentals from a range of languages, Donohue and Donohue (2004) argue that some instrumentals are arguments and others are adjuncts. Other authors who have commented on the ambiguous status of instrumentals include Koenig et al. (2003), Van Valin and LaPolla (1997), and Schütze (1995).

3.6 Experiencers

Many verbs of perception can optionally take a *to*-PP experiencer (or 'goal of perception', Asudeh and Toivonen 2007):

(45) It looks to me like it's going to rain.

(46) The market seems to the experts to be slowing down.

(47) John sounded to them like he had a cold.

The *to*-experiencer is restricted in use to verbs of perception, which indicates that it is an argument. However, the fact that it is optional indicates that it is an adjunct. Moreover, the preposition stranding test aligns the *to*-experiencer with adjuncts. Compare (45–47) to (48–50):

(48) *Who does it look to like it's going to rain.

(49) *Who does the market seem to to be slowing down?

(50) *Who did John sound to like he had a cold.

The preposition *to* cannot be stranded in experiencer PPs.

In sum, experiencer *to*-PPs display mixed behavior with respect to argumenthood. This is discussed further in Asudeh and Toivonen (2012). See also Rákosi (2006a,b).

3.7 Directionals

PPs denoting a direction, source or goal are implied with verbs of motion, but rarely obligatory:

(51) John ran (towards the station)

(52) Laura arrived (from Paris) yesterday.

(53) Fabian went to the store.

These PPs are similar to adjunct locations in that they are optional and refer to places. However, they are different in that they are tied to verbs that refer to motion. Furthermore, the preposition can be stranded:

(54) Which station did John run towards?

(55) Which city did Laura arrive from yesterday?

(56) Which store did Fabian go to?

The preposition stranding test indicates that the direction PPs are arguments, and this is also consistent with the fact that these PPs are limited to a specific class of verbs. However, the preposition is restricted but not completely fixed, so the result of the FIXED PREPOSITION test is ambiguous. Finally, directional PPs are typically optional, like adjuncts.

3.8 Summary

This section has discussed phrases that are not easily classified as arguments or adjuncts. Many of these cases have been previously recognized in the literature as falling in between arguments and adjuncts. There are no doubt more in-between cases than the ones listed here, especially if languages other than English are taken into account. The phrases discussed here have cross-linguistic parallels (see, e.g., Rákosi 2006a, Donohue and Donohue 2004). There are also potential in-between cases to be found in some languages but do not occur in English. Examples include perceptual sources, such as the *på*-PP in Swedish (57) and Dyirbal applicatives (58):

(57) SWEDISH

Det	verkar	på	Sune	som	om	han	är	trött
it	seems	on	S.	as	if	he	is	tired

'Sune seems as if he is tired.'

(58) DYIRBAL

a.

yabu	nguma-nggu	balga-n	yugu-nggu
mother.ABS	father.ERG	hit	stick-INSTR

'Father hit mother with a stick.'

b.

yugu	nguma-nggu	balgal-ma-n	yabu-gu
stick.ABS	father.ERG	hit	mother-DATIVE

'Father hit mother with a stick.'

Swedish *på*-sources are argument-like in that they only occur with a certain class of verbs, perceptual verbs. However, they are adjunct-like in that they are optional. For a more detailed discussion of these expressions, see Asudeh and Toivonen (2012). In applicatives, the applied argument is adjunct-like in that it is optional, yet it has the argument-like characteristic of alternating with a direct object.

Phrases that are neither clear arguments nor clear adjuncts are difficult to analyze in most theories of syntax and argument structure. In LFG, it is crucial to determine the argument status of PPs, as it affects the assignment of grammatical function: argument PPs are OBLs and adjunct PPs are ADJs at f-structure. The notion of grammatical functions is fundamental to LFG.

4 Towards an LFG understanding of the in-between cases

Consider an example with an instrument, such as *The patient opened the door with a key*. Is the PP *with a key* an argument or an adjunct? How does this affect an LFG analysis of the sentence? If *with a key* is classified as an argument, it will be in the argument structure of the PRED feature of *open*, it will be treated as an OBL at f-structure, and it will be a sister of the verb at c-structure. If *with a key* is classified as an adjunct, it will not be in the argument structure of the PRED feature of *open*, it will be treated as an ADJ at f-structure, and it will be adjoined to VP at c-structure. The argument/adjunct status of the PP thus has consequences throughout the grammar, and the fact that instruments and several other types of phrases display some characteristics of arguments and some characteristics of adjuncts is therefore problematic.

We propose that the solution to this problem can be found at a-structure. Bresnan (2001, 310) notes: "The lexical stock of a-structures in a language can be extended by morphological means." This implies that there is a basic lexical stock that is a subset of the entire lexical stock. The analysis that we propose assumes that arguments listed in the basic a-structure of verb have a different status than arguments listed in the manipulated a-structure.

In LEXICAL MAPPING THEORY, phenomena such as passivization are handled with suppression rules (Bresnan, 2001, 310), where one of the basic arguments is suppressed. We analyze instruments and the other types of phrases listed in section 3 as *derived arguments*, arguments *added* to the argument structure of verbs by a lexical rule. This idea is suggested for instrumentals already in Bresnan (1982):

> "It is possible to define a lexical rule of *Instrumentalization* (analogu-ous to lexical rules of *Causativization*) which converts an n-adic predicate argument structure P to an $n+1$-adic predicate argument structure *P-with* whose $n+1$st argument is assigned the grammatical function INSTR OBJ [instrumental object]." (p. 165)

Our treatment of instrumentalization differs slightly from Bresnan's (see section 4.1), but the basic idea is the same. We do not not view lexical rules as procedural derivations, instead, a lexical rule is intended as a statement relating two possible lexical entries, one basic entry and one augmented entry.

The analyses in this section are cast in LMT (Bresnan and Moshi 1990; Alsina 1996; Bresnan and Zaenen 1990; Bresnan 2001, and others), where the basic argument functions are defined in terms of the features [$\pm$r] and [$\pm$o]. The feature [+r] singles out the grammatical functions that are semantically *restricted*. The syntactic functions that are marked [$-$r] are not semantically restricted; in fact, they have the option of being associated with no semantic role at all. The feature [+o] refers to the *objective* functions, i.e., functions that complement transitive V or P. The basic argument functions are thus grouped as shown in (59):

(59)

	$-$r	+r
$-$o	SUBJ	OBL_θ
+o	OBJ	OBJ_θ

Patientlike roles are classified as $[-r]$, secondary patientlike roles are [+o], and other semantic roles are [$-$o]. Lexical specifications may override this classification.

LMT gives a theory of the mapping between a(rgument)-structure and f(unctional)-structure. A-structure is a syntactic level of representation which links the lexical semantics of predicates and their arguments to f-structure. The arguments of a predicate are ordered for their relevant prominence according to the thematic hierarchy:

(60) **Thematic Hierarchy:**
agent $\succ$ beneficiary $\succ$ experiencer/goal $\succ$ instr $\succ$ patient/theme $\succ$ loc

The mapping between a-structure and f-structure is governed by the principles in (61), adapted from Bresnan (2001, 311). The logical subject is defined as the most prominent semantic role of a predicator.

(61) **Mapping Principles:**

a. Subject roles:
   i. The logical subject marked [$-$o] is mapped onto SUBJ when initial in the a-structure; otherwise:
   ii. The semantic role marked with [$-$r] is mapped onto SUBJ.

b. Other roles are mapped onto the lowest compatible function (according to the following partial ordering: SUBJ $\succ$ OBJ, OBL_θ $\succ$ OBJ_θ).

We devote the remainder of the paper to a discussion of each of the examples introduced in section 3.

4.1 Instruments

Our analysis of PP-instruments builds on the analysis suggested in Bresnan (1982), mentioned above. Although we do treat *with*-instruments as obliques, not objects, the spirit of the rule is the same.

(62) Optionally add the following argument to verbs whose first argument is an agent:

$$\begin{array}{c} \text{y} \\ [-\text{o}] \\ | \\ \text{OBL}_{instr} \end{array}$$

The restriction that the first argument must be an agent comes from Reinhart (2002), who notes that instruments are added to “agent verbs”. This accounts for the asymmetry between (63) and (64), noted by Bresnan (1982):

(63) a. John killed Harry.
b. John killed Harry with dynamite.

(64) a. An explosion killed Harry.
b. #An explosion killed Harry with dynamite.

Only the unlikely interpretation that *an explosion* is an agent would render (64b) acceptable.

Under this analysis, *with*-instruments are arguments. However, they are not listed as part of the basic argument structure of verbs, but optionally added with the rule in (62).

4.2 The passive *by*-phrase

Active verbs relate to passive verbs by the following rule:

(65)
$$\begin{array}{c} \hat{\theta} \\ | \\ \emptyset \end{array}$$

The rule in (65) states that the highest argument (the most prominent role according to the thematic hierarchy, $\hat{\theta}$) in a verb’s argument list is suppressed. Rule (65) accounts for instances of the passive where the highest argument is suppressed. However, the highest argument can also be expressed as an *by*-phrase. Originally, LMT simply stated that that the most prominent role can be linked to an “argument-adjunct” like the *by*-phrase (Bresnan, 2001, 310). However, the notion of an “argument-adjunct” has no official status in LFG. An analysis must account for the fact that the *by*-PP has the same semantic role as the active subject. This is illustrated in (66–67):

(66) Kelly shot the rabbit. The rabbit was shot by Kelly.

(67) Miriam received two packages. Two packages were received by Miriam.

In (66), *Kelly* is an agent both when expressed as a subject and when expressed as a *by*-PP. Similarly, in (67), *Miriam* is a recipient in both examples.

In order to account for the remapping from SUBJ to OBL in passives, we adopt the analysis proposed in Kibort (2001). Kibort suggests that the feature **[+r]** may be added to the highest argument of a passive verb. The highest argument then has the feature combination [−o, +r], which maps it onto an OBL function:

(68) Add the feature [+r] to passive verbs. Passive-OBL

<	x	y	>
	[−o]	[−r]	
	[+**r**]		
	|	|	
	OBL	SUBJ	

At a-structure, either the rule (65) or the rule in (68) applies to a passive verb. Since the passive *by*-phrase is part of the manipulated argument structure of the verb, it is a derived argument, and we expect it to display mixed argumenthood characteristics.

4.3 Possessive phrases of event nominals

Nouns that refer to events can express a participant of the event as a possessive NP: *the enemy's destruction, the city's destruction*. The possessive can correspond to the subject of the verb (*enemy's*) or the object of the verb (*city's*). The possessive NP is argument-like in that it expresses a core participant of the event, but its adjunct-like in that it is optional.

Consider a transitive verb like *destroy*. Loosely based on Laczkó (2000) and Falk (2001), we assume that *destruction* and other event nominals inherit the argument structure specification of the verb, and the realization of the arguments depends on which of the three following lexical rules applies:

(69) The arguments are suppressed.

(70) Add [−r] to the highest role, which is specified as [−o].

(71) Add [−o] to the lowest role, which is specified as [−r].

If rule (69) applies, no argument is expressed. If (70) applies, the highest role is expressed as a [−r, −o] role, which normally is the subject. However, in nominals, this role is expressed as the possessor. If (71) applies, the lower role (corresponding to the verb's object) is expressed as a [−r, −o] role. Many questions remain, of course. For example, why does the 'subject' of a nominal get possessive morphology? Also, how can the object of the verb be expressed as the 'subject' of the nominal? Some discussion of these issues can be found in Laczkó (2000) and Falk (2001). Setting these important issues aside, we suggest that the answer to the question at hand is related to the fact that the possessor of event nominals is permitted only by the application of a lexical rule. This means that the possessive phrase is a derived argument, which explains its mixed behavior.

4.4 Experiencers

Experiencers such as *to me* in (72) display some characteristics of arguments and some of adjuncts:

(72) It looks to me as if John has forgotten to bring his notes today.

We propose that an experiencer can be added by the following rule:

(73) For verbs of perception, optionally add: $\begin{array}{c} \text{y} \\ [-\text{o}] \\ | \\ \text{OBL}_{goal} \end{array}$

For further discussion of the treatment of experiencers in LFG, see Rákosi (2006b,a) and Asudeh and Toivonen (2012).

4.5 Benefactives

In section 3, benefactives were included as an example of phrases that fall between arguments and adjuncts. However, it is difficult to narrow down a class of verbs that take benefactives, other than verbs that denote events that can be performed for the benefit of another person, and Koenig et al. (2003) conclude that benefactives are in fact adjuncts. We will not attempt an analysis of benefactives here, but note that only some benefactives *for*-PPs alternate with direct objects.

4.6 Directionals

Verbs of motion can occur with obliques denoting some direction (goal, source, path). The oblique is generally optional, even though it is semantically understood. For example, if someone is *running*, the running is taking place along some path. We propose the following rule for verbs of motion:

(74) For verbs of motion, optionally add: $\begin{array}{c} \text{y} \\ [-\text{o}] \\ | \\ \text{OBL}_{goal/source/path} \end{array}$

This solution is unlikely to cover all relevant examples, as there are many types of motion verbs.

4.7 Displaced themes

Themes are sometimes expressed as *with*-PPs in English (e.g., *swarm with bees* and *fill with sand*). So-called *with*-themes are not a uniform class (Levin, 1993; Lewis, 2004), and their behavior depends on what verb class they occur with. Lewis (2004) demonstrates that distinct types of *with*-themes behave differently with respect to argumenthood. Each type of *with*-theme must be considered separately, but we will not attempt to formulate an explicit proposal for each class. However, we want to point out that our general approach to in-between cases makes certain predictions. For example, consider (75):

(75) a. Bees swarmed in the garden.
b. The garden swarmed with bees.

According to our analysis, *with bees* in (75b) is a derived argument, since it shows mixed argument-adjunct characteristics (Lewis, 2004). It is of course possible that both examples of *swarm* given in (75) are less basic than some other version of *swarm*, but most straightforwardly, (75a) would be considered basic. It is then necessary to investigate whether there is support for this hypothesis, which may seem reasonable for the examples in (75), but perhaps less natural for examples such as those in (76).

(76) a. Excitement buzzed at the party.
b. The party buzzed with excitement.

We leave this issue for future research.

5 Conclusion

The distinction between arguments and adjuncts is crucial for many linguistic theories and frameworks, including LFG. Yet many phrases are difficult to classify as either clear arguments or clear adjuncts; they seem to fall in between. In this paper, we have discussed a number of such cases and we have proposed that the phrases that display mixed behavior are *derived arguments*. If this proposal is correct, it still needs to be determined exactly what the different argumenthood diagnostics are testing. It is possible that some tests distinguish between arguments and non-arguments, some between core and non-core arguments, and others between c-structure categories (NPs versus PPs, for example), and finally, according to the present claims, some tests may distinguish between basic and derived arguments.

This paper has discussed a number of phrases, such as experiencers, passive agents, etc. These distinctions are sure to be too crude, as was already mentioned in the section on *with*-themes. For further discussion of experiencers, see Rákosi (2006b,a). For a discussion of kinds of instrumentals, see Donohue and Donohue (2004), who argue that some instrumentals are included in the Lexical-Conceptual Structure of verbs, but others are not.

The examples and arguments here are based on English only, even though many of the references cited include data from a variety of languages. A fuller understanding is of course likely be gained from cross-linguistic investigations.

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EXLEPSE: AN ECLIPSE-BASED, EASY-TO-USE EDITOR FOR COMPUTATIONAL LFG GRAMMARS

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Abstract

We present eXLEpse, an easy-to-use editor for creating computational grammars based on the Lexical-Functional Grammar (LFG) formalism (Dalrymple, 2001). The editor is implemented as a plugin for the open-source program development platform Eclipse. eXLEpse provides functionality for editing computational LFG grammars and an interface to the XLE grammar development platform (Crouch et al., 2011). The editor can replace Emacs as an editor and provides a graphically enriched user interface as an alternative to the shell-based interface of the XLE platform. It is available free of charge on the internet.

1 Introduction and Motivation

The Eclipse plugin eXLEpse[1] provides functionality for editing computational LFG grammars and an interface to the XLE grammar development platform. The primary goal of eXLEpse was to develop an easy-to-use editor for computational grammars with a simple yet powerful interface to XLE. The editor can replace Emacs[2] as an editor and provides an alternative to the shell-based interaction with the XLE platform.

For novices in XLE grammar development, it can be quite hard to get used to Emacs and the XLE command prompt. Also, the grammar syntax required by XLE can sometimes be confusing (e.g., nested templates). eXLEpse addresses these problems, providing a graphically enriched user interface via the Eclipse platform[3]. eXLEpse connects to the XLE binaries and the X11 windows platform to parse text and display parse results. Furthermore, various error support functions and advanced syntax highlighting enable novice users to concentrate solely on the grammar development process without painfully learning the details of Emacs and its concepts. Additionally, Eclipse offers support for a diversity of version control systems (VCS) such as the version management software Subversion via the Subclipse[4] plugin. Developers can make use of all the Subversion features through this plugin, without having to leave eXLEpse. This is useful especially for large grammar projects.

We emphasize that eXLEpse and its concepts constitute work in progress. In particular, we do not, as of yet, view eXLEpse as a Swiss army knife of grammar development, but rather as an evolutionary development based on previously existing XLE editors towards a homogenous LFG design environment. The eXLEpse plugin is available as public and free software under the terms of the Eclipse Public License (EPL). The plugin is distributed together with Eclipse and the Subclipse

[†] We thank the LFG11 audience and the members of the ParGram community for their constructive criticism and feedback.

[1] `http://www.exlepse.org`

[2] `http://www.gnu.org/s/emacs/`

[3] `http://www.eclipse.org`

[4] `http://subclipse.tigris.org/`

plugin in a single zipped package for easy installation; packages for the most common operating systems are available.

In Section 2, we review some of the issues that arise in current approaches to LFG grammar development, introducing the features of the eXLEpse editor step by step in subsections. The paper concludes with a brief summary and perspectives for future work.

2 eXLEpse – an XLE Perspective for Eclipse

The motivation for the development of the eXLEpse editor arose from registering usability problems in user interfaces currently employed in LFG grammar development with XLE. This section describes some of these problems; novices in grammar development taking XLE courses at the Universität Konstanz have reported that part of their difficulties with XLE have to do with the usability obstacles reported here. The eXLEpse project therefore focuses on problems experienced by XLE and Emacs novices, looking for accessible techniques to start learning about LFG grammar development.

LFG grammar development with XLE usually takes place using Emacs in combination with the Unix command shell. The Emacs plugin `lfg-mode.el`, written by Mary Dalrymple, is distributed together with XLE for easier LFG grammar development.[5] It loads commands that cause Emacs to activate syntax highlighting, indentation, and other visual aids that help in LFG grammar development. Moreover, `lfg-mode.el` provides Emacs with special commands that are loaded into the Emacs menus. The commands are used to load (1) load files that are relevant to the grammar being opened, (2) start and restart XLE shells, and (3) let you browse rules, templates and lexical entries.

The views and tools of eXLEpse are described in the following sections and compared to the standard grammar development process using Emacs in combination with `lfg-mode.el`.

2.1 Managing Windows and Editors

In the non-eXLEpse architecture, the actual XLE process used for parsing and generating sentences has to be opened in a separate Emacs buffer. Therefore, the user's desktop environment during grammar development may look as in Figure 1, with different grammar files opened in multiple Emacs buffers and a separate buffer for the XLE process. For professional grammar developers or computer scientists, this may not be a big issue, but for novices looking to learn about grammar development in an easy way, this can be very cumbersome.

Note that the user may open several files in a single Emacs window pane. The user can then cycle through the files using special Emacs-specific shortcuts. Note

[5]For the remainder of the paper, we use the term Emacs, referring to instances of Emacs running with the `lfg-mode.el` plugin.

further that a single Emacs pane may be split (vertically or horizontally) in two or more parts. The user can open and edit different files in the different parts of the pane. They may also display, e.g., a grammar file in one part of the pane and the XLE buffer for parsing text in another part of the pane. These functionalities are accessible using special keyboard commands or the drop-down menus. Thus, it is in fact not necessary to open files in separate Emacs windows; however, to command these functionalities, it is necessary to know a) that Emacs offers them and b) the menus and keyboard shortcuts that activate them.

In eXLEpse, these functionalities are provided in a more intuitive way. See Figure 2 for an overview of the eXLEpse perspective. The files of a grammar folder may be opened by double-clicking them in the project explorer on the left. If a file is already open, the newly opened file will be displayed in a new tab. The user may create additional editor windows (with their separate tabs) by dragging files to the edge of the central editing area of eXLEpse; see Figure 3. Files may be distributed across editor windows and tabs within editors using drag-and-drop.

2.2 Different Keyboard Shortcuts

The default keyboard shortcuts of Emacs do not conform to current conventions. By consequence, the keyboard shortcuts for opening, creating, or saving files in Emacs differ from the shortcuts used throughout well-known operating systems. Hence, a user who is already familiar with conventional operating systems or standard applications (e.g. word processor, text editor) has to learn Emacs shortcuts from scratch. For instance, in Emacs M-w (for "wipe") is set as a shortcut to cut selected regions whereas most WIMP[6] applications use Ctrl+X (Cmd+X on Mac OS). This complicates the fluent grammar development, as the novice user needs to shift focus away from grammar development to look up unknown shortcuts. In contrast, all shortcuts of eXLEpse are in accordance with current editor standards set across operating systems.

2.3 XLE Programming

To implement LFG, XLE uses a syntax that is distinct from programming or scripting languages (e.g. Java, C#/WPF) and thus a beginner needs to learn XLE syntax from scratch. In combination with the sparse error messages, this can lead to user frustration. As an example, consider the delimiter symbol that separates the entries within a grammar (e.g. rules, lexical entries) — in XLE, the delimiter symbol is the dot, which is the smallest visible lexical symbol and therefore hard to find on the screen. This gives rise to errors in grammar development as the result of a missing dot or other delimiters (e.g., semicolons). If an error occurs, XLE prints error messages to the standard command line output and the grammar developer has to distinguish regular output and error messages. However the details of these error

[6] Windows Icons Menus Pointers

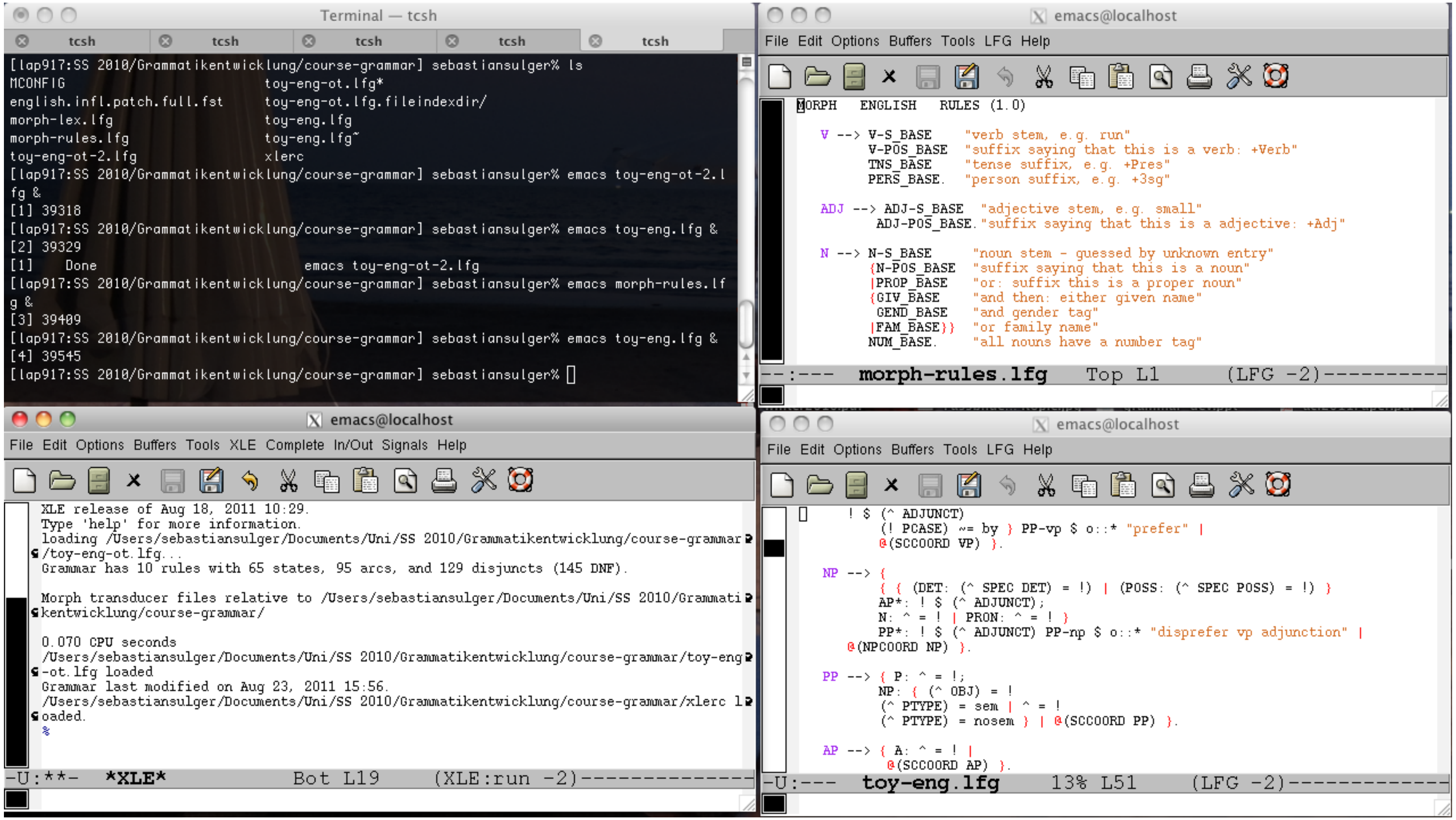


Figure 1: Possible user desktop during grammar development with XLE and Emacs

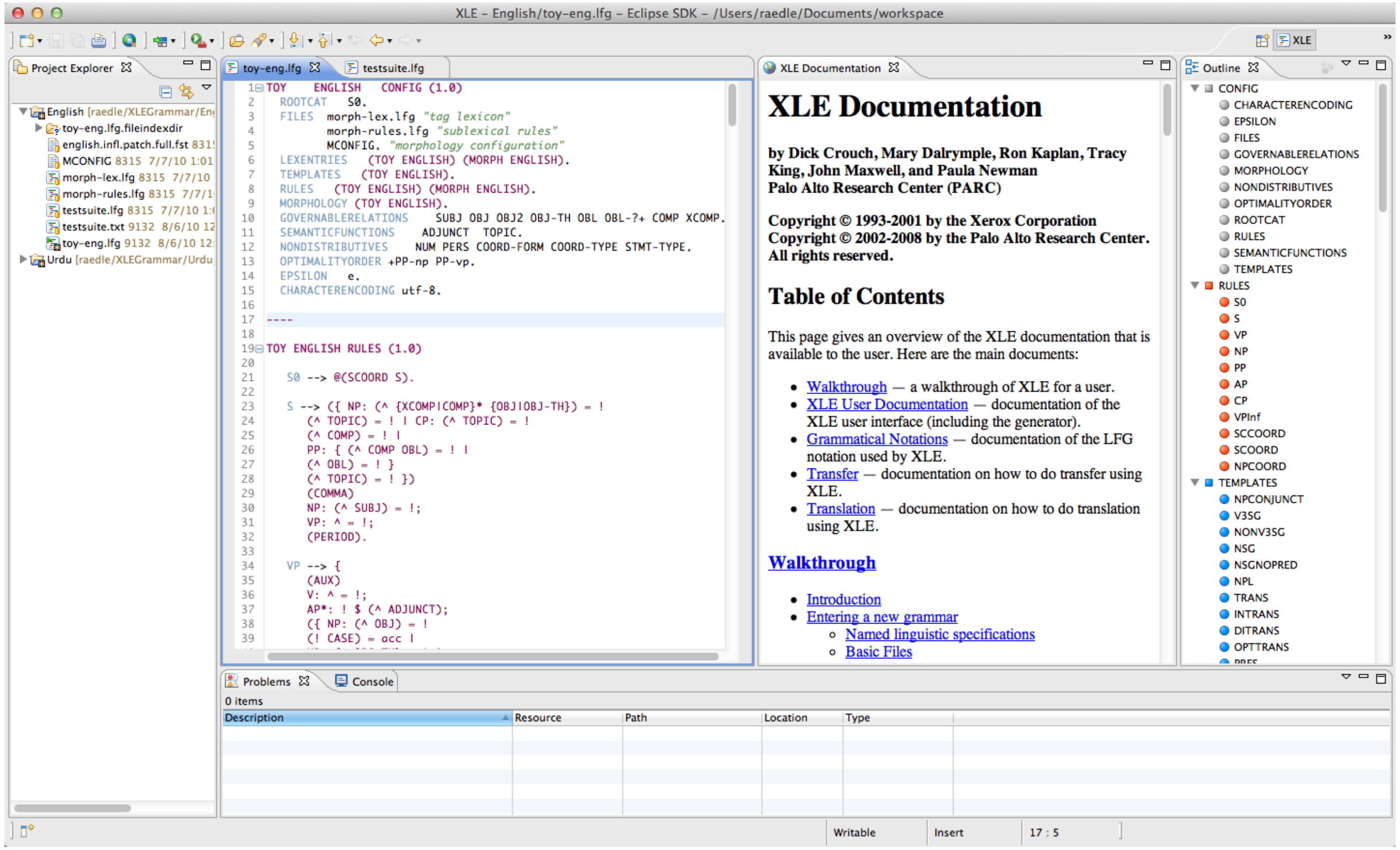


Figure 2: The eXLEpse XLE perspective consists of a project explorer (left), an XLE editor (middle-left), an XLE documentation browser (middle-right), a grammar outline (right), console input and output and a problems view (both at the bottom).

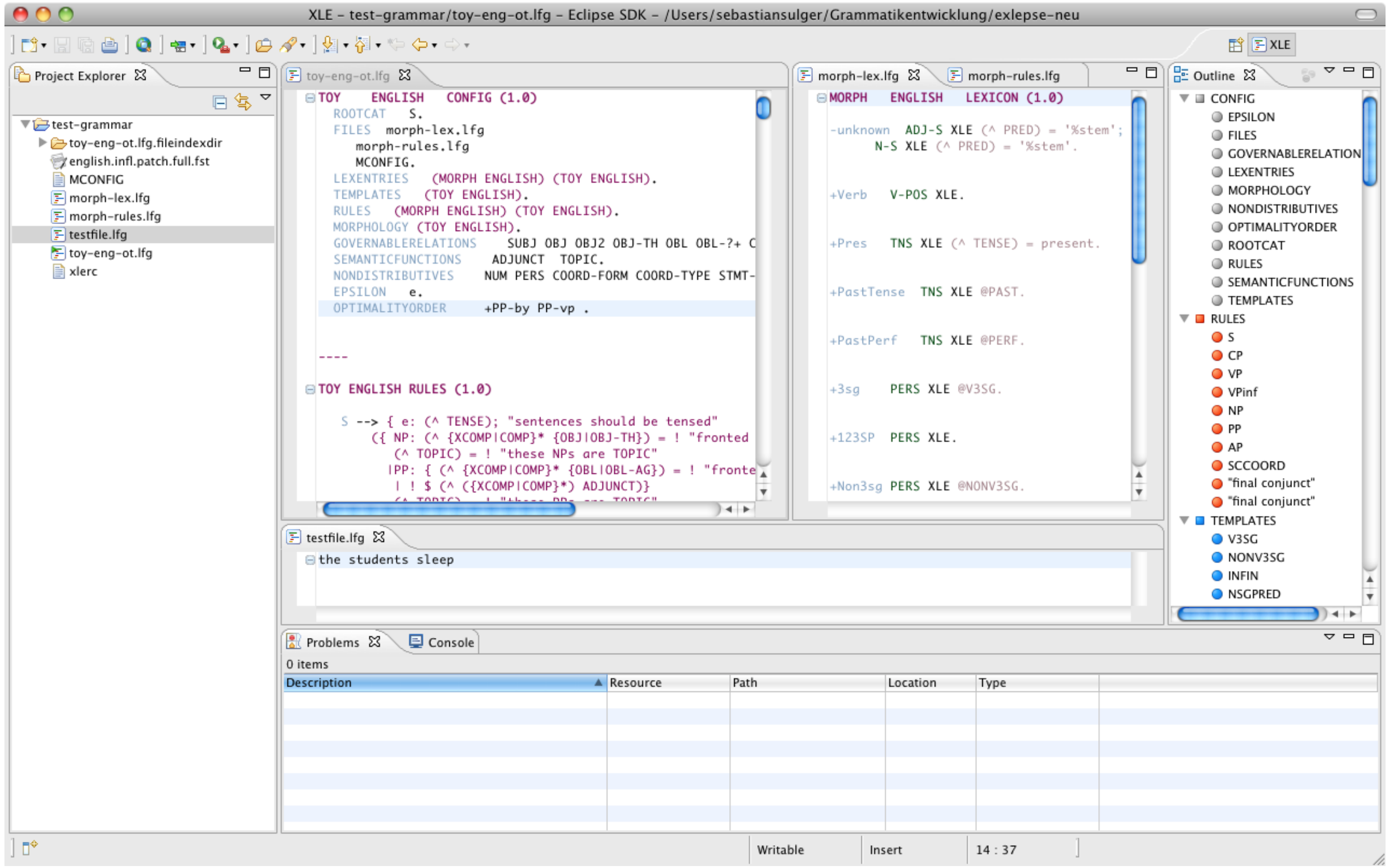


Figure 3: The eXLEpse XLE perspective allows for editing distributed across editor windows and tabs using drag-and-drop. In the above screenshot, `toy-eng-ot.lfg` is displayed in the editor to the left, while the testsuite `testfile.lfg` is displayed in the bottom editor, and `morph-lex.lfg` and `morph-rules.lfg` are displayed together in the editor to the right, each file in its own tab.

messages are problematic because of the sparse clues that are given to identify the error in the grammar.

In contrast to Emacs, eXLEpse evaluates grammars automatically after saving a grammar file. The error message and a line number is shown in the problems view if an error occurs during evaluation (see Figure 4). The grammar developer is provided with rapid, incremental feedback that allows them to make fewer errors and complete grammar development in less time (Shneiderman, 1983). In addition, new error detection can be added if future XLE releases introduce further error types. The eXLEpse preference pane provides an input dialog to add additional problem types based on regular expressions. One of the five different problems that are currently recognized is the template invocation error, an example of which is given in (1).

(1) Template invocation error near line 242, column 105 in file /Users/xle/Documents/toy-eng.lfg: The invocation of template NPL has 1 argument, but the definition has 0 parameters at line 131 in /Users/xle/Documents/toy-eng.lfg.

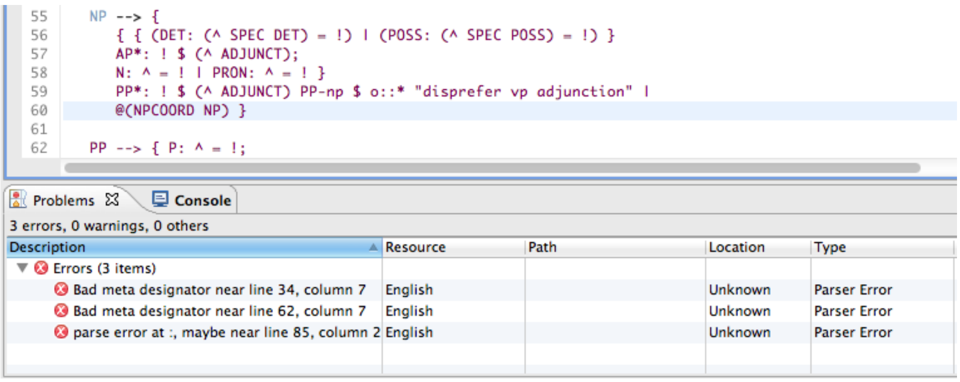


Figure 4: The problems view in eXLEpse displays errors of a currently opened grammar file and highlights error position. Error positions are extracted from XLE console output.

2.4 Syntax Highlighting

The Emacs editor highlights different aspects of an LFG file such as rules, templates, or comments. Some aspects, however, are not highlighted, for instance the different parts of a configuration section (see Figure 6(a)). The eXLEpse editor highlights the previously mentioned parts and moreover offers support for code completion within the configuration section (see Figure 6(b)). When pressing the shortcut Ctrl+Space the code completion popup opens and displays suitable configuration templates. The programmer can select a desired template to auto-complete the input. Also, the colors used by eXLEpse to highlight the grammar code can be changed by the user using the eXLEpse preference pane to match their personal preferences (see Figure 5).

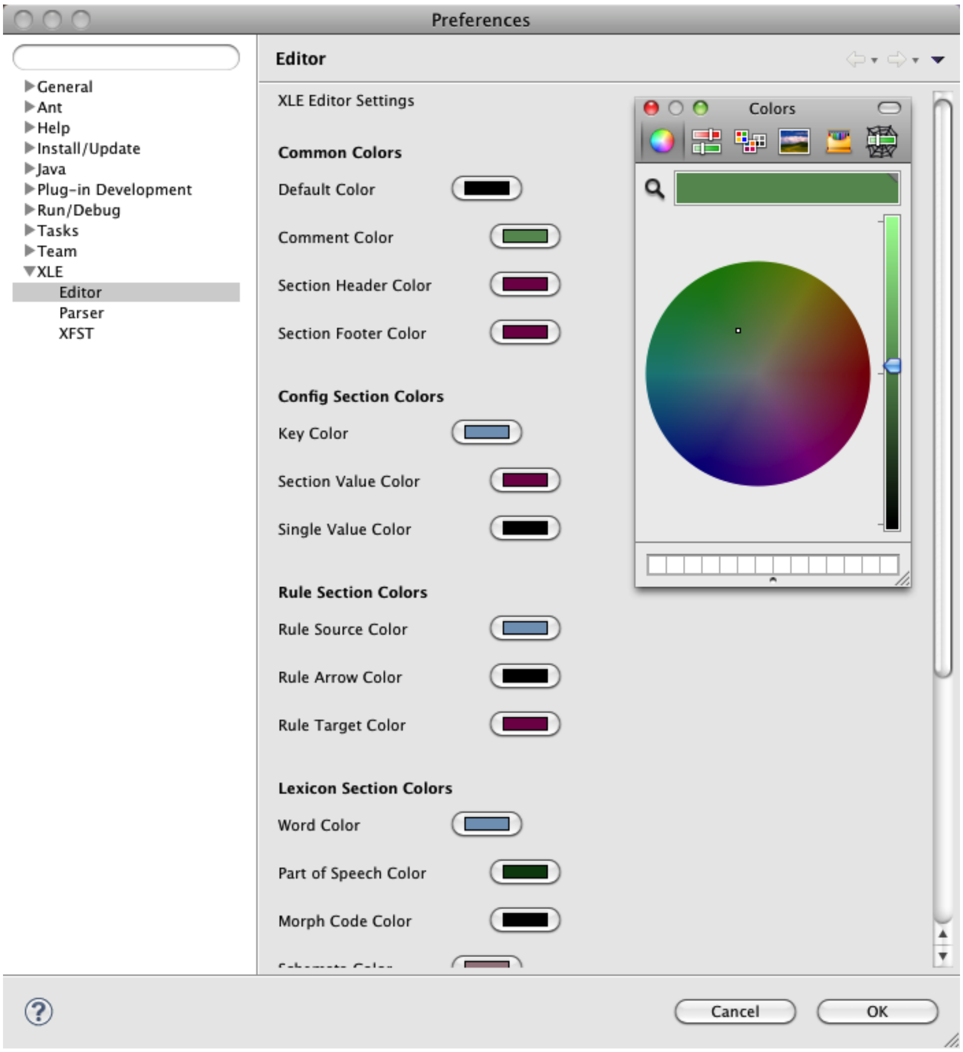
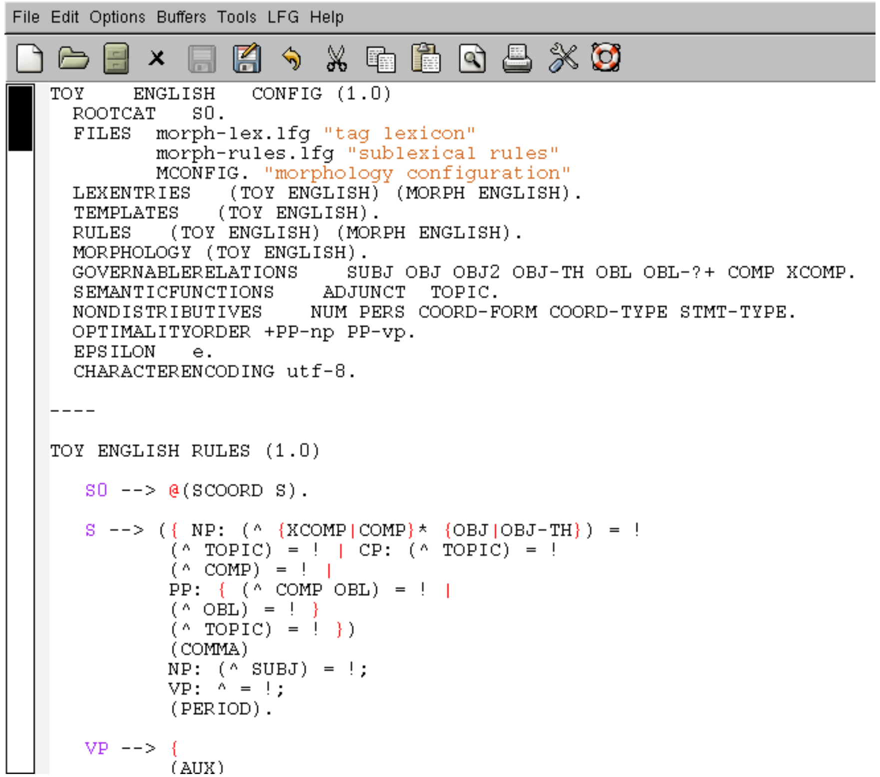


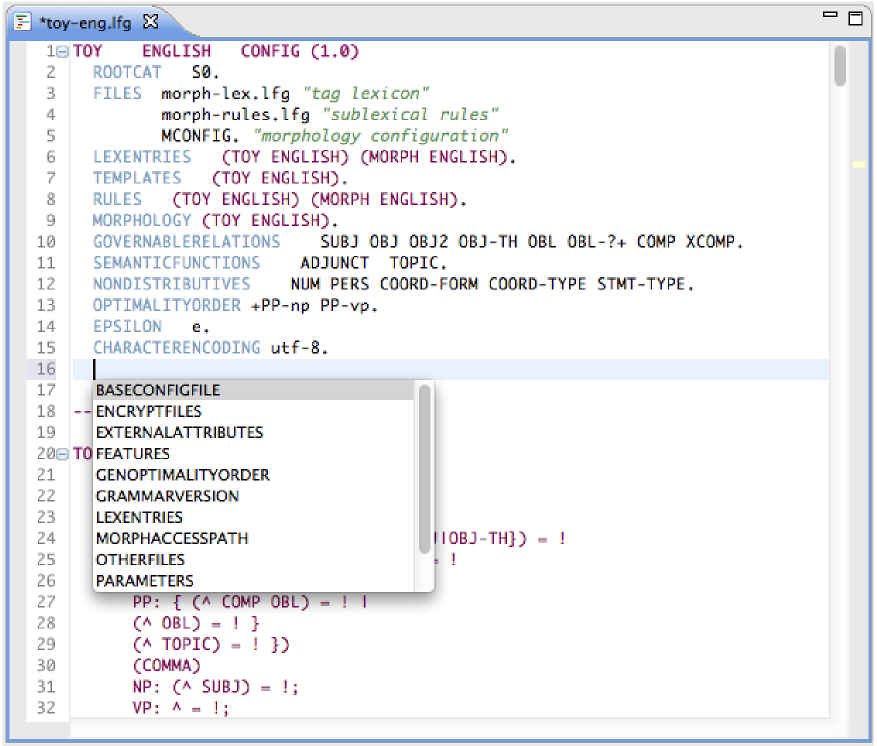
Figure 5: The colors used for the syntax highlighting in eXLEpse can be changed using the eXLEpse preference pane.

2.5 Grammars as Projects

Large grammars often consist of several files (e.g. morphological rules or test suites). Therefore, eXLEpse offers the possibility of assigning files of a grammar to a logical construct, so called projects (see Figure 7). Multiple projects are further organized in workspaces. On the one hand, this reduces complexity by chunking different grammars into smaller units. On the other hand it provides cen-



(a) Standard Emacs view with XLE syntax highlighting.



(b) eXLEpse XLE editor with improved syntax highlighting and code completion.

Figure 6: The two different XLE editors – Emacs and eXLEpse – in a side-by-side comparison.

tralized access to grammars so that fast and frequent switches between projects is enabled. The grammar developer can display several grammar files of different projects simultaneously and within a single eXLEpse instance just by pointing at double-clicking the files. Files may also be shared across grammar projects, e.g. by putting them in the top-level directory of the workspace that contains the grammar projects.[7]

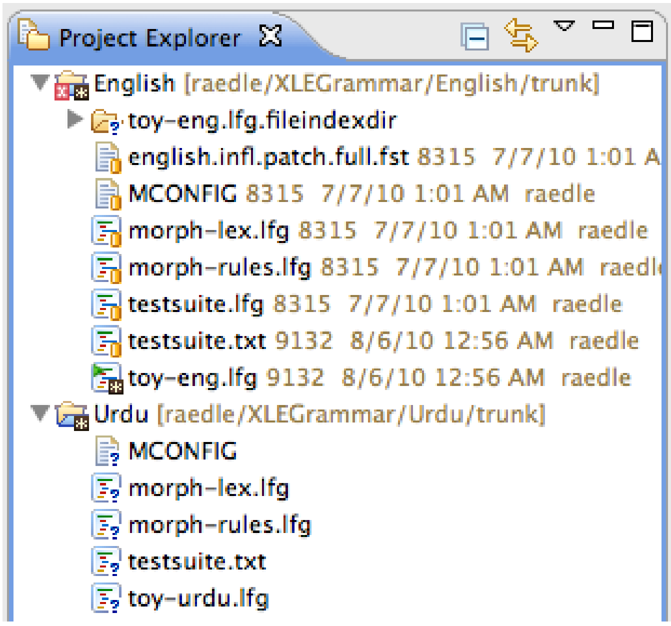


Figure 7: XLE grammars consisting of multiple files can be grouped into logical units, so called projects.

2.6 The Outline View

In Emacs, rules, templates and lexical entries contained in a grammar file may be browsed using the LFG drop-down menu *Rules, templates, lexicon menus*. Selecting the desired rule, template or lexical entry causes Emacs to jump to the respective place in the grammar file.

In eXLEpse, the outline view summarizes the contents of a currently opened grammar file (see Figure 8). Hence, contents are grouped into config, rules, templates, and lexical entries. Therefore users can rapidly overview a grammar and highlight the corresponding grammar fragment by selecting an item of the outline view. This functionality relies on the concept of brushing and linking (Buja et al.,

[7]The common templates and common features files of the ParGram project are examples of grammar files that are commonly shared across grammars (Butt et al., 2003). In eXLEpse, these can be put in the workspace directory for easy access.

1991). In contrast to Emacs, the outline feature in eXLEpse is provided to the grammar developer without the need to navigate through the application menu by selecting rules, lexical entries or templates from nested drop-down menus. The outline view is provided to the user immediately after opening the file.

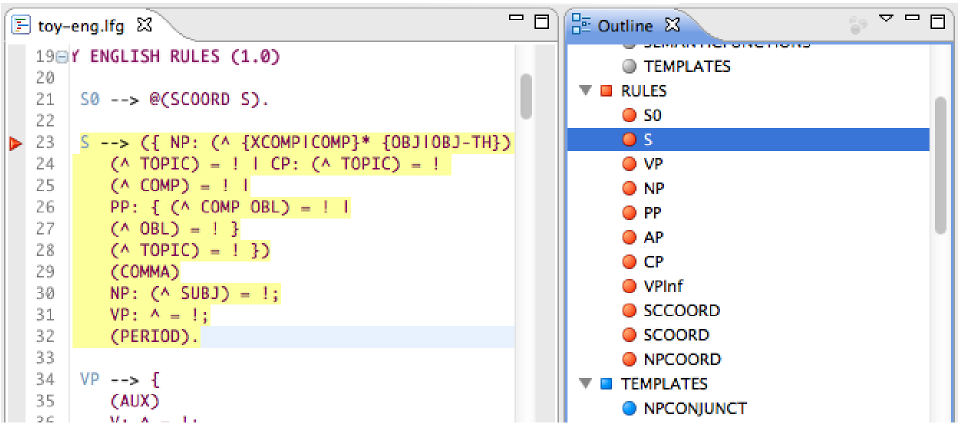


Figure 8: This view outlines config, rules, templates, and lexical entries and thus provides a quick access to the contents of a grammar file.

2.7 Sentence Parsing

When using Emacs, text parsing with XLE is executed in a separate buffer. If the user does not use split buffers as described in Section 2.1, they need to arrange buffer windows in order to perceive application states (see Figure 1). Although rearrangement of buffer windows is possible, the user has to layout windows manually. Whenever the grammar developer wants to parse text, they are forced to switch to the proper buffer, which could be hidden by other windows. Often, users will have an XLE buffer running somewhere in the background of an Emacs pane. They then have to select that pane, and cycle through all buffers opened in that pane to find the XLE buffer.

Moreover, when changes are made to rules within a grammar, the currently running XLE process has to be restarted for the changes to take effect.[8] While XLE produces a warning if there are non-lexicon changes without a restart of XLE, this can lead to user frustration, as novice users may forget to restart XLE and ignore the warning. Emacs buffers displaying grammar files include commands from the LFG drop-down menu to either start a new XLE process, or start an XLE process in an XLE buffer or switch to an existing one (among other commands, see Figure 9(a)). Emacs buffers that display a running XLE process include commands from

[8]Note that it is not necessary to restart XLE if only the lexicon is affected by changes (i.e., additions to the lexicon or changes in lexical entries), since the lexicon sections of a grammar are re-indexed by XLE at parse-time.

the XLE drop-down menu to either restart XLE (alternatively, using the XLE-specific shortcut Ctrl+c+Ctrl+f) or start a new XLE process in another window (among other commands, see Figure 9(b)). That is, there is no possibility to directly restart XLE from a grammar buffer and switch to the XLE buffer at the same time.

Another problem with sentence parsing in the non-eXLEpse architecture is connected to the XLE command `create-parser`. When a new XLE process is started, the main grammar file containing the rules etc. is not loaded automatically, unless there is an `xlerc` configuration file for the grammar. If the command `create-parser grammar-file` is put in the `xlerc` file, the XLE process will load the specified grammar when starting up. In many cases, the `xlerc` file will only contain that single command.[9]

In eXLEpse, none of these issues arise. Because of the integrated design, there is no need to switch between windows. The user can specify which of the files of a project is the main grammar file containing the configuration section; that file will receive a small green arrow next to the file name (see Figure 7). When the user attempts to parse a sentence, eXLEpse automatically calls `create-parser` on that specified file, effectively eliminating the need for an `xlerc` file in most cases. `create-parser` is called again automatically when a user saves a grammar file, so that it is not necessary to restart XLE manually.

Current approaches that aim at parsing sentences with XLE require at least basic experience with a command line tool (e.g., shell). Therefore, grammar developers have to learn how to use the shell in advance. However, eXLEpse hides this complexity and provides simple access to the parser actions through a toolbar or a context menu (see Figure 10). The grammar developer can either input text manually (see Figure 10(a)) or choose to parse a pre-selected text (see Figure 10(b)).

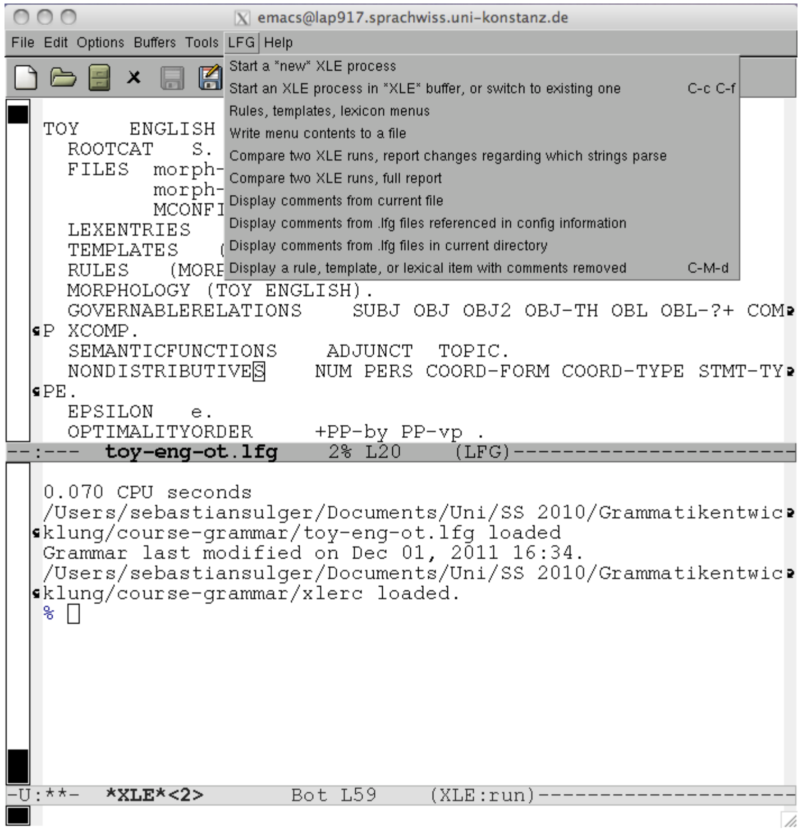
2.8 Console Input

Only basic XLE commands (i.e., parsing sentences, parsing parts of a testsuite) are implemented in the current version of eXLEpse via icons and context menus (see Figure 10), although we plan to integrate more commands in the future (see Section 3). In order to provide eXLEpse with fully-fledged XLE support, a console has been included (see Figure 11). The console constitutes a command line interface to XLE. It allows text input and enables a grammar developer to give arbitrary commands to the XLE process. Any XLE command that is otherwise not accessible may be issued to XLE using the console from within eXLEpse.

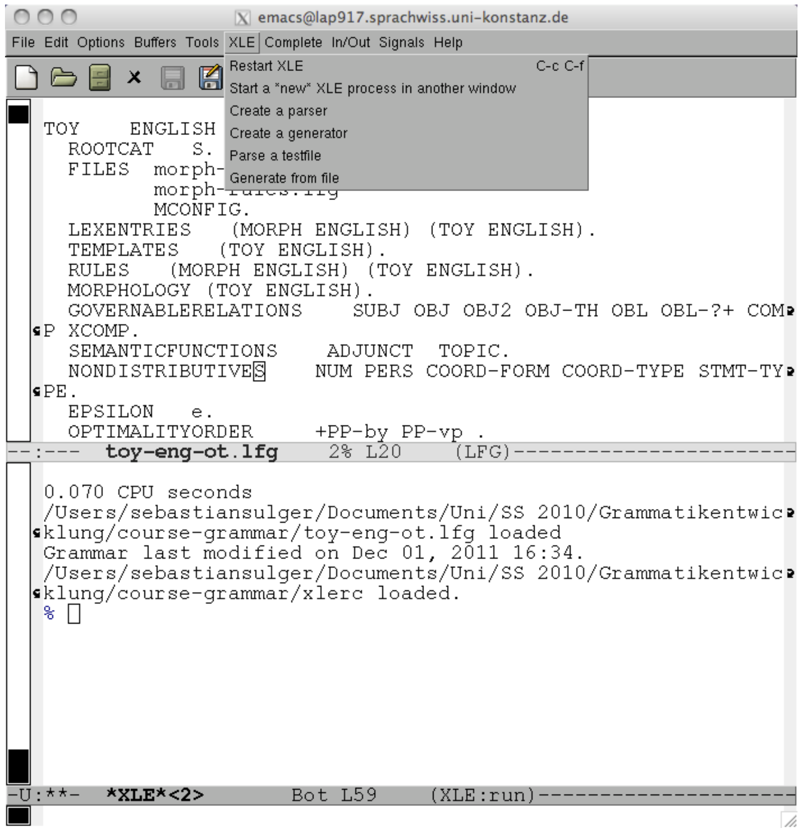
2.9 XLE Documentation

For programming tasks it is very important to have documents at hand that describe either the programming syntax or the application programming interface (API).

[9]Note that `xlerc` files may contain useful shortcut commands, ranging from manipulating OT marks to running complicated testsuite commands to customizing the XLE display windows. For the novice, however, these commands will not be applicable in the majority of cases.

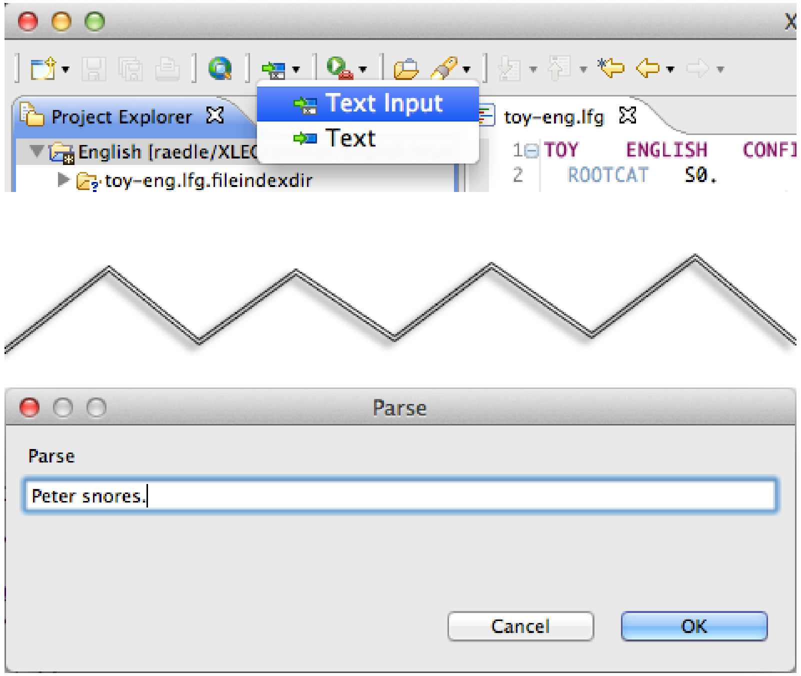


(a) Emacs editor with LFG drop-down menu, accessible from buffers with grammar files.

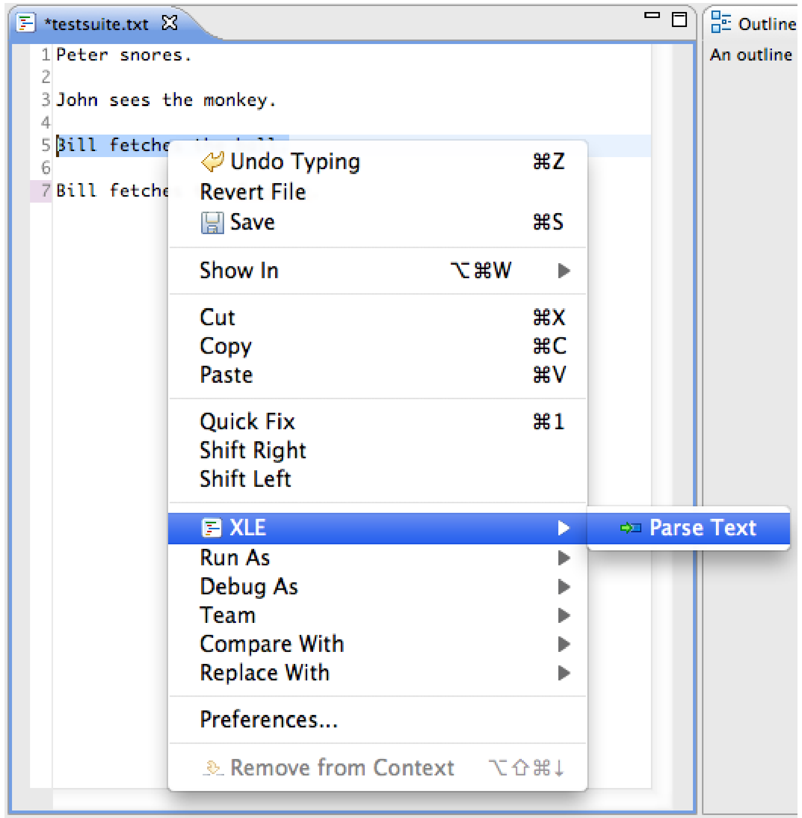


(b) Emacs editor with XLE drop-down menu, accessible from XLE buffers.

Figure 9: The two different drop-down menus to interact with XLE from within Emacs.



(a) Input a text using a dialog.



(b) Parse an arbitrary selected text with help of the context menu.

Figure 10: The two different options to parse text with eXLEpse. Option (a) allows manual input of text whereas option (b) enables parsing of a given, pre-selected text.

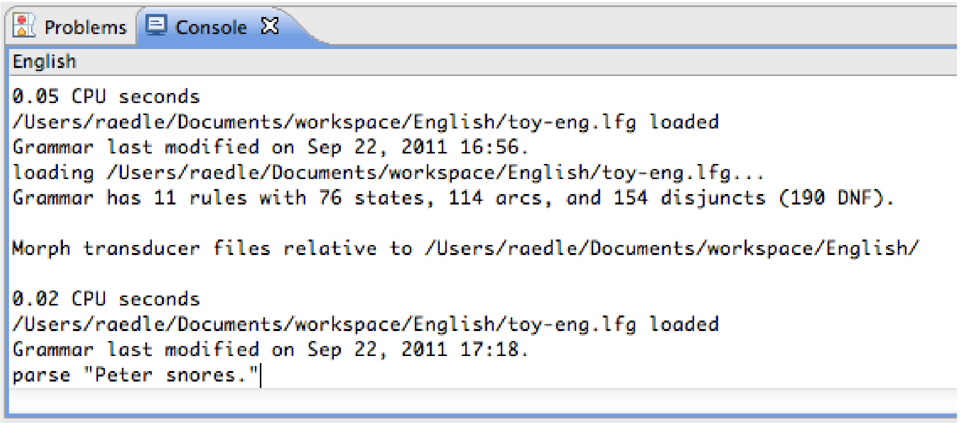


Figure 11: eXLEpse's console view allows input of arbitrary not yet graphically supported XLE commands.

In the Emacs interface to XLE, users can enter the command `documentation`, which launches a web browser and displays the XLE documentation.

In eXLEpse, the XLE documentation (Crouch et al., 2011) is accessible directly in the eXLEpse window; an external browser application is not needed. Moreover, the documentation window integrates seamlessly into the eXLEpse perspective and can be placed next to the XLE editor in order to program and to look up a definition or examples simultaneously (see Figure 12).

3 Conclusion and Future Work

We have presented eXLEpse, an easy-to-use editor plugin for developing computational LFG grammars. eXLEpse supersedes both shell-based parsing and command input as well as the Emacs editor. It represents a complete development platform that seamlessly integrates into operating systems with help of the Eclipse platform. eXLEpse uses the XLE binaries to parse sentences and displays parser results to the user by communicating with the X11 window system.

Future work includes the following improvements to eXLEpse. We plan to integrate the `parse-testfile` command in the editor, providing a button for file input similar to the parse button. Also, we intend to include code reformatting functionalities (indentation etc.) similar to the Esc+q command in Emacs, which provides a reliable way to render grammars more readable. Moreover, we plan to change the outline pane to refer not only to the currently opened file, but to the whole grammar project. This way, the user can work with a more complete overview of rules, templates and lexical entries included in a grammar. Also, popup menus can be integrated and open up when a specific template or rule is selected by a user. The popup shows where that template or rule is called in the

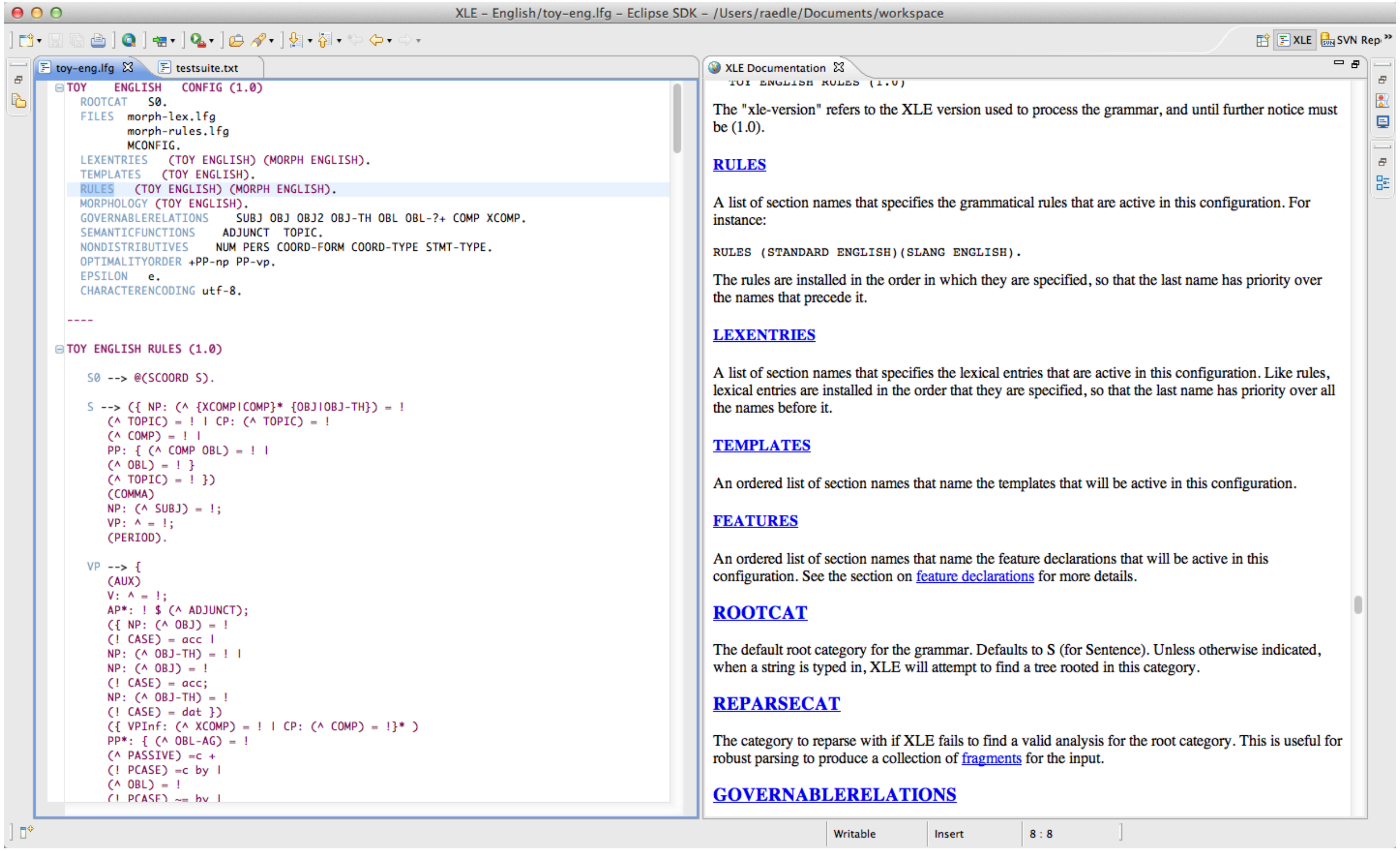


Figure 12: A documentation view is integrated in eXLEpse.

grammar. Incorrect template calls (e.g., template calls with the wrong number of arguments) could be detected more easily in this manner. Functionalities for creating and editing finite-state morphologies (Beesley and Karttunen, 2003) from within eXLEpse are currently being investigated. Finally, support for generating documentation from commented XLE grammars or additional XML documentation files as suggested by Dipper (2003) could be integrated straightforwardly into eXLEpse.

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INFLECTING SPATIAL PARTICLES AND SHADOWS OF THE PAST IN HUNGARIAN

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Abstract

The paper investigates the grammar of two types of inflecting spatial particles in Hungarian. We argue that the attested synchronic variation in the grammar of the particle-verb constructions discussed can directly be correlated with distinct stages of a diachronic grammaticalization path that different particles have trodden to different degrees. We provide an LFG-theoretic analysis and its XLE implementation that captures this variation qua variation in c-structure and f-structure encoding.

1. Introduction

The cross-linguistic variation in the encoding of spatial relations has attracted the attention of linguists of different theoretical persuasions, and this attention has produced an extensive literature in the last couple of decades. In this paper, we aim to contribute to this on-going discussion by a study of two particular spatial markers in Hungarian, paying special attention to constructions in which they function as verbal particles.

The two particle-verb constructions (PVCs) that we focus on are represented in (1) below:

(1)	a.	*Rá*	*ugrott-ál*	*az*	*asztal-ra.*
		onto.3SG	jumped-2SG	the	table-onto
		'You jumped onto the table.'			
	b.	*Mögé*	*ugrott-ál*	*az*	*asztal-nak.*
		behind.to.3SG	jumped-2SG	the	table-DAT
		'You jumped behind the table.'			

(1a) contains what we refer to as a *reduplicating particle*. These particles function elsewhere as suffixal markers, and in the PVC, they are part of a dependency with a lexical noun phrase that bears the same case morphology as what is spelled out by the particle (with possible phonological differences that are irrelevant for us). What we call *possessive particles* are postpositions elsewhere, and as particles, they license a dative case marked associate in the dependency as in (1b).

In this paper, we investigate the grammatical properties of the two types of inflecting particles and the role they play in establishing the dependencies in (1). We present an LFG-theoretic account that has been implemented and tested in our XLE grammar of Hungarian. In Laczkó & Rákosi (this volume), we discuss and analyse two other Hungarian particle-verb constructions, and the two papers together provide a comprehensive description and an in-depth LFG-theoretic analysis of spatial particle-verb phenomena in Hungarian.

Our primary objective in this paper is twofold. First, we aim to contribute to the existing LFG-theoretic line of analysis in the domain of particle-verb constructions, building on previous work by Toivonen (2001a, 2002) and by Forst, King & Laczkó (2010). Second, we develop a proposal that recognizes the historical development of the two spatial markers from possessive nominal constructions to particles with reduced feature content and impoverished c-structure properties. We claim that variation in the grammar of the PVCs we discuss here, involving dialectal variation across native speakers in certain instances, is best captured in a synchronic account that reflects this diachrony. It has been shown that LFG is a framework well-suited to describe diachronic phenomena as well as diachronically motivated synchronic variation (see, especially, Vincent 2001, and Toivonen 2001b), and we hope our work will offer further evidence in support of this claim.

The structure of the paper is as follows. In Section 2, we give a brief description of the grammar of Hungarian inflecting particles, as well as their respective uses as postpositions and case suffixes. In Section 3, we offer an overview of the previous literature on particle-verb constructions involving inflecting particles. In Sections 4 and 5, we present our analysis of possessive particles and inflecting particles, respectively. We round up and conclude in Section 6.

2. Inflecting spatial markers in Hungarian: a descriptive overview

2.1. Inflecting postpositions and suffixes

Outside of PVCs, possessive particles function as postpositions (2a), whereas reduplicating particles are used as case markers (2b). An obvious argument for the postulation of a categorical difference between the two is that the former can be coordinated but the latter cannot, cf. (3a) and (3b).

(2)	a.	*Az asztal*	*mögé*	*ugrott-ál.*	
		the table.NOM	behind.to	jumped-2SG	
		'You jumped behind the table.'			
	b.	*Az*	*asztal-ra*	*ugrott-ál.*	
		the	table-onto	jumped-2SG	
		'You jumped onto the table.'			

(3)	a.	*az*	*asztal*	*mögé*	(*vagy*	*mellé*)
		the	table	behind.to	or	beside.to
		'behind or beside the table'				
	b.	*az*	*asztal-ra*	(**vagy*	*-ba*)	
		the	table-onto	or	into	
		'onto or into the table'				

For a more extensive description, we refer the reader to the overviews in Marácz (1989), É. Kiss (2002) and Asbury (2008).

These postpositions and suffixes have one crucial property that has been discussed several times in the literature and that is especially relevant in the current context: both can take agreement morphology. When they combine with lexical noun phrases, they are used in their default, non-marked form (which is formally identical with the 3SG form, the part of the agreement paradigm that can be unmarked in Hungarian). If their "complement" is pronominal, they agree with it in person and number. The pronominal part is generally *pro*-dropped unless it bears some discourse function like (contrastive) topic or focus. Thus (4a) is a discourse neutral construction, but in (4b), where no *pro*-drop takes place, the oblique pronominal is interpreted in the immediately preverbal position as the exhaustive *focus* of the clause.

(4) a. *A* *kutya* *rá-m* *ugrott*.
the dog.NOM onto-1SG jumped.3SG
'The dog jumped on me.'
b. *A* *kutya* *ÉN-RÁ-M* *ugrott*.
the dog.NOM I.NOM-onto-1SG jumped.3SG
'It was ME that the dog jumped on.'

The agreement paradigm of inflecting postpositions and suffixes is fully-fledged, and shows some crucial similarities to the possessive paradigm. Table 1 below provides a parallel overview of the three paradigms in the singular.

	INFLECTING SUFFIX	**INFLECTING POSTPOSITON**	**POSSESSIVE CONSTRUCTION**
1SG	(*én-*)*rá-m* I.NOM-onto-1SG 'onto me'	(*én-*)*mögé-m* I.NOM-behind.to-1SG 'behind me'	*az* (*én*) *arc-om* the I.NOM face-1SG 'my face'
2SG	(*te-*)*rá-d* you.NOM-onto-2SG 'onto you'	(*te-*)*mögé-d* you.NOM-behind.to-2SG 'behind you'	*a* (*te*) *arc-od* the you.NOM face-2SG 'your face'
3SG	(*ő-*)*rá* he.NOM-onto.3SG 'onto him'	(*ő-*)*mögé* he.NOM-behind.to.3SG 'behind him'	*az* (*ő*) *arc-a* the he.NOM face-3SG 'his face'

Table 1

The nominative possessor, which agrees with the noun head of the possessive construction in person and number, can be *pro*-dropped. We refer the reader to Laczkó (1995) and É. Kiss (2002) for a detailed account of the Hungarian possessive construction, and we only note here that the apparent optionality of a pronominal dependent in the presence of agreement morphology on the head is an obvious feature that inflecting spatial markers share with true possessive phrases.

The analogy is certainly not forced, given that we know that the majority of inflecting postpositions and suffixes developed from possessive constructions (see Hegedűs 2011 for a recent overview). For example, the bound stem *mög* of the postposition *mögé* ‘to behind’ was still in use as a noun in the Old Hungarian period (roughly between 900 and 1500 AD) in the meaning ‘area behind something’ (Zajácz 2006). Combined with a now extinct directional suffix, it occurred frequently in directional possessive constructions (‘to the hind area of someone/something’), and it got grammaticalized by the end of the Old Hungarian period as a postpositional construction (‘to behind something/someone’).

Inflecting suffixes underwent a similar diachronic development before the beginning of the Old Hungarian period. In fact, Hegedűs (2011) argues that only inflecting postpositions showed a reduced level of possessive behaviour at the end of this period, and inflecting suffixes did not. In this paper we argue that this difference in terms of degrees of grammaticalization still exists, and it is observable to some extent in contemporary Hungarian.

2.2. Inflecting postpositions and suffixes as particles

As has been pointed out in Section 1, both inflecting postpositions and suffixes can function as verbal particles in what prima facie looks like their pronominal form. These particles license an oblique associate together with the verb. The associate of a reduplicating particle shows the same case morphology as the particle, and it is dative-marked in the case of inflecting postpositional particles. We repeat (1) as (5) to illustrate this point.

(5) a. *Rá* *ugrott-ál* *az* *asztal-ra*.
onto.3SG jumped-2SG the table-onto
‘You jumped onto the table.’
b. *Mögé* *ugrott-ál* *az* *asztal-nak*.
behind.to.3SG jumped-2SG the table-DAT
'You jumped behind the table.'

It is a fundamental question in the grammar of inflecting particles whether the particles in (5) are grammatically equivalent to the pronominals we discussed in Section 2.1. We will argue in Sections 4 and 5 that the answer is *yes* in the case of possessive particles (5b), but reduplicating particles are not pronominal (5a). They are agreement markers of a special sort.

We use the term *particle* throughout in a pre-theoretical sense to refer to any verbal modifier that immediately precedes the verb in neutral sentences.

As we argue in Laczkó & Rákosi (this volume), this immediately preverbal position is the specifier of the VP. All of these particles are separable, and the particles are forced to appear in positions other than Spec,VP if the clause contains preverbal focus or negation, cf. (6):

(6) a. *TE* *ugrott-ál* *rá* *az* *asztal-ra*.
you.NOM jumped-2SG onto.3SG the table-onto
'It was YOU who jumped onto the table.'

b. *Nem* *ugrott-ál* *mögé* *az* *asztal-nak*.
not jumped-2SG behind.to.3SG the table-DAT
'You did not jump behind the table.'

Beyond this basic level of identical behaviour, we argue that the two inflecting particles we discuss in this paper are in fact categorically non-identical. Reduplicating particles are non-projecting words in the sense of Toivonen (2001a, 2002), *PRT*s for short. Possessive particles project a full PP. Irrespective of this divide, Hungarian orthography is somewhat inconsistent as to whether these particle-verb combinations should be spelled as one word or not, and native speakers are often uncertain about which spelling variant they should use. Based on the relevant aspect of our analysis, we consistently spell preverbal particles and their verbs as two distinct orthographical units (contrary to the standard Hungarian spelling practice).

As É. Kiss (1998) and Surányi (2009a,c) show, the two PVCs represented in (5) are subject to a thematic constraint on the choice of the particle that can head the dependency with the oblique associate: only locative and directional particles are licensed in these constructions. A list of reduplicating particles is given in (7), and that of possessive particles is given in (8).

(7) a. *bele* 'into'
b. *benne* 'in'
c. *érte* 'for'
d. *hozzá* 'to'
e. *neki* 'to/against'
f. *rá* 'onto'
g. *rajta* 'on'

(8) a. *alá* 'to under'
b. *alatt* 'under'
c. *mellé* 'to beside'
d. *mellett* 'beside'
e. *mögé* 'to behind'
f. *mögött* 'behind'
g. *után* 'after'

The list in (7) is exhaustive: it contains all the inflecting suffixes that can function as particles. This is a little more than half of the total number of inflecting case suffixes. The list in (8) is representative of a relatively larger group of inflecting postpositions that can be used as particles. Most of these postpositions form locative-directional pairs (8a-f) and they do so in a more transparent way than the inflecting suffixes that can be paired up on the basis of function and meaning (7a&b, 7f&g). This fact can be interpreted as a sign of the less grammaticalized nature of inflecting postpositions, especially in comparison with inflecting case suffixes.

3. Previous literature on locative dependencies

There exists a relatively large body of literature on particle-verb constructions in Hungarian, which we overview in more detail in Laczkó & Rákosi (this volume). Here we focus on what this literature has to say about the particular PVCs that we discuss in this paper. Since the reduplicating construction has received more attention, we start our overview with this PVC type.

The basic divide between various approaches concerns the locus of the particle-verb combination, and two entirely different views can be distinguished. A strong lexicalist account is propagated in a number of papers by Ackerman (1987, 1990, 2003) and Ackerman & Webelhuth (1993). Consider the following examples from Ackerman (2003: 24-25).

(9) a. *A* *gyerekek* *bele* *szerettek* *a* *tanítójuk-ba*.
the children.NOM into loved the teacher.their-into
'The children fell in love with their teacher.'
b. *bele szeret* V: 'fall in love with sb <SUBJ, OBL>'
OBL CASE = illative

(10) a. *A* *gyerekek* *belé-m* *szerettek*.
the children.NOM into-1SG loved
'The children fell in love with me.'
b. *belém szeret* V: 'fall in love with sb <SUBJ, OBL>'
OBL PRED = 'pro'
OBL NUM = sg
OBL PERS = 1

This is a non-compositional example, but according to Ackerman *any* particle-verb combination is lexical in nature (a claim that covers reduplicating and postpositional particles alike). The difference between the reduplicating particle (9) and the pronoun (10) is that the former is not predicative, i.e. it does not have a PRED (semantic) feature for the oblique argument, but the verb+particle unit is a lexical entry in both cases. To all intents and purposes, Ackerman treats the reduplicating particle *bele* as some sort of special derivational element, which can take on agreement morphology in the absence of an oblique associate (see *belém* in (10)). É. Kiss (1998), in the same spirit, takes reduplicating particles to be verbal prefixes of an adverbial sort that are selected by the verb.

In what we dub here as the *strong syntactic account*, reduplicating particles do not combine with the verb in the lexicon. Instead, they are assumed to form a syntactic dependency with the oblique associate. We are aware of the existence of three versions of this approach. É. Kiss (2002) takes reduplicating particles to be pronominal PPs which represent the oblique argument of the verb, and the case-marked noun phrase is an adjunct to them in an appositive relation. In Ürögdi (2003), particles and their associates form a chain, and the particle is in fact a feature bundle that represents the oblique argument, and that is spelled out in a higher position as a pronoun corresponding to the respective φ-features. On Surányi's (2009a,b,c) account, too, the two members of a particle-associate chain are related via syntactic movement. These chains involve the multiple spellout of the same syntactic object, where the head of the chain (the particle) is a reduced copy of the associate.

With the exception of É. Kiss (2002), it is a recurrent theme in these analyses that reduplicating particles are reduced pronominals of some sort. This is an assumption that we capitalize on in our analysis. Furthermore, we argue below for an analysis that cross-references the particle and the verb in the lexicon but which nevertheless treats the two as distinct lexical entries. In some sense then, our approach to reduplicating PVCs can be seen as a particular combination of the insights of both lexicalist and syntactic approaches.

Postpositional particles have received less attention in the literature, two notable exceptions being É. Kiss (1998, 2002) and Surányi (2009a,b). É. Kiss explicitly argues for a parallel treatment of possessive constructions and inflecting postpositions, based primarily on data of the following sort:

(11) a. *NEK-EM* *ugrott-ál* *mögé-m.*
DAT-1SG jumped-2SG behind.to-1SG
'It is ME that you jumped behind.'
b. *NEK-EM* *lopt-ák* *el* *a* *bögré-m.*
DAT-1SG stole-3PL away the cup-POSS.1SG
'It is MY cup that was stolen.'

It is well-known that dative possessors can be extracted in Hungarian if they receive some discourse function (see Laczkó 1995, É. Kiss 2002). Such extracted dative possessors usually refer to participants who have been affected in the event somehow (11b). The extraction trigger is the same in the case of inflecting postpositions acting as particles, and we can indeed treat this dependency on a par with possessor extraction. It follows from this that the inflected postposition in (11a) has to be a possessive construction *in some sense*. É. Kiss and Surányi mention this fact by assuming that these postpositions project a possessive layer in syntax, but given that their immediate concerns lie elsewhere, they do not spell out this analysis in more detail. Our aim here is to specify what it means for these postpositions to be possessive.

4. Possessive particles

Unlike É. Kiss (2009a,b), Surányi observes that extraction of the dative complement of an inflecting postposition is not acceptable across the board. It is only a subset of speakers that find constructions like (11a), repeated as (12), acceptable.

(12) *NEK-EM* *ugrott-ál* *mögé-m.*
DAT-1SG jumped-2SG behind.to-1SG
'It is ME that you jumped behind.'

Surányi argues that only those speakers who accept (12) can treat the postposition as a possessive construction of some sort. In our view, this is an important insight, which is supported by other observations that also point toward the conclusion that there is crucial inter-speaker variation in this domain. In what follows we discuss two such observations briefly.

Directional inflecting postpositions have a more complex morphological form in 3SG, which sounds somewhat archaic but which is still widely available dialectally. The standard form of the particle is in (13a), and the non-standard form is in (13b).

(13) a. *mögé*
behind.to.3SG
'(to) behind him'
b. *mögé-je*
behind.to-POSS.3SG
'(to) behind him'
c. *zené-je*
music-POSS.3SG
'his music'

Notice that the extra morphology in the non-standard variant of the postposition (13b) is remarkably similar to the standard possessive morphology (13c). We argue that the two in fact are the same. This is supported by the fact that whoever accepts (13b) will also generally accept the extraction of the dative complement, cf. (14).

(14) *Mögé-je* *ugrott-ál* *az* *asztal-nak*.
behind.to-POSS.3SG jumped-2SG the table-DAT
'You jumped behind the table.'

A second, and seemingly unrelated observation concerns the coding of reflexivity in locative PPs in Hungarian. Consider the following minimal pair:

(15) a. *Le-tett-em* *magam mellé* *a* *könyv-et*.
down-put-1SG myself beside.to the book-ACC
'I put the book down beside myself.'
b. *Le-tett-em* *mellé-m* *a* *könyv-et*.
down-put-1SG beside.to-1SG the book-ACC
'I put the book down beside me.'

In standard Hungarian, anaphoric coding of reflexivity (15a) is the only choice for many speakers, and only a subset of them accepts pronominal encoding in these contexts (15b). Rákosi (2010) discusses this phenomenon in detail, and he argues that non-standard speakers optionally have a possessive lexical entry for the inflecting postposition in (15b). In particular, this representation includes a silent PLACE predicate, and thus the semantics of (15b) can be roughly described with the English 'I put down the book beside my place'. Because of the presence of this extra possessive layer at f-structure, the referential dependency in question is non-local in nature, and pronominal coding is licensed.

In sum, the dative-type PVC is a marked phenomenon in standard contemporary Hungarian because not every speaker has the required alternative possessive representation for the particle. But whether possessive or not, these particles always project a PP at c-structure, and the difference only manifests itself in the lexical entries and in the respective f-structures. Likewise, irrespective of whether this PP co-occurs with a dative associate or not, it is always the PP itself that spells out (the PRED feature of) the oblique argument of verb.

We illustrate our analysis with the following examples:

(16) a. *Mögé* *ugrott-ál*.
behind.to.3SG jumped-2SG
'You jumped behind it.'
b. *Mögé* *ugrott-ál* *az* *asztal-nak*.
behind.to.3SG jumped-2SG the table-DAT
'You jumped behind the table.'

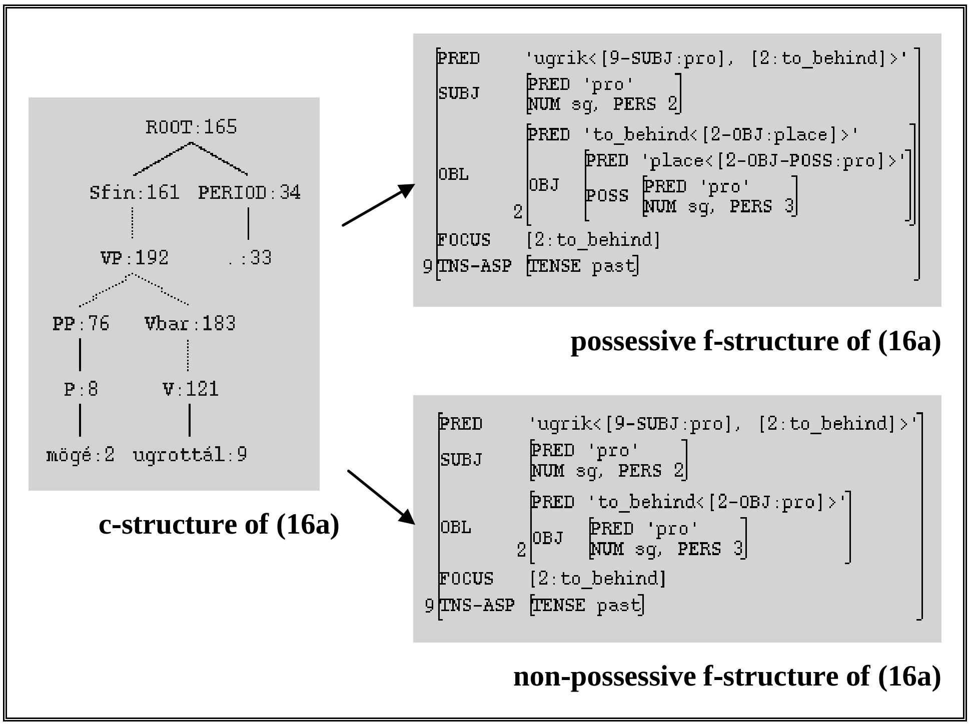


Figure 1

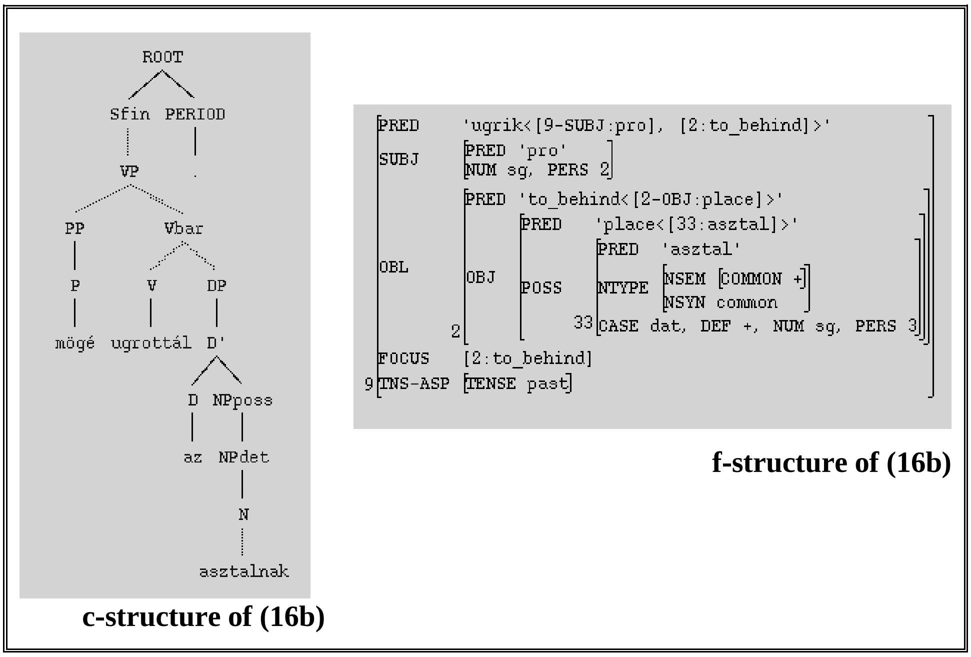


Figure 2

Figure 1 on the preceding page contains c- and f-structure representations that we generated in the XLE-implementation of our grammar for (16a). We claim that (16a) is potentially subject to an f-structure ambiguity: it includes the possessive or the non-possessive variant of the particle. (16b), on the other hand, has to be non-ambiguous in this respect, for only the possessive particle can license the dative associate. The corresponding representations are in Figure 2.

This analysis requires four distinct lexical entries for the particle, which we compress now into one complex entry (as it is actually stored in our XLE-based lexicon of Hungarian):

(17) *mögé*: P (↑PRED)= ‘to_behind <(↑OBJ)>’
(OBL ↑) (i)
({ (↑OBJ PRED)= ‘place <(↑OBJ POSS)>’
(↑OBJ POSS PERS)= 3
(↑OBJ POSS PRED)= ‘pro’ (ii)
(↑OBJ POSS NUM)= sg
| (↑OBJ PRED)= ‘place <(↑OBJ POSS)>’
(↑OBJ POSS CASE)=c dat (iii)
(↑OBJ POSS PERS)=c 3
| (↑OBJ PRED)= ‘pro’ (iv)
(↑OBJ PERS)= 3
(↑OBJ NUM)= sg }).

To ease reference, we have marked the four distinct layers of the entry with Roman numbers. The layer that projects the postposition taking lexical complements is (i); (ii) and (iii) are the possessive entries, of which (ii) is pronominal, and (iii) licenses a dative associate; and (iv) is the non-possessive pronominal entry. Informally, (17) reads as follows: if *mögé* is not a postposition, then it can be a possessive particle with a *pro*-dropped possessor or a possessive particle with a dative possessor, or a non-possessive particle. In each case, *mögé* will project a PP.

For the functional annotations of (17/iii) to work, we need to augment the inventory of annotations that can be associated with DPs in Hungarian in the way shown in (18).

(18) (↑OBL OBJ POSS) = ↓ (↓ CASE)=c dat

These two annotations encode the following scenario. The DP in the dative expresses the possessor argument of the object of the main predicate’s oblique argument.

This analysis provides an easy way to explain the observed variation across native speakers: the speakers who accept the dative dependency by inflecting particles have a lexical representation of the respective P-element that is possessive in nature (17/ii & 17/iii).

It is to be noted that this account is restricted to constructions which are productive and which involve a compositional particle-verb combination. There also exist idiosyncratic combinations that are non-compositional and which should be regarded as constructional idioms. Consider the following example:

(19) a. *Után-a* *jár-ok* *az* *ügy-nek*.
After-3SG go-1SG the case-DAT
'I make inquiries into this case.'
b. **Az ügy* *után* *jár-ok*.
The case.NOM after go-1SG
Intended meaning: 'I make inquiries into this case.'

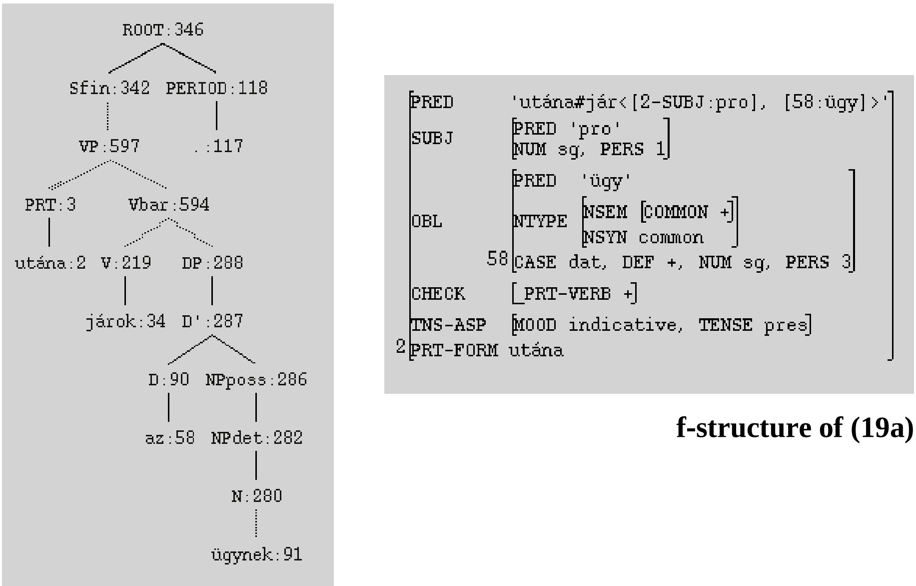
Interestingly, in this case the dative-type PVC must be used even in standard Hungarian: (19a). The "plain" postpositional variant is totally unacceptable: (19b).

For such cases, we make use of the CONCAT template of XLE. Referring the reader to Forst, King & Laczkó (2010) and to Laczkó & Rákosi (this volume) for a more detailed description, we only note here that this device allows for concatenation of two independent lexical entries that coreference each other in the lexicon. Thus, to take care of (19a), we need the entry in (20a) for the verb, and the extra entry in (20b) for the particle.

(20) a. *utána*: PRT (↑PRT-FORM) = utána
(↑OBL PERS) = 3
(↑OBL CASE) = dat
(↑ CHECK _PRT-VERB) =c +
b. *jár*: V (↑PRED)= '%FN <(↑SUBJ) (↑OBL)>'
(↑PRT-FORM)=c utána
(↑CHECK _PRT-VERB) = +
@(CONCAT (↑ PRT-FORM) # jár %FN)

The particle and the verb coreference each other via a check feature, which allows them to stay syntactically independent. The CONCAT template creates a name for the resulting complex predicate.

Notice that this analysis requires the particle to be a non-projecting head in the sense of Toivonen (2001a, 2002). This, we believe, is the right analysis of the facts, since the particle in this case (unlike in the compositional cases) cannot be modified, and it shows no phrasal properties. Notice further that this non-projecting particle (or PRT, for short) does not have possessive feature content either. Figure 3 contains the resulting c- and f-structure for (19a).



f-structure of (19a)

c-structure of (19a)

Figure 3

5. Reduplicating particles

Capitalizing on a relatively consensual intuition in the literature (see Section 3), we do not treat the pronominal particle and the reduplicating particle on a par in this case. Thus, whereas the particle *rá* functions as a phrasal pronominal element in (21a), we analyze the reduplicating particle in (21b) as an agreement marker of a special kind that has become completely bleached, and it has lost its semantic content altogether. Our proposal thus owes much in spirit to that of Ackerman (1987, 1990, 2003).

(21) a. *Rá* *ugrott-ál.*
onto.3SG jumped-2SG
'You jumped onto it/her/him.'
b. *Rá* *ugrott-ál* *az* *asztal-ra* / *az* *asztal-ok-ra.*
onto.3SG jumped-2SG the table-onto the table-PL-onto
'You jumped onto the table/tables.'

The underlying assumption is that inflecting case suffixes have gone much further on the grammaticalization path than inflecting postpositions. This has resulted in the reduplicating construction, where the particle is a non-projecting word (in the sense of Toivonen 2001a, 2002) that has no lexical semantic content. A grammaticalization process whereby a pronominal element becomes an agreement marker is well-attested cross-linguistically (see Bresnan 2001 and Toivonen 2001b in the LFG literature). In fact, Coppock & Wechsler (2010, to appear) have claimed recently that definiteness object agreement morphology in Hungarian is the result of a similar grammaticalization process. If they are on the right track, then their analysis provides language-internal evidence for the availability of the kind of grammaticalization that we propose here for reduplicating particles.

The lexical representation that we assume for the pronominal particle in (21a) is as follows:

(22) *rá*: Pron (↑PRED)= ‘pro’
(↑CASE)= sublative
(↑PERS)= 3
(↑NUM)= SG

This is relatively straightforward, except for the fact that the whole entry is treated as a pronoun that projects a DP, rather than a PP. We follow Bartos (1999) in making this categorical distinction between inflected case suffixes and inflected postpositions (which project a PP). Furthermore, we also assume that the case suffix itself does not have a PRED feature, but only a CASE feature that can possibly be interpreted compositionally at the level of semantic structure. This reflects the current state of our XLE-implementation, but nothing crucial hinges on this assumption. The essence of our argumentation and the analysis would not change if we treated inflecting case markers as P-elements with a PRED feature, and with concomitant lexical or pronominal P-objects.

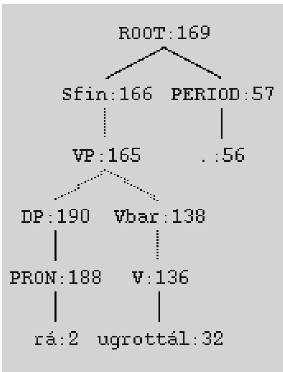
The lexical entry of the reduplicating particle is given in (23a).

(23) a. *rá*: PRT (↑PRT-FORM) = rá
(↑OBL PERS) = 3
(↑OBL CASE) = sublative
(↑ CHECK _PRT-VERB) =c +

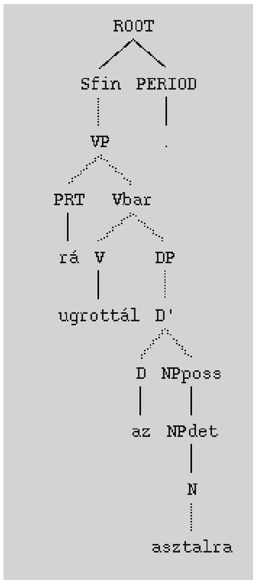
b. *ugrik*: V (↑PRED)= ‘%FN <(↑SUBJ) (↑OBL)>’
(↑PRT-FORM)=c rá
(↑CHECK _PRT-VERB) = +
@(CONCAT (↑ PRT-FORM) # ugrik %FN)

Such a particle is a non-projecting PRT. Given that it can combine with singular and plural associates alike (see 21b), we assume that it is underspecified for the NUMBER feature (which is formally treated here as the absence of this feature). The particle encodes two pieces of information about the oblique associate: its PERSON and CASE features. We treat reduplicating particles as agreement markers of some sort exactly for the reason that they spell out specific features of their dependent. The particle is specified as forming a complex predicate with the verb (and vice versa) via the machinery that we introduced in Section 4. The appropriate verbal entry is in (23b).

We invite the reader to compare the resulting c-structures and f-structures in Figures 4, 5 and 6. As before, we use XLE-generated representations.



c-structure of (21a)



c-structure of (21b)

Figure 4

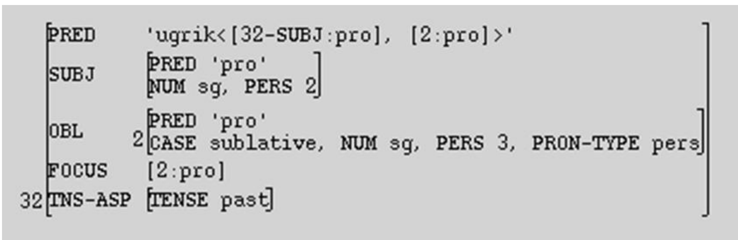


Figure 5: f-structure of (21a)

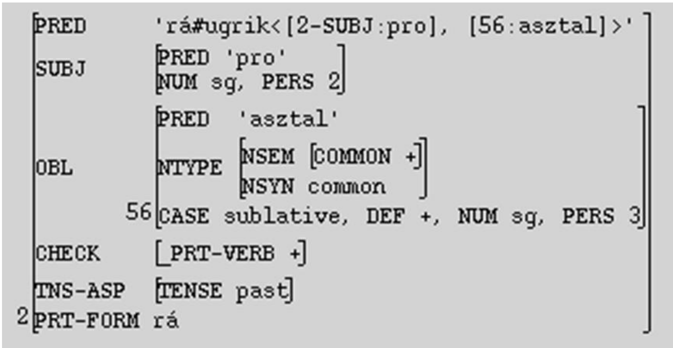


Figure 6: f-structure of (21b)

The use of the CONCAT template might seem unwarranted in the case of a complex predicate like *rá#ugrik* 'jump onto', which is straightfowardly compositional.

The primary reason why we decided to store every attested reduplicating particle plus verb combination in the lexicon is that the majority of these combinations (both in terms of types and tokens) are in fact non-compositional. It is actually not easy to find compositional reduplicating PVCs in corpora. It should also be added that there is quite a lot of idiosyncracy involved in whether this kind of reduplication is obligatory, possible or unavailable for any potential verbal host. As a rule of thumb, it is the inherent aspectual feature of the particle that drives the combinations. The particle *rá* 'onto', for example, has a telic nature. Thus, this particle is usually obligatory if the resulting complex is telic (24a), and it is unavailable if the intended verbal meaning is atelic (24b). However, the particle can be optional in telic complexes (25a), and it can even be obligatory in atelic ones (25b).

(24) a. *Nem jövök* *(*rá*) *a megoldás-ra*.
not come.1SG onto.3 the solution-onto
'I cannot figure the solution out.'
b. *Nem tartozik* (**rá*) *Kati-ra*.
not belongs onto.3 Kate-onto
'This does not concern Kate.'

(25) a. *Nem rivallt-am* (*rá*) *Kati-ra*.
not yelled-1SG onto.3 Kate-onto
'I did not yell at Kate.'
b. *Nem szorul-ok* *(*rá*) *Katira*.
not press-1SG onto.3 Kate-onto
'I stand in no need of Kate('s help).'

We, therefore, believe that it seems justified to subject reduplicating constructions to a lexical treatment in compositional and non-compositional cases alike. In this, we follow previous accounts that treat these particles as derivational elements (see especially É. Kiss 1998 and Ackerman 1987, 1990, 2000).

It may seem odd at first sight to assume that a particle that has a derivational character is an agreement marker of some sort at the same time. To give this analysis further substantiation, we would like to conclude by a brief discussion of interesting dialectal variation involving reduplicating PVCs with pronominal obliques. As far as we are aware, these data have only been noted in passim in Ackerman (1987) and Surányi (2009a,b).

It follows from our analysis that reduplicating particles should be able to license pronominal associates. This indeed is the case in third person, a consequence of the fact that the lexical specification of the particle in (23a) involves a third person constraint on the oblique:

(26) *Én* *Ő-RÁ* *szorul-ok* *rá*.
I.NOM he-onto.3SG press-1SG onto.3
'It is HIM that I stand in need of.'

If, however, the oblique pronominal is in non-third person, there is no optimal reduplicating solution in standard Hungarian (notice that with this particular non-productive combination, reduplication is obligatory, see (25b)). A subset of the speakers, however, can resort to the strategy of generalizing *rá* as a default form to these cases (27a), and another subset doubles the second person pronominal as a particle (27b):

(27) a. %*Én* *TE-RÁD* *szorul-ok* *rá*.
I.NOM you-onto.2SG press-1SG onto.
'It is YOU that I stand in need of.'

b. %*Én* *TE-RÁD* *szorul-ok* *rád*.
I.NOM you-onto.2SG press-1SG onto.2SG
'It is YOU that I stand in need of.'

The group of speakers that accept (27a) simply do not have the third person constraint in the reduplicating entry. Those who go for (27b) have developed a non-predicative use of the second person pronominal form of the case suffix, and treat it essentially as a reduplicating particle in the current sense of the term. Variation of this sort is attested in agreement marking systems, and can easily be modelled in the account that we have proposed here.

6. Conclusion

In this paper, we have scrutinized the grammar of two inflecting spatial particle types in Hungarian, both of which developed historically out of possessive nominal constructions. We have argued that traits of this origin are still detectable in contemporary Hungarian, but different particle-verb constructions show non-identical degrees of grammaticalization, and important interspeaker variation is also observable. We have presented an LFG-theoretic analysis of data, and we have shown how this analysis can be implemented in XLE.

The grammar of *possessive particles* and *reduplicating particles* is subject to variation along the following dimensions:

c-structure

- whether the particle projects a PP (productive possessive particles), or it acts as a non-projecting PRT (non-productive possessive particles and reduplicating particles);

f-structure

- whether the particle functions as a grammaticalized possessive structure with a silent PLACE-predicate acting as its semantic head (productive possessive particles vs the rest),
- whether the particle encodes a spatial relation or not (possessive or non-possessive postpositional particles vs reduplicating particles),
- and whether the particle constrains the agreement features of its associate or not (dialectal variation across reduplicating particles).

We have argued that LFG provides a suitable framework for the adequate description of this variation, and it also allows the grammar writer to reflect on the known diachrony of the particles – a perspective that, as we have tried to show here, allows for a more insightful treatment of the synchronic facts.

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ARGUMENT SCRAMBLING WITHIN URDU NPS

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Abstract

Clause-level discontinuity of NPs in different languages has been reported in the literature under different headings like discontinuity, extraposition, extraction, free topic, quantifier float and so on. However, discontinuity within the constituent-level, has only recently been noted (Raza, 2011) and is reported on in this paper. Urdu is a language in which both types of discontinuity, clause-level and constituent-level, have been found. In constituent-level discontinuous NPs, discontinuity occurs inside NPs at one structural position of a clause. In such phrases, the arguments of heads are non-contiguous to their respective heads inside NPs. The heads, however, cannot precede their arguments. This discontinuity and the constraints on the order of elements in NPs in Urdu pose a modeling problem. In contrast to what is usually assumed within ParGram (Butt et al., 1999; Dipper, 2003), a flat c-structure for Urdu NPs is therefore proposed and is modeled in the LFG framework.

1 Introduction

In simple terms, a constituent in which the individual words that make it up appear separately and are interleaved with other elements is called a discontinuous constituent. Languages that exhibit several of the following characteristics: free word order, discontinuous constituents, split-ergative case marking and null anaphora, are often referred to as non-configurational languages (Hale, 1980, 1983, 1992; Simpson, 1983, 1991). Warlpiri is considered a typical example of a non-configurational language which shows almost all the properties that have been associated with non-configurational languages. A sample sentence of Warlpiri is given in (1) to show the phenomenon of discontinuous NPs across the clause.

(1) **wita-jarra-rlu** ka-pala wajili-pi-nyi *yalumpu* (WarlPiri)
small-Du-Erg Pres-3DuSubj chase-NPast that.Abs

kurdu-jarra-rlu *maliki*.
child-Du-Erg dog.Abs

'The two small children are chasing that dog.'

(Austin and Bresnan 1996:217)

In (1) the two NPs 'two small children' and 'that dog' are not continuous. Some other elements are interleaved between the head nouns 'children' and 'dog' and their modifiers 'small' and 'that'. Other permutations of words in the sentence (provided the auxiliary *ka-pala* is always in the second position) can also be uttered spontaneously by a native speaker and the truth-conditional meaning of the sentence does not change. Austin and Bresnan (1996) have worked out a detailed analysis of non-configurationality in Australian aboriginal languages in the LFG framework.[1] Discontinuous noun phrases have also been investigated in detail for many other languages like German (Müller, 2004; van Riemsdijk, 1989;

[1]Legate (2002), however, has argued for a configurational analysis of Warlpiri.

Kuhn, 1998; Fanselow and Ćavar, 2002; Roehrs, 2006), Russian (Kazenin, 2005; Gouskova, 2001; Sekerina, 1997), Greek (Nthelitoes, 2004; Agbayani and Golston, 2005), Dutch (van Hoof, 1997), Ukrainian (Féry et al., 2007), Serbo-Croatian-Bosnian (Ćavar, 1999; Boškovič, 2005), etc.

Urdu/Hindi is a free-word-order language. The dependents of nouns and arguments of verbal predicates are usually marked for case by clitics. As part of providing a complete analysis and model of Urdu noun phrases in the context of a broad-coverage ParGram grammar of Urdu within the LFG framework (Butt et al., 1999), parallel to the syntax of other languages like English, German, French etc. (Butt et al., 1999), a corpus of Urdu newspapers, *Roznama Jang* and *Roznama Nawaiwaqt*, of Pakistan has been analyzed to establish patterns within Urdu noun phrases. Some of our observations about possible permutations of modifiers, specifiers and arguments in Urdu NPs point to an interesting NP organization of a kind not previously reported in the literature. For one, Urdu NPs can have two genitive marked arguments as specifier/complement of the head noun (Raza, 2010), just as in German and English. However the Urdu genitives are not always tied to a particular phrase structure position, unlike in German and English. And Urdu does not have alternate constructions for possessors in NPs as found in English and Hungarian (Laczkó, 2000), for example, although an *ezafe* construction is sometimes found with Persian loan words (Bögel and Butt, to appear). Furthermore, evidence for a general non-hierarchical nature of the Urdu NP comes from the fact that the arguments in NPs can be non-contiguous to their respective heads. In this paper we present and analyze the latter phenomenon and model it in LFG. In contrast to what is usually assumed within ParGram (Butt et al., 1999; Dipper, 2003), we propose a flat c-structure for Urdu NPs. Although Urdu NPs have been described at length in grammar books (e.g., Schmidt 1999; Platts 1967), the phenomenon described in this paper to our knowledge has not been noted before.

The paper is organized as follows. Section 2 provides an overview of the basic terminology of discontinuity. In section 3 we describe the argument-taking adjectives in Urdu. The argument-taking adjectives in Urdu interact with nouns to generate discontinuous constituents in noun phrases. The data of discontinuous noun phrases in Urdu is described in section 4. Theoretical implications of the data are described in section 5. In section 6, the constituent-level discontinuity in Urdu is implemented in the LFG framework and section 7 concludes the paper.

2 State of the Art

Different phenomena of discontinuous noun phrases have been discussed in the literature (see for example (Fanselow and Féry, 2006)) and are briefly described in the following subsections. Many examples quoted in these subsections are taken from Fanselow and Féry (2006).

2.1 Simple and inverted discontinuous noun phrases

If the order of elements in the discontinuous noun phrase is the same as the canonical order in the corresponding continuous noun phrase, then the discontinuous noun phrase is called a simple discontinuous noun phrase, else it is called an inverted discontinuous noun phrase.

Considering the prosodic properties, discontinuous noun phrases are divided into cohesive and non-cohesive discontinuous noun phrases. When the whole discontinuous noun phrase is integrated into a single intonational phrase, then it is a cohesive discontinuous noun phrase and if its two parts are separated into two intonational phrases then it is a non-cohesive discontinuous noun phrase. Simple discontinuous noun phrases are usually cohesive and inverted discontinuous noun phrases are usually non-cohesive. In Ukrainian (Féry et al., 2007) both types of discontinuous noun phrases have been reported.

(2) a. Marija maje **bahato krisel**. (Ukrainian)
Mary has.got many chairs.Gen.Pl
'Mary has got many chairs.'

b. **bahato** maje Marija **krisel.**

c. **krisel** Marija maje **bahato**.

The example sentence (2) from Ukrainian depicts the canonical order of a continuous noun phrase in (2a) and a simple discontinuous noun phrase in (2b) and an inverted discontinuous noun phrase in (2c).

2.2 Extraction from DP

Extraction from DP involves the dislocation of an argument or adjunct of the head noun to the left in the DP. For example in (3), *über Logik* 'about logic' is thematically dependent on the lexical noun *Bücher* 'books'. In (3b), although the DP is discontinuous, the adjunct of the noun is still adjacent to it. In (3c), however, the adjunct *über Logik* is taken out of the DP to the left and hence is an example of extraction.

(3) a. Er hat **viele Bücher über Logik** gekauft. (German)
He has many books on logic bought
'He has bought many books about logic.'

b. **Bücher über Logik** hat er **viele** gekauft.

c. **Über Logik** hat er **viele Bücher** gekauft.

This distinction between extraction and other discontinuous phrases was made by generative syntacticians (Haider, 1985). Extraction as in (3c) is generally explained by movement. Only a maximal projection is posited to move to a pre-auxiliary position. As *über Logik* is the maximal projection of a preposition, it can be moved to the pre-auxiliary position. *Bücher über Logik*, however, is considered a submaximal projection of a noun. The maximal projection of a noun is assumed to have the specifier position filled by the determiner. So (3b) and (3c) are explained by different mechanisms and a distinction is made between (3b) and (3c). Müller (2004) has described various possible analyses for (dis)continuous constituents in German in HPSG with different assumptions and explanations.

2.3 Quantifier Float

Quantifier Float involves dislocation of the quantified expression away from the noun. This phenomenon has also been explained in terms of movement dependencies in that the DP can move to Spec,TP and the quantifier could be left *in situ* (Déprez, 2003). A further analysis for *all* is made in terms of adverbial quantification as it shares the distributional properties of adverbs like *ever*.

(4) a. **They all** have bought a car.

b. **They** have **all** bought a car.

In (4a) the base generated 'They all' has moved to Spec,TP and in (4b) the quantified part 'all' has been left *in situ* and only *They* has moved to Spec,TP.

McCloskey (2000) has observed another type of quantifier float in the context of *wh*-movement. The quantifier in (5b) is not bound with the subject, rather it is construed with the *wh*- question word referring to the object.

(5) a. **What all** did you get *t* for Christmas? (Irish English)

b. **What** did you get **all** for Christmas?

2.4 Free Topic structure

In a Free Topic structure, two semantically related elements forming a unique theme become discontinuous in the clause. Usually one element that is more abstract is made the topic and the other more specific element is placed in the canonical position.

(6) **Say-nun** ku-ka **nightingale-man** a-n-ta. (Korean)
bird-Top he-Nom nightingale-only know-Pres-Dec
'As for birds, he only knows nightingales.'

In (6) *bird* and *nightingale* are both semantically related and form a unified theme in the clause, although they are separate from each other in the clause.

2.5 Extraposition

Extraposition is a phenomenon in which the dependent element of a noun is moved to the right in contrast with extraction where the dependent element is moved to the left.

(7) a. **A man** came in **who had a beard**.

b. **A book** came out **about logic**.

The relative clause in (7a) that describes the noun in the main clause is postposed and in (7b) the PP adjunct of the noun is postposed.

Although extraction, quantifier float, free topic and extraposition are all in some sense discontinuous noun phrases, in the generative framework these are generally distinguished from the absolute discontinuous noun phrases that only involve the separation of the head noun from its determiner, article or an adjective modifying it. Theoretically the phenomenon of a discontinuous noun phrase is licensed only if at least one of the heads involved appears in an A-bar position (Fanselow and Féry, 2006).

2.6 Clause-level discontinuity in Urdu

Almost all types of discontinuous NPs at clause level mentioned above have also been observed in Urdu. Although clause-level discontinuous NPs are not the main topic here, however, for contrast, evidence for such phrases is provided by the following examples.

(8) a. ندا نے منطق پر ایک کتاب خریدی ہے.

nıda=ne	**mɑntıq=pɑr**	**ek**	**kıtab**	xɑrid-i	hɛ.
Nida=Erg	logic=Loc.on	one	book.F.3Sg	buy-Perf	be.Pres

'Nida has purchased a book on logic.'

b. منطق پر ندا نے ایک کتاب خریدی ہے.

mɑntıq=pɑr	nıda=ne	**ek**	**kıtab**	xɑrid-i	hɛ.
logic=Loc.on	Nida=Erg	one	book.F.3Sg	buy-Perf	be.Pres

(Extraction from DP)

(9) a. علی نے بہت آم کھائے.
ɑli=ne **bɑhʊt am** k^{h}a-e
Ali.M.3Sg=Erg many mango.M eat-Perf.M.3Pl
'Ali ate many mangoes.'

b. آم علی نے بہت کھائے.
am ɑli=ne **bɑhʊt** k^{h}a-e
mango.M Ali.M.3Sg=Erg many eat-Perf.M.3Pl
(Quantifier Float)

(10) a. علی کو آم پسند ہے.
ɑli=ko **am** pɑsɑ̃d hɛ
Ali.M.3Sg=Dat mango.M liked be.Pres
'Ali likes mango.'

b. پھل، علی کو آم پسند ہے.
p^{h}ɑl ɑli=ko **am** pɑsɑ̃d hɛ
fruit.3Sg Ali.M.3Sg=Dat mango.M liked be.Pres
'With respect to fruits, Ali likes mangoes' (Free Topic)

(11) a. ایک شخص، جس کی داڑھی تھی، آیا.
ek ʃɑxs jɪs=ki daṛ^{h}i t^{h}i a-ya
one person.M.3Sg Rel.3Sg=Gen.F beard.F.3Sg be.Past come-Perf.M.3Sg
'One person, who had a beard, came.'

b. ایک شخص آیا جس کی داڑھی تھی.
ek ʃɑxs a-ya **jɪs=ki daṛ^{h}i t^{h}i**
one person.M.3Sg come-Perf.M.3Sg Rel.3Sg=Gen.F beard.F.3Sg be.Past
'One person came who had a beard.' (Extraposition)

Extraposition with relative clauses and correlatives has been discussed in detail by Dayal (1994) and a relevant discussion is also made by Dwivedi (1994). Note that, the sentence in (9b) is an instance of an inverted discontinuous noun phrase in Urdu. Before moving to the within-constituent discontinuity in Urdu, argument taking adjectives are briefly described in section 3 to provide the necessary background.

3 Argument-taking adjectives

In Urdu, participial adjectives and some other adjectives originally derived from verbal stems of other languages take arguments. Some examples of the second type of argument-taking adjectives are listed in Table 1. The nouns in parenthesis are modified by the argument taking adjective.

Nr.	Type of Argument	Example of Adjective Phrase
(i)	Dative Marked	sɑdɑr=ko **hasıl** (ıxtıyarat) president=Dat attained (powers) '(The powers) attained by the president'
(ii)	Instrumental Marked	ɑdlıyɑh=se **xaıf** (hʊkmɑran) courts=Inst afraid (ruleres) '(The rulers) afraid of courts'
(iii)	Locative (in) Marked	bʊxar=mẽ **mʊbtɑla** (ʃɑxs) fever=Loc.in suffered (man) '(The man) suffered with fever'
(iv)	Locative (on) Marked	tɑqarir=pɑr **mʊʃtɑmıl** (kıtab) speech.Pl=Loc.on comprised (book) '(The book) comprised of speeches'
(v)	Adpositional	sıhɑt=ke lıye **mʊzır** (xurak) health=Gen for harmful (food) '(The food) harmful for health'
(vi)	Genitive Marked	sɑdɑr=ke **hami** (ɑfrad) president=Gen.Pl supporting (people) '(People) supporting to the president'

Table 1: Argument-taking adjectives

Adjectives listed in Table 1 are derived from Arabic verbal stems and can sometimes be replaced with native participial adjectives as shown in (12).

(12) a. صدر کو حاصل اختیارات
sɑdɑr=ko hasıl ıxtiyarat
president=Dat attained power.M.3Pl
'powers attained by the president'

b. صدر کو ملے ہوئے اختیارات
sɑdɑr=ko mɪl-e hu-e ɪxtiyarat
president=Dat attain-Perf.M.3Pl be-Perf.M.3Pl power.M.3Pl
'powers attained by the president'

The adjective *hasɪl* in (12a) and the participial form *mɪl-e hu-e* in (12b) are semantically equivalent with the meaning of 'attained'.[2] The examples of noun phrases shown in Table 1 are not discontinuous as the nouns here are without arguments. Examples of discontinuous constituents will come in the next section.

Some adjectives like *hami* 'supporting/supporter' in (vi) of Table 1 taking a genitive marked argument are also used as nouns in Urdu. In addition to these adjectives, participial forms of verbs are also used as adjectives. The subject of transitive participial form is genitive marked when the participial form is used as an adjective (see (Raza, 2011) for detail). Apart from the subject of participial adjectives, the theme of some degree adjectives in Urdu is also marked by genitive case, as is shown in (13) for the two adjectives *bʊra* 'bad' and *accʰa* 'good'.

(13) a. دل کا برا شخص
dɪl=ka bʊra ʃɑxs
heart.M.3Sg=Gen.M.3Sg bad.M.3Sg person.M.3Sg
'a person of bad heart'

b. طبیعت کی اچھی لڑکی
tɑbi'ɑt=ki ɑccʰi lɑṛki
nature.F.3Sg=Gen.F.3Sg good.F.3Sg girl.F.3Sg
'a girl of good nature'

Ikeya (1995) showed that degree adjectives in English are one-place predicates and the contextual/semantic dimensions are in fact modifiers of these predicates. He reported three contextual dimensions of such predicates: Thematic Dimension (TD), Comparative Dimension (CD) and Degree Dimension (DD). In his example *He is very good at basketball for a short Japanese* all these dimensions are expressed: *at basketball* is TD, *for a short Japanese* is CD and *very* is DD. The first dimension TD was first reported by Bartsch (1986/87). These dimensions of degree adjectives are usually encoded by different case phrases or adpositional phrases. The genitive marked elements in (13) in fact are modifiers of adjectives encoding the thematic dimension of adjectives.

[2]The equivalent construct in Persian for this meaning is *hasɪl ʃʊdah* which is the participial form of *hasɪl ʃʊdɑn*. In Urdu, the adjective *hasɪl* can also be considered as the reduced participle form of complex predicate *hasɪl ho*.

Adjectives in Urdu can also allow for clausal complements. There is one class of adjectives that can appear in the copula constructions illustrated in (14). The morphemes *yɪh* or *yɪh bat* are equivalent to expletives in Urdu and can sometimes be dropped.

(i) [Nominalized property] Adj Cop
(ii) [(*yɪh/yɪh bat*) 'it'] Adj Cop CP

(14) a. علی کا انعام جیتنا ممکن ہے.
[ɑli=ka ɪn'am jit-na] **mʊmkɪn** hɛ
[Ali=Gen.M.3Sg prize.M.3Sg win-Inf.M] possible be.Pres.3Sg
'Ali's winning of the prize is possible.'

b. (یہ (بات)) ممکن ہے کہ علی انعام جیتے.
(yɪh (bat)) **mʊmkɪn** hɛ [kɪh ɑli ɪn'am jit-e]
(this (thing.F.3Sg)) possible be.Pres [that Ali prize.3Sg win-Subjn]
'It is possible that Ali will win the prize.'

In addition to *mʊmkɪn* 'possible', some other adjectives that fall in this class are *yaqini* 'sure', *zaruri* 'important', *sahih* 'true', etc.

Consider another class of adjectives which can take three alternate frames with the typical example *hɛran* 'surprised' illustrated in (15).

(i) NP-*par*
(ii) that-clause
(iii) NP-*par* that-clause

(15) a. ندا علی کے انعام جیتنے پر حیران ہے.
nɪda [ɑli=ke ɪn'am jit-ne]=pɑr **hɛran** hɛ
Nida.F [Ali=Gen.Obl prize.M win-Inf.Obl]=Loc.on surprised be.Pres.3Sg
'Nida is surprised at Ali's winning of the prize.'

b. ندا حیران ہے کہ علی نے انعام جیتا.
nɪda **hɛran** hɛ [kɪh ɑli=ne ɪn'am jit-a]
Nida.F surprised be.Pres.Sg [that Ali=Erg prize.M win-Perf.M]
'Nida is surprised that Ali won the prize.'

c. ندا اس بات پر حیران ہے کہ علی نے انعام جیتا.
nɪda ɪs bat=pɑr **hɛran** hɛ [kɪh ɑli=ne ɪn’am jit-a]
Nida this thing=Loc.on surprised be.Pres [that Ali=Erg prize.M win-Perf.M]
‘Nida is surprised that Ali won the prize.’

d. ندا علی پر حیران ہے کہ اس نے انعام جیتا.
nɪda ɑli=pɑr **hɛran** hɛ [kɪh ʊs=ne ɪn’am jit-a]
Nida.F Ali.M=Loc.on surprised be.Pres [that 3Sg=Erg prize.M win-Perf.M]
‘Nida is surprised that Ali won the prize.’

It can be said that the canonical argument of the adjective *hɛran* ‘surprised’ is *par* marked NP. However, if the *par* marked element is some nominalization then the adjective can alternatively take *that*-clause arguments (15b–d). The adjectives *pareʃan* ‘sad’ and *xʊʃ* ‘happy’ show similar syntactic behavior.

4 NP-internal discontinuity

In NPs, both nouns and their arguments/modifiers can have their own arguments. The discontinuous constituents in NPs occur in Urdu when some argument-taking adjectives modify some argument taking noun or if the argument of the head noun licenses its own argument in the noun phrase.

Argument-taking adjectives are placed further away from the head noun in comparison with argument-less adjectives. Both the argument of the head noun and the argument of its modifier/argument can co-occur at the start of noun phrases giving rise to discontinuous constituents within a noun phrase. Although Urdu noun phrases have been described in grammar books (see Schmidt 1999; Platts 1967, etc.), the phenomenon of discontinuity within the bounds of noun phrases has not been noticed and discussed before. Consider first rather simple examples of noun phrases in (16)–(17).

(16) a. مقدّمات سے استثنی
mʊqaddɑmat=se ɪstɪsna
court-case.M.3Pl=Abl immunity.M.3Sg
‘immunity from court-cases’

b. سلامتی پر بریفنگ
sɑlamti=pɑr bɑrifĩg
security.F.3Sg=Loc.on briefing.F.3Sg
‘briefing on security’

c. آرمی چیف سے مطالبہ
armi-cif=se mʊtalbɑh
army-chief.M.3Sg=Abl demand.M.3Sg
‘demand to the army-chief’

(17) a. مقدّمات سے آئینی استثنی
mʊqaddɑmat=se aini **ɪstɪsna**
court-case.M.3Pl=Abl constitutional immunity.M.3Sg
‘constitutional immunity from court-cases’

b. سلامتی پر تفصیلی بریفنگ
sɑlamti=pɑr tɑfsili **bɑrifĩg**
securit.F.3Sgy=Loc detailed briefing.F.3Sg
‘detailed briefing on security’

c. آرمی چیف سے قانونی مطالبہ
armi-cif=se qanuni **mʊtalbɑh**
army-chief.M.3Sg=Abl legal demand.M.3Sg
‘legal demand to the army-chief’

Example (16) contains just head nouns with a single argument. In (17), however, the head nouns are modified by argument-less adjectives. We see that the argument of the head noun in Urdu is separated from the noun when an adjective modifies the head noun. In English, on the other hand, the adjective modifying the noun is placed prenominally and the complement of the noun comes postnominally and so both remain contiguous to the head noun. A complex example of noun phrases in Urdu with different order of elements is given in (18).

(18) a. صدر کو حاصل مقدّمات سے آئینی استثنی
sɑdɑr=ko$_1$ hasıl$_1$ mʊqaddɑmat=se$_2$ aini ıstısna$_2$
president=Dat possessed court-cases=Abl constitutional immunity
'constitutional immunity from court-cases possessed by the president'

b. مقدّمات سے صدر کو حاصل آئینی استثنی
mʊqaddɑmat=se$_2$ sɑdɑr=ko$_1$ hasıl$_1$ aini ıstısna$_2$

c. صدر کو مقدّمات سے حاصل آئینی استثنی
sɑdɑr=ko$_1$ mʊqaddɑmat=se$_2$ hasıl$_1$ aini ıstısna$_2$

d. *حاصل مقدّمات سے صدر کو آئینی استثنی
*hasıl$_1$ mʊqaddɑmat=se$_2$ sɑdɑr=ko$_1$ aini ıstısna$_2$

e. *حاصل صدر کو مقدّمات سے آئینی استثنی
*hasıl$_1$ sɑdɑr=ko$_1$ mʊqaddɑmat=se$_2$ aini ıstısna$_2$

The subscripted numbers in (18) show which arguments belong to which heads. The order of elements in (18a) seems to be canonical where arguments of both noun and adjective are close to their heads. The bracketing structure for (18a) is given as:

[$_{NP}$[$_{AP}$[$_{KP}$ sɑdɑr=ko$_1$] hasıl$_1$][$_{KP}$ mʊqaddɑmat=se$_2$] aini ıstısna$_2$]

The bracketed NP shows the logical structure and association of arguments in this noun phrase. The elements marked for case are called case phrases (Butt and King, 2005), hence the case marked arguments of nouns or adjectives are labelled as KP in the bracketed structure. All of the examples in (18a–c) are valid noun phrases of Urdu and are equivalent in meaning. The canonical order of elements in (18a), interestingly, is rarely found in newspaper corpora. Instead the orders in (18b)-(18c) are generally found in news corpora, with the latter one being the most common. In (18b) the argument-less adjective is adjacent to the head noun, then comes the argument-taking adjective with its argument to its left and the argument of the noun is at the left-most edge of the NP. The constituent AP in (18b) is contiguous; however, it becomes non-contiguous in (18c) where arguments of the adjective and the noun are in order on the left; then all the heads follow on the right. The orders in (18d–e) are ungrammatical due to a violation of the head-final constraint in Urdu NPs. More examples of NP-internal discontinuity are shown in (19)–(20), where the head noun has a genitive marked argument and another ablative-marked argument.

(19) a. سلامتی پر بریفنگ کا آرمی چیف سے مطالبہ
sɑlamti=pɑr$_1$ bɑrifĩg$_1$=ka armi-cif=se$_2$ mʊtalbɑh$_2$
security=Loc.on briefing=Gen army-chief=Abl demand
'the demand to the army chief for a briefing on security'

b. آرمی چیف سے سلامتی پر بریفنگ کا مطالبہ
armi-cif=se$_2$ sɑlamti=pɑr$_1$ bɑrifĩg$_1$=ka mʊtalbɑh$_2$

c. سلامتی پر آرمی چیف سے بریفنگ کا مطالبہ
sɑlamti=pɑr$_1$ armi-cif=se$_2$ bɑrifĩg$_1$=ka mʊtalbɑh$_2$

(20) ملکی سلامتی پر آرمی چیف سے تفصیلی بریفنگ کا قانونی مطالبہ

mʊlki	sɑlamti=pɑr	armi-cif=se	tɑfsili
of-country	security.F.3Sg=Loc.on	army.chief.M.3Sg=Abl	detailed

bɑrifĩg=ka	qanuni	mʊtalbɑh
briefing.F.3Sg=Gen.M.3Sg	legal	demand.M.3Sg

'the legal demand to the army chief for a detailed briefing on the security of the country'

The argument *bɑrifĩg* 'briefing' of the head noun *mʊtalbɑh* 'demand' in (19) takes its own case marked complement *sɑlamti=pɑr* 'on security'. All orders in (19a–c) are acceptable to native speakers and the last one is the most common in news corpora. Here, again we see that the argument of the genitive marked argument and the other argument of the head noun stack together on the left edge, and the genitive marked argument and the head noun are lumped together at the right edge. The noun phrase in (20) shows that the argument-less adjectives always have their positions adjacent to the head nouns.

5 Theoretical implications

In English, adjectives cannot take complements in their prenominal position. Consider the examples in (21).

(21) a. a proud mother

b. a mother [proud of her daughter]

c. *a [proud of her daughter] mother

d. *a [yellow with age] manuscript (Maling 1983:284)

Emonds (1976) has proposed the 'Surface Recursion Restriction' according to which the modifiers themselves cannot be modified in prenominal position. Williams (1982) has formulated the 'Head-Final Constraint' in English: prenominal phrasal modifiers of nouns must be head-final. Due to this constraint no prepositional phrase (PP) can occur before nouns, as shown in (21c–d). The PP *of her daughter* is the complement of the adjective *proud* and *with age* is an adjunct of the adjective *yellow*.

Emond's restriction does not apply to Urdu as the modifiers at prenominal position can themselves be modified. William's Head final constraint only accounts for continuous constituents. So, it is also not applicable to Urdu as it does not account for the discontinuous AP within an NP.

Theoretical implications resulting from empirical observations of Urdu NPs can be stated in the form of two constraints. One is the adjacency constraint that the argument-less adjective is always contiguous to the head noun. In case there are more than one argument-less adjectives, their scrambling among each other is only possible in the vicinity of the head noun. The second constraint is the head-final constraint that the predicate heads cannot appear before their arguments or modifiers in NPs with the condition that the constituents within NPs may or may not be continuous. In Urdu NPs, the head noun appears at the right-most position (considering the order from left to right). The argument-less adjectives are placed just to the left of the head nouns and the rest of elements at the left edge can scramble among each other with the head final constraint in effect.

6 LFG implementation

As discussed above, examples of NPs from Urdu news corpora show that the arguments of the head noun and its modifiers/arguments can scramble inside the noun phrase, but that the heads must systematically follow their arguments. Non-continuous APs can appear inside a noun phrase. This evidence of discontinuous constituents within NPs implies a non-hierarchical structure of Urdu NPs. So we propose a flat structure for Urdu NPs. The pattern of Urdu NPs with the order of different elements is depicted in Figure 1. An excerpt from the grammar rules for the implementation of NPs in LFG is given in Figure 2.

Urdu NPs have been implemented in the XLE environment as part of a large scale Urdu grammar (Butt and King, 2007). To model discontinuous XPs at the constituent level within the LFG framework, use of several operators is made. The disjunction notation (|) has been used to assign various functional labels to the

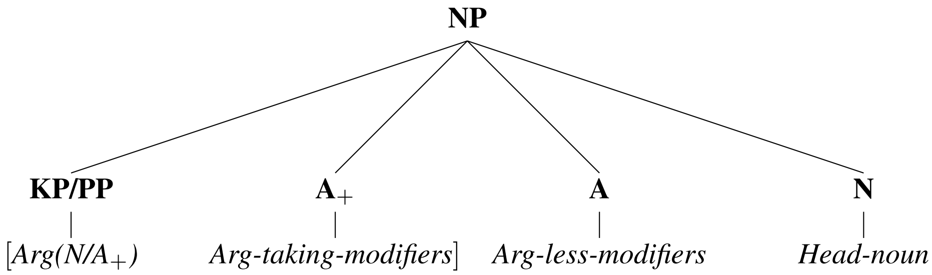


Figure 1: Word order in Urdu NPs: Elements in brackets can scramble among each other but the head-final constraint is in effect.

$$
\begin{array}{rl}
\text{NP} \rightarrow \text{KP*:} & \{(\uparrow \text{ADJUNCT \$ OBL})\!=\!\downarrow \\
& |(\uparrow \text{ADJUNCT \$ OBJ-GO})\!=\!\downarrow \\
& |(\uparrow \text{OBL})\!=\!\downarrow \\
& |(\uparrow \text{OBJ-GO})\!=\!\downarrow\} \\
& ,\ \text{`}\textit{shuffle operator}\text{'} \\
\text{A}_{+}\text{*:} & \downarrow \in (\uparrow \text{ADJUNCT}) \\
\text{A*:} & \downarrow \in (\uparrow \text{ADJUNCT}) \\
\text{N:} & \uparrow = \downarrow
\end{array}
$$

$$
\begin{array}{rl}
\text{NP} \rightarrow \text{KP*:} & \{(\uparrow \text{ADJUNCT \$ OBL})\!=\!\downarrow \\
& \;(\uparrow \text{ADJUNCT}) >\text{h} (\uparrow \text{ADJUNCT \$ OBL}) \\
& |\ \ldots\ldots\ldots\} \\
& \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots
\end{array}
$$

Figure 2: Grammar Rules

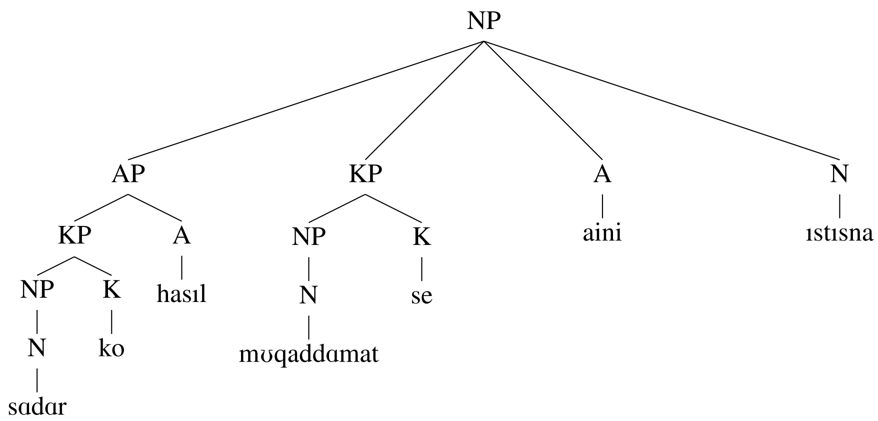
KP. The shuffle (,) operator establishes different word orders of the arguments in noun phrase. The $\in$ sign has been used for two different purposes. It is used to add some element to an adjunct set. This is its general use. However, it is also used to assign some value nondeterministically to some feature of a member of the adjunct set. Both of its uses appear in the grammar rules for the NP. In the first two lines of the grammar rules in Figure 2, $\in$ has been used to assign KP to the OBL function or OBJ-GO function of a member of the adjunct set. Another operator that has been taken advantage of is the head precedence operator (>h). The new rule with this operator is shown in the lower part of Figure 2. This operator is used for f-structure precedence and here it is used to make it sure that the head will not precede its arguments in the NP, thus implementing the Head-Final constraint. The possible c-structures for (18a–c) are shown in Figure 4. In (18c) the hierarchical structure of the AP inside the NP is not possible. So, a flat structure for Urdu NPs is assumed in general. The f-structure representation for each valid instance of (18) is shown in Figure 3. In the f-structure we see that logical grouping of different elements is correctly captured.

$$\left[\begin{array}{ll}
\text{PRED} & \text{‘ɪstɪsna}\left\langle\text{mʊqaddɑmat}\right\rangle\text{’}\\
\text{OBL} & \left[\begin{array}{ll}\text{PRED} & \text{mʊqaddɑmat}\\ \text{CASE} & \text{abl, GEND masc, NUM pl}\end{array}\right]\\
\text{ADJUNCT} & \left\{\begin{array}{l}\left[\begin{array}{ll}\text{PRED} & \text{‘hasɪl}\left\langle\text{sɑdɑr}\right\rangle\text{’}\\ \text{OBL} & \left[\begin{array}{ll}\text{PRED} & \text{sɑdɑr}\\ \text{CASE} & \text{dat, GEND masc, NUM sg, PERS 3}\end{array}\right]\end{array}\right]\\ \left[\begin{array}{ll}\text{PRED} & \text{aini}\end{array}\right]\end{array}\right\}\\
\text{GEND} & \text{masc, NUM sg}
\end{array}\right]$$

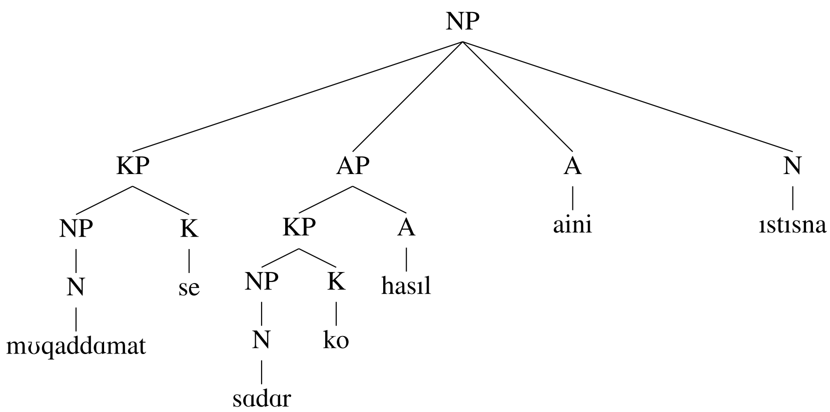
Figure 3: f-structure representation of (18)

7 Conclusion

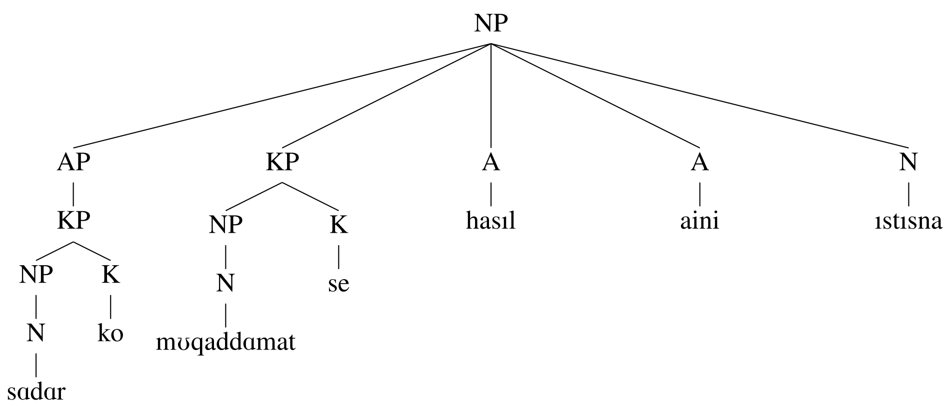
It has been shown that discontinuous constituents in Urdu can be found both at the clause level and at the noun phrase level. In Urdu NPs, discontinuous constituents arise when an argument taking noun is modified by an argument taking modifier or the argument of the head noun takes its own argument. The argument of the head noun and the arguments of its arguments/modifiers can scramble among each other with the head-final constraint in effect. This evidence suggests a flat structure for Urdu NPs. Alongside providing the theoretical implications of the phenomenon of constituent-level discontinuity, the syntax of Urdu NPs is implemented in the LFG framework. The existing theories about prenominal adjectives do not fit with the data of Urdu NPs. A constraint on adjacency of argument-less adjectives and a head final constraint allowing discontinuous constituents were posited to explain the syntax of Urdu NPs. Although existing apparatus in the LFG framework is sufficient to implement theoretical implications of syntax of Urdu NPs, the logical groupings of elements in these constructions are syntactically ambiguous and need semantics and pragmatics to disambiguate them.



(a) C-structure for (18a)



(b) C-structure for (18b)



(c) C-structure for (18c)

Figure 4: C-structures for the instances in (18)

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IMPLEMENTING THE MORPHOLOGY-SYNTAX INTERFACE: CHALLENGES FROM MURRINH-PATHA VERBS

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Abstract

Polysynthetic languages pose special challenges for the morphology-syntax interface because information otherwise associated with words, phrases and clauses is encoded in a single morphological word. In this paper, I am concerned with the implementation of the verbal structure of the polysynthetic language Murrinh-Patha and the questions this raises for the morphology-syntax interface.

1 Introduction

The interface between morphology and syntax has been a matter of great debate, both for theoretical linguistics and for grammar implementation (see, e.g. the discussions in Sadler and Spencer 2004). Polysynthetic languages pose special challenges for this interface because information otherwise associated with words, phrases and clauses is encoded in a single morphological word. In this paper, I am concerned with the implementation of the verbal structure of the polysynthetic language Murrinh-Patha and the questions this raises for the morphology-syntax interface.

The Murrinh-Patha grammar is implemented with the grammar development platform XLE (Crouch et al. 2011) and uses an XFST finite state morphology (Beesley and Karttunen 2003). As Frank and Zaenen (2004) point out, a morphology module like this in combination with sublexical rules makes a lexicon with fully inflected forms unnecessary, which is especially important for a polysynthetic language as listing all possible morphological words would be unfeasible, if not impossible. However, this raises the question of the division of work between syntactic grammar rules in XLE and morphological formations in XFST. By looking at different cases of long distance dependencies within the Murrinh-Patha verbal template, this paper contributes to an understanding of the division of work between these two components of grammar.

The paper is structured as follows. Section 2 gives a short overview over the Murrinh-Patha verb and provides some examples of the complexities of the verbal template. Section 3 then outlines the assumed architecture for the morphology-syntax interface. The first part of the section summarizes the theoretical framework put forth by Butt and Kaplan (2002). This framework is then illustrated by the basic outline of the Murrinh-Patha XLE and XFST implementation.

Sections 4 and 5 discuss the details of the implementation of the dependencies in the verbal template. Section 4 deals with the implementation of dependencies concerning subject and object number marking as well as tense marking. I

[†]I would like to thank Rachel Nordlinger who kindly provided me with field data and information about the language. Further thanks go to my supervisor Miriam Butt and the audience of the LFG Conference 2011 for discussions about this topic, and to Jane Simpson and the members of the Language Technology Group at Macquarie University for discussions on previous versions of the talk.

argue that these dependencies should be considered morphological dependencies and should thus be modeled within the morphological component.

In contrast to the purely morphological features discussed in section 4, section 5 introduces dependencies between two lexical-semantic components of the Murrinh-Patha verb. Although the combination of these components is also part of the word formation process, I argue that the dependencies are nevertheless more efficiently modeled in the syntactic component, as their combinatory possibilities depend on syntactic features. Dependencies within a word thus do not have to be modeled in the morphology exclusively. Especially in polysynthetic languages some dependencies may also involve syntactic features and can more efficiently be implemented in the syntax.

2 Dependencies in the Murrinh-Patha Verbal Template

Murrinh-Patha is a non-Pama-Nyungan language spoken around Wadeye in the Northern Territory of Australia. It is a headmarking, polysynthetic language with a very complex verbal template and minimal case morphology on the noun. Due to space limitations only some examples of the dependencies within the verbal template can be discussed here. For a more detailed overview of the complexities of the verbal template see Nordlinger (2010b), and see Blythe (2009) for a more general introduction to the language.

The Murrinh-Patha verbal template can be considered to have nine different slots for verbal stems, agreement markers and incorporated body parts, adverbials or particles. This paper mainly discusses the slots 1, 2, 5, 6 and 8 and their interdependencies.

1	2	3	4	5	6	7	8	9
Class.	SubjN/ Obj	RR	IBP APPL	Lex	TNS	Adv/Prt	SubjN/ ObjN	Adv/Prt

Class:	classifier stem, marked for tense, aspect & subject number
SubjN:	subject number markers for dual & paucal subject
Obj:	object agreement marker
ObjN:	object number marker for dual & paucal
RR:	reflexive / reciprocal marker
IBP:	incorporated body part
APPL:	applicative marker *-ma*
Lex:	lexical stem
TNS:	tense marker
Adv/Prt:	Adverbial / Particle

Figure 1: Murrinh-Patha verbal template (adapted from Blythe 2009)

The semantics of the Murrinh-Patha verb is determined by two morphemes together, the so-called classier stem and the lexical stem. There are 38 different classifier stems. Classifier stems inflect for tense, aspect and subject number and they encode this information in portmanteau forms. They mostly have a generic meaning. In contrast, lexical stems may express more specific meaning and are also noninflecting.

(1) shows some first simple examples.[1] In (1a), the classifier stem SNATCH(9) combines with the lexical stem *rta*, 'hug', while in (1b) the classifier stem 13 combines with the lexical stem *ngkardu* 'see'. (1c,d) show that not every lexical stem can combine with every classifier stem and vice versa. The details of these combinatory possibilities and their consequences for the implementation will be discussed in section 5.

(1) a. *manganta*
mangan-rta
3sgS.SNATCH(9).nFut-hug
'He/she hugged him/her.' (Nordlinger, 2010a)

b. *bamkardu*
bam-ngkardu
3sgS.13.nFut-see
'He/she saw him/her.' (Fieldnotes R. Nordlinger)

c. *mangan - ngkardu

d. *bam - rta

The classifier stems are inflected for tense. However, in all but the non-future tense, a corresponding tense marker has to attach to the classifier stem in slot 6. For example, the tense marker *-nu* has to attach to the future classifier stem form, as in (2a). In (2b), the tense marker *-dha* attaches to the past imperfective form of the classifier stem. (2c) shows that only corresponding tense markers can attach to the classifier stems.

(2) a. ba - ngkardu - nu
1sgS.SEE(13).Fut - see - Fut

b. be - ngkardu - dha
1sgS.SEE(13).PImpf - see - PImpf

c. *ba - ngkardu - dha
1sgS.SEE(13).Fut - see - PImpf

While the tense dependencies can be considered as simple agreement, the relationship between the number information encoded in the classifier stem and the

[1]Because of their generic meaning, classifier stems are glossed either with capitals or a number; lexical stems are glossed according to their meaning in combination with the classifier stem. Abbreviations used in the glosses are: RDP: reduplicated; Fut: Future tense; PImpf: Past Imperfective; du.f: dual female subject; pauc.f: paucal female subject; 1sgDO: 1st singular direct object marker; etc.

separate subject number markers in slots 2 and 8 is more complex. The classifier stems themselves show a three-way number contrast: singular, dual and plural. The singular classifier stem can combine with a separate dual number marker which overwrites the information of the classifier stem, as can be seen in (3a). The dual classifier stem without a separate subject number marker denotes the dual, non-sibling category as in (3b). However, this information can also be overwritten by attaching a paucal number marker as in (3c).

(3) a. bam - ngintha - ngkardu
3sgS.SEE(13).nFut - du.f - see
'They two (non-siblings) saw him/her.'

b. pubamka - ngkardu
3duS.SEE(13).nFut - see
'They two (siblings) saw him/her.'

c. pubamka - ngkardu - ngeme
3duS.SEE(13).nFut - see - pauc.f
'They few (non-siblings) saw him/her.'

As can already be seen in these simple examples, the number markers for dual and paucal subject behave differently in the verbal template. The paucal number marker attaches after the lexical stem (in slot 8), while the dual number marker attaches before the lexical stem (in slot 2).

However, the placement of the dual number marker is more complex as can be seen in the examples in (4). The subject number marker competes with the object markers for slot 2. Thus, if an overt object marker is present, the subject marker has to move to slot number 8 ((4a)). However, as can be seen in (4b), if no overt object marker is present, the subject number marker is disallowed in slot 8.

(4) a. bam - ngi - ngkardu - ngintha
3sgS.SEE(13).nFut - 1sgDO - see - du.f
'They two (non-siblings) saw me.'

b. *bam - ngkardu - ngintha
3sgS.SEE(13).nFut - see - du.f

These quite simple examples already show that the Murrinh-Patha verbal template is quite complex. It involves long distance dependencies as well as constraints which depend solely on the linear ordering within the template, and are not constrained by the functions the morphemes fulfill. Moreover, even more complex cases exist, e.g. with discontinuous object markers, in which case the subject number markers cannot be expressed overtly and the form is ambiguous. These examples, however, are too complex to be treated in detail here and the simpler examples in (1)-(4) suffice to illustrate the analysis. Before going into the details of the analysis, though, the next section lays out the general architecture of the morphology-syntax interface assumed in this paper.

3 Morphology - Syntax Architecture

As morphemes in polysynthetic languages often fulfill similar functions as words fulfill in non-polysythetic language, the dependencies described in the previous section could in principle either be modeled in the syntax or in the morphology. This section describes the general architecture of the morphology-syntax interface assumed in this paper. It first describes the theoretical background of the relationship between morphology and syntax and then shows how such an approach can be realized in a computational implementation.

3.1 General Architecture

The architecture assumed in this paper is a realizational model of morphology that passes on morphological information to the syntax. This morphological information may then trigger syntactic operations.

For a formalization of the architecture, the basic layout of the morhology-syntax interface as proposed by Butt and Kaplan (2002) is used. Butt and Kaplan (2002) define a complex relation *R* to model the interface between morphology and syntax. More precisely, *R* is a relation that "realizes the morphological features of a given f-structure as a string: *f R w*" (Butt and Kaplan, 2002, 3). The complex relation *R* can be decomposed into two relations which Butt and Kaplan (2002) call *Sat* and *D*:

(5) $R = Sat \circ D.$

The relation *Sat* is the satisfaction relation holding between an f-structure and an f-description as already proposed by Kaplan and Bresnan (1982). The description relation *D* models the relation between the f-description and a string. Butt and Kaplan (2002) display *D* as a set of ordered pairs <f-description, sequence> and use (6) as an example for the string /walks/ which is associated with f-descriptions concerning the subcategorization frame of the verb as well as number, person and tense information.

(6) $<$ { (f_1 PRED) = 'walk$<$(f_1 SUBJ)$>$', (f_1 SUBJ PERS) = 3,
(f_1 SUBJ NUM) = sg, (f_1 TNS-ASP TENSE) = pres }, /walks/ $>$

As Butt and Kaplan (2002) point out, the relation called *D* is traditionally considered the morphology-syntax interface and how this interface should be formally modeled has been the point of much debate. They propose to model the interface by decomposing *D* further into a lexical relation *L* and a sequence relation *Seq*, which renders (7) as the overall decomposition of *R*.

(7) $R = Sat \circ L \circ Seq$

The lexical relation *L* maps between f-descriptions and what Butt and Kaplan (2002) call description-names (D-names). Examples are given in (8). These D-names are atomic symbols (with arbitrary names, but for convenience mnemonic terms are chosen) and are, in the sequence relation *Seq*, linked to the string, e.g. as in (9).

(8) walk: $(\uparrow \text{PRED}) = \text{`walk}<(\uparrow \text{SUBJ})>\text{'}$
3: $(\uparrow \text{SUBJ PERS}) = 3$
Sg: $(\uparrow \text{SUBJ NUM}) = \text{sg}$
Pres: $(\uparrow \text{TNS-ASP TENSE}) = \text{pres}$

(9) $< \{3, \text{Sg}, \text{walk}, \text{Pres}\}, /\text{walks}/ >$

The described architecture thus associates a string (or phonological word) with an f-structure via a set of D-names and f-descriptions. The use of D-names makes this approach a realizational model, in which the relationship between affixes and their functions can be quite complex.

To summarize, the seqence relation *Seq* maps a set of D-names to a string, determining which strings are possible in a given language. It can thus be considered the morphological part of the relation. The satisfaction relation *Sat* maps between an f-structure and an f-description and is thus part of syntax, while the lexical relation *L* is the mapping between the morphological D-names and the syntactic f-descriptions and can thus be considered the morphology-syntax interface.

By separating these mappings in the described way, this approach is in line with LFG's general modular architecture. Different mechanisms can be at work on the different levels, and the choice of one model for one level does not necessarily preempt the choice of model for a different level. The following subsection shows how this theoretical architecture can be implemented in a computational XLE / XFST implementation.

3.2 Test Case: XLE / XFST Implementation

In the computational implementation used here as a test case, an XFST finite state morphology (Beesley and Karttunen, 2003) is used in combination with an XLE grammar (Butt et al., 1999; Crouch et al., 2011). XFST morphologies are used in a variety of XLE (ParGram) implementations, and make a lexicon with fully inflected forms unnecessary. This is crucial for a polysynthetic language, as listing all inflected forms for a language like Murrinh-Patha would be unfeasible, if not impossible.

The output of a finite state morphology is a two-sided morphology in which a string is associated with a number of tags to encode information. In (10), the surface form *bamkardu* is associated with the information that this form is made up of the stem *bam*, which is classifier stem number 13 in its 3rd person singular non-future form, an unexpressed 3rd person direct object, and another stem *ngkardu* which is a lexical stem, marked by *+LS*.[2] The relation between the string and the tags (D-names) is thus the instantiation of the sequence relation *Seq*.

(10) bamkardu : bam +class13 +3P +sg +nFut +3sgDO +ngkardu +LS

The morphology output serves as input for XLE and thus needs to be interpretable by the syntax. For this purpose, the D-names need to be associated with f-descriptions. An example of an excerpt of a 'morphological lexicon' instantiating the lexical relation *L* is given in (11). The D-name +class13, for example, passes up the information that the classifier is number 13, the tag +3P that the subject is 3rd person, etc.[3]

(11)	+class13	CLASS	(↑ CLASSIFIERSTEM) = 13
	+3P	PERS	(↑ SUBJ PERS) = 3
	+sg	NUM	(↑ SUBJ NUM) = sg

In order for XLE to interpret these lexical entries, sublexical rules are needed which determine how the constraints for a combination are composed (Kaplan and Newman, 1997). (12) shows a very simple, flat sublexical rule in which the constraints are just passed up.

(12) V —> CS: ↑ = ↓
CLASS: ↑ = ↓
PERS: ↑ = ↓
NUM: ↑ = ↓
....

The sublexical rules in XLE thus have to take up the ordering of the morphology output again.[4] In this way, the sublexical rules mirror the morphology output. While this may seem to be an unnecessary complication of the implementation, it offers the possibility of testing various ways of implementing morphologically complex words. The dependencies in the Murrinh-Patha verb, for example, could be modeled either in the XFST morphology or in XLE in the sublexical rules. In the remainder of this paper I show that it makes sense to treat morphological dependencies in the morphology while other dependencies can be left for the syntax.

[2]The details of the implementation will be explained in subsection 4.1.

[3]This is a very simple example in which a morphological feature only triggers one syntactic interpretation. However, the Murrinh-Patha system is more complex than that. For details of the analysis, for example of the number features, see Nordlinger (2010a).

[4]As T.H. King pointed out, this does not have to be the case necessarily. Instead, variables of the form "{stem | affix}+" could be used. Most ParGram grammars, however, use detailed sublexical rules, as e.g. exemplified in (12), to allow for using the same tag in different sublexical rules.

4 Morphological Interdependencies

In this section the implementation of tense marker dependencies and the interdependencies of subject and object markers is discussed. I show that it is not viable to model these dependencies within XLE, while it is possible in XFST.

This may seem surprising at first glance as actually, the formalisms of XLE and XFST are equivalent, as finite state automata can be translated into context-free grammars and vice versa. However, I am concerned with the interplay of these two formalisms. The combination of both formalisms makes it apparent that it is theoretically desirable to make a distinction between morphological and syntactic dependencies within a word and consequently to model these dependencies in different modules.

The first subsection discusses the implementation of the subject and object markers in XLE and argues that it is not theoretically desirable to model the complex interdependencies in XLE. The second subsection then shows how these dependencies can be modeled in XFST which allows for a very simple XLE sublexical rule.

4.1 Tense, Subject and Object marking in XLE

The architecture of the morphology-syntax interface described in the previous section offers the possibility to model the dependencies found in the Murrinh-Patha verb in XLE with the help of sublexical rules. This may seem feasible as word formation processes for a polysynthetic language may be similar to the formation of phrases in non-polysynthtic languages. However, in this subsection I discuss that modeling complex morphological dependencies between subject and object markers in XLE faces various problems.

As was discussed in section 2, the dependencies involving subject and object marking involve 3 different verbal template slots, i.e. the classifier stem form (slot 1) as well as slot 2 and slot 8, which host the special markers for subject number and direct and indirect object person and number marking.

For reasons of space, only the case for the singular classifier stem form will be discussed. The relevant data is repeated in (13) and shows the interplay of the placement of the subject number marker and the direct object marker. The dual subject number marker competes with overtly expressed direct object markers for slot 2. Thus, when no direct object marker is expressed overtly as in (13a), the dual subject number marker is in slot 2. When a direct object marker is expressed overtly, the subject number marker has to move to slot 8 ((13b)). However, the dual subject number marker is ungrammatical in slot 8 when slot 2 is not filled ((13c))

(13) a. bam-nintha-ngkardu :
bam +class13 +3P +sg +nFut **+3sgDO +du.m.Nsibl.S** +ngkardu +LS

b. bam-ngi-ngkardu-ngintha:
bam +class13 +3P +sg +nFut **+1sgDO** +ngkardu +LS **+du.f.Nsibl.S**

c. *bam-ngkardu-ngintha:
bam +class13 +3P +sg +nFut **+3sgDO** +ngkardu +LS **+du.f.Nsibl.S**

Because the dependencies are subject to the linear ordering within the verbal template, i.e. they do not solely depend on whether the markers are present or not, the only possibility for modelling these dependencies in XLE is in the sublexical rules. However, the dependencies are also long-distance, which means one needs to keep track of what choices have been made in the other template slots.[5]

This can be achieved by introducing so-called "CHECK" features in the f-structure. The sublexical rule in (14), for example, models the dependency between subject and object markers for singular classifier stems. If the object is overtly expressed, i.e. non-3rd person singular, the subject number marker can only be expressed in slot 8, after the lexical stem. The subject marker can only be expressed before the lexical stem, i.e. in slot 2, if the object marker is not overtly expressed, i.e. if the object is 3rd person singular or if it is an intransitive verb.

```
(14)   V   —>   CS: (↑TAM TENSE) =c non-fut;
                CLASS PERS NUM TENSE
                { (DO: (↑OBJ NUM) =c sg (↑OBJ PERS) =c 3)
                  (↑ CHECK _DO) = 3sg
                |
                  DO: {(↑ OBJ NUM) =c {dual | paucal | pl } |
                          (↑ OBJ NUM) =c sg (↑ OBJ PERS)=c 1 |
                          (↑ OBJ NUM) =c sg (↑ OBJ PERS) =c 2 }
                  (↑ CHECK _DO) = non3sg }
                (SNUM2: (↑ CHECK _DO) =c 3sg )
                ....
                LexStem
                (SNUM2: (↑ CHECK _DO) =c non3sg )
```

This implementation has various disadvantages. First, there is no principled way of talking about the overtly expressed object markers in the syntax. The notion of whether a marker is present or not is morphological: on this level only the functions of the markers are left. We thus have to tie the two alternatives to having a 3rd singular direct object or all other cases, which have to be listed individually.

Second, using CHECK features undesirably leads to an f-structure which is crowded with information that is not important functionally, but only serves to keep track of the form of the lexical entry. These features are standardly used within the ParGram group for XLE grammar writing, for example for the implementation of auxiliary verb constructions, as has been discussed by Butt et al. (2004). Butt et al. (2004) propose a separate m-structure to keep track of these morphological forms to avoid these features in the f-structure. This m-structure, however, cannot be considered a complete morphological structure, and proposals to expand it to a real

[5]Alternative implementations also exist, i.e. one could list all possible combinations of sublexical rules. However, this would be unfeasible as it would involve many different sublexical rules for all different combinations (tense, subject number etc.).

morphological structure, as e.g. proposed by Frank and Zaenen (2004), lead to an unnecessary partial reduplication of the f-structure in the m-structure.

For periphrastic expressions such as auxiliary verb combinations, these CHECK features are sometimes inevitable because they model the dependencies between different words. However, in the Murrinh-Patha case the CHECK features used in (14) model dependencies within a word. For such cases modeling the dependencies directly in the morphology results in a much cleaner division of work between the morphology and syntax, and a cleaner division between morphological and syntactic features. Thus, the next section describes how these dependencies can be modeled within the morphology using XFST.

4.2 Tense, Subject and Object marking in XFST

The last section showed that modeling the dependencies of the Murrinh-Patha verbal template within the sublexical rules in XLE is inelegant. This section now discusses how the dependencies can be modeled in the morphology, i.e. with XFST. I first provide a short introduction to XFST and the basic mechanisms, and then explain how the long distance dependencies can be modeled with the help of flag diacritics.

The concept of finite state morphology was developed in the 1980s as a tool for the computational morphological analysis of natural language. It combines ideas of sequenced phonological rewrite rules with two-level morphology (Koskenniemi, 1983). For a detailed historic overview and a formal description of the formalisms at work see Beesley and Karttunen (2005).

Different tools exist which allow the implementation of finite state morphologies. In the implementation of Murrinh-Patha discussed here, XFST in connection with LEXC (Beesley and Karttunen, 2003) is used. The discussion of the implementation of Murrinh-Patha verbal templates will only be concerned with the creation of the verbal lexicon with LEXC. Other questions such as the modeling of the phonological changes that apply are left undiscussed.

LEXC uses two-sided continuation classes to model the concatenation of strings. The mechanism is best explained with an example. (16) describes a network that produces the output in (15). The colon separates the level of the surface form *bamngkardu* on the lower side and the morphological information this surface form is associated with.

(15) bam +class13 +3P +sg +nFut +3sgDO +ngkardu +LS : bamngkardu

(16)
```
Lexicon ROOT
bam+class13+3P+sg+nFut:bam    OBJECT;

Lexicon OBJECT
+3sgDO:0                      LEX;

Lexicon LEX
+ngkardu+LS:ngkardu           #;
```

LEXC uses continuation classes which are implemented as so-called lexicons. The first lexicon is called ROOT, it comprises all possible first morphemes of a word. In this lexicon, the classifier string *bam* is associated with the morphological information that it carries (*bam+class13+3P+sg+nFut*). The right side of the lexicon entry specifies which lexicon is used next. In (16), *bam* can be concatenated with objects from the lexicon OBJECT, which in this case only contains the 3rd person direct object marking which is not overtly realized (noted as 0). This combination combines with items from the lexicon LEX, which contains the lexical stem *ngkardu*. The hash key marks the end of a word.

In the actual implementation of Murrinh-Patha verbs, the lexicon ROOT contains all forms of the 38 classifier stems, and a large number of different lexical stems are contained in the lexicon LEX. The other template slots are implemented with the help of lexicons in a similar way.

Dependencies between neighboring lexicons can be easily modeled by specifying different continuation classes, i.e. entries of one lexicon do not have to lead to the same next lexicon. However, most dependencies in the Murrinh-Patha verbal template are long-distance, which is very difficult to model just with the concatenation described above.

For long distance dependencies, flag diacritics are used in the implementation of the Murrinh-Patha verbal template. Flag diacritics are special entities in XFST which add a kind of "short term memory" to keep track of what choices have been made before. Thus, as Beesley and Karttunen (2003, 341) explain, normally, "the transition from one state to the next depends only on the current state and the next input symbol". Using flag diacritics, however, allows one to keep track of those choices, so that certain transitions can also be constrained by choices made earlier.

In the implementation, flag diacritics can be recognized by two surrounding @-symbols. After the first @-symbol, an operator is followed by a feature-value pair, each separated by periods. Different operators exist, i.e. U(nification), P(ositive) (Re)setting, R(equire) test, D(isallow) test etc. The names of the features and values can be chosen arbitrarily, but for convenience, morphological features and values have been chosen.

As a first simple illustration of the use of flag diacritics, the long distance dependency between the tense marking on the classifier stem and separate tense markers in slot 6 will be used. For all tenses but the non-future tense, tense markers in slot 6 are obligatory. The relevant examples are repeated in (17). In example (17), *bam* is the non-future form of the classifier stem 13 while *ba* is the future form of the corresponding classifier. The future form has to combine with the future tense marker *-nu* (tagged as +Fut2) as can be seen in (17b); it is ungrammatical without *-nu* ((17d)). On the other hand, *-nu* cannot attach to the non-future classifier stem form ((17c)).

(17) a. bam-ngkardu : bam +class13 +3P +sg +nFut +3sgDO +ngkardu +LS
b. ba-ngkardu-nu : ba +class13 +3P +sg +Fut +ngkardu +LS +Fut2
c. *bam-ngkardu-nu :

bam +class13 +3P +sg +nFut +3sgDO +ngkardu +LS +Fut2

d. *ba-ngkardu : ba +class13 +3P +sg +Fut +ngkardu +LS

This interplay can be modeled with the help of P- and R-type flag diacritics as in (18). In the lexicon ROOT, the classifier stem forms are associated with the classifier number information as well as person, subject number and tense information. The flag diacritics "@P.Tense.nFut@" and "@P.Tense.Fut@" remember the choices made for the tense values. When the corresponding tense markers are attached in slot 6, *-nu* can only attach to a future classifier stem form, i.e. this choice requires that the feature "Tense" has been set to the future value before. Similarly, the first line in the lexicon TENSE specifies that no tag is only possible if the value of the feature "Tense" has been set to "nFut" before.

(18) Lexicon ROOT
bam ... +nFut@**P.Tense.nFut**@:bam@**P.Tense.nFut**@ LEX;
ba ... +Fut@**P.Tense.Fut**@:ba@**P.Tense.Fut**@ LEX;
....
Lexicon TENSE
@R.Tense.nFut@ #;
+2Fut@**R.Tense.Fut**@:nu@**R.Tense.Fut**@ #;

These dependencies for tense markers are quite simple examples of long distance dependencies. However, flag diacritics also allow the modeling of complex long distance dependencies such as the subject number and object marker dependencies which are dependencies between three different verbal template slots. (19) provides an example of such a complex interplay by modeling the facts displayed by the examples in (13). It is thus the XFST alternative to the XLE implementations in (14).

(19) Lexicon ROOT
bam+class13...+sg@**P.NUM.sg**@..:bam@**P.NUM.sg**@ SLOT2;

Lexicon SLOT2
@**P.SMark.no**@ RR;
+1sgDO:ngi RR;
+du.m.Nsibl.S@**P.SMark.pres**@@**R.Num.sg**@
:nintha@**P.SMark.pres**@@**R.Num.sg**@ RR;
...
Lexicon SLOT8
+du.m.Nsibl.S@**D.SMark.pres**@@**D.SMark.no**@@**R.Num.sg**@
:nintha@**D.SMark.pres**@@**D.SMark.no**@@**R.Num.sg**@ #;

The excerpt in (19) models the dependencies between subject number and object markers for the singular classifier form. In the lexicon ROOT, the classifier form *bam* is associated with the singular form of classifier 13, and this choice is marked by the P-type flag diacritic, i.e. it remembers that the value for the number feature singular has been set positively.

In the lexicon SLOT2, three different choices are possible. In the first case, nothing is attached. This is for example the case for intransitive verbs with singular subjects. However, the system has to remember that nothing has been attached in this slot, which is implemented with the flag diacritic @P.SMark.no@. Alternatively, an overtly expressed object marker can attach in slot 2, i.e. the marker for the 1st person singular direct object marker *-ngi*. As a third choice, the dual masculine non-sibling subject number marker *-nintha* can attach in slot number 2. However, *-nintha* can only attach if the classifier stem form is singular, which is modeled by the flag diacritic @R.Num.sg@, which requires the value of the number feature to have been positive before. In this case, the flag diacritic @P.SMark.pres@ tells the system to remember that the dual subject marker is present in slot 2.

The lexicon SLOT8 then takes care of all the possible choices. Thus, the dual subject number marker can only attach in slot 8 if it is not present in slot 2. This dependency is modeled by the flag diacritic @D.SMark.pres@ which disallows this choice if the value of the feature SMark has been set to "pres(ent)" before. Secondly, the dual number marker can only attach in slot 8 if slot 2 is not empty, i.e. this choice is disallowed if the value of the SMark has been set to "no" before. And thirdly, as has been already discussed before, the classifier stem has to be in its singular form.

The combination of different flag diacritics thus models the dependencies between singular classifier forms, dual subject number markers and object markers in slots 2 and 8. It is similar to modeling the dependencies in the alternative XLE implementation in (14) involving CHECK features. However, the implementation in XFST has a range of advantages over the corresponding XLE implementation.

First, flag diacritics model the dependencies within the morphology and are therefore invisible to the syntax. In contrast to the CHECK features, they do not show up in the f-structure or need to be put in a separate m-structure.

Second, the features modeled here are morphological features and it was very difficult to address these in XLE. Flag diacritics, however, make it easy to talk about separate morphological features on the one hand, for example as in the @P.Num.sg@ flag which picks out the number feature from the classifier stem form. On the other hand, it is easy to combine features and remember the choice of a combination of features by flag diacritics, i.e. as in the case of the flag diacritic @P.SMark.pres@, which remembers that the subject number marker is dual, masculine and non-sibling. In a way, however, it just remembers that this marker has been present in slot 2, i.e. it is bound to the appearance of the morpheme, and not to the features it represents. This is not possible in XLE as it assumes the strict lexicalist hypothesis that the internal structure of words is not visible to the syntax.

To sum up, in this section different possibilities for the implementation of long distance dependencies in the Murrinh-Patha verbal template have been discussed. I argued for a treatment of the tense marker and the subject number and object marker dependencies in XFST as the dependencies are morphological and should therefore be modeled in the morphology. The features in question are morphological features, and, more importantly, the dependencies are influenced, to a large degree, not only by the features realized by the markers, but by the linear ordering of the markers in the verbal template.

The next section is concerned with a different set of dependencies, i.e. the dependencies between the classifier stem and the lexical stem. In contrast to the dependencies discussed above, these dependencies seem to be syntactic (or even semantic) in nature and should thus be treated differently from the morphological dependencies.

5 Classifier plus lexical stem combinations

While the previous section dealt with purely morphological dependencies in the Murrinh-Patha verb such as dependencies between tense or number features, this section discusses the combination of lexical stem and classifier stem. As has been argued by Seiss and Nordlinger (2010), the combinations can be considered complex predicates in which both stems contribute part of the meaning and the combination determines the syntactic information. Although a lexical stem and classifier stem form one word together and their combination is thus a morphological formation, I argue that it makes more sense to model the dependencies between these stems in the syntax, as their combinatory possibilities are determined by syntactic features.

This section is divided into two parts. First, the different combinatorial possibilities of lexical and classifier stems will be discussed briefly. I show that while some regularity exists when valency matching is assumed, many combinations are in fact lexicalized or semi-productive, so that we need to associate the different combinations with distinct syntactic lexicon entries. This leads to the analysis of these dependencies within XLE, which will be discussed in the second part of the section.

5.1 Empirical basis

In the paper so far, only one simple example of a classifier plus lexical stem combination has been used to illustrate the morphological complexity of the verbal template. However, many different combinations of classifier and lexical stems exist. This section presents the main patterns found in the combinations and discusses their syntactic properties.

Different lexical stems can combine with different classifier stems, and vice versa. (20) shows an example of the same lexical stem (or, more precisely, its reduplicated form) in combination with two different classifier stems, STAND(3) and HANDS(8). Although the combinations are formed with the same lexical stem, they differ in their valency. (20a) is intransitive while (20b) is transitive.

(20) a. ngirra - dharday - nu
3sgS.STAND(3).Fut - down - Fut
'I'll descend straight down.' (Street and Street, 1989)

b. nanthi karlay mam-dhardarday
NC fishing net 3sgS.HANDS(8).nFut-down(RDP)
wurran
3sgS.GO(6).nFut
'He continually lets the fishing net down.' (Street and Street, 1989)

This alternation can be explained by assuming that the valency of the complex predicate usually follows the valency of the classifier stem. Classifier stems can be divided into intransitive and transitive classifier stems, as well as Reflexive/ Reciprocal (RR) classifier stems. Determining the valency of lexical stems is more difficult; however, the valency of many lexical stems can be derived based on their lexical semantic meaning and the valency patterns in their combinations with classifier stems.

In many cases, it seems that the valency of the classifier and the lexical stem match. However, other patterns are also possible. (21) shows three different possibilities with intransitive classifier stems. In (21a), the classifier stem and lexical stem are both intransitive, and the resulting combination is intransitive as well. This seems to be a case of valency matching.

In contrast, in (21b), the transitive lexical stem *lerrkperrk* combines with the intransitive classifier stem SIT(1). The combination is intransitive with a resultative meaning in which only the patient is expressed. Thus, in this case the valency of the combination also follows the valency of the classifier stem.

This, however, is not always the case. (21c) is formed with the intransitive classifier stem BE(4) combined with *gurdugurduk* 'drink'. The resulting combination is transitive, and it seems that BE(4) only contributes some aspectual meaning.

(21) a. dim - karrk
3sgS.SIT(1).nFut - cry
'He's crying.' (Street and Street, 1989)

b. dim - lerrkperrk
3sgS.SIT(1).nFut - crush
'It's smashed.' (Seiss and Nordlinger, 2010)

c. kura patha kanam - gurdugurduk
NC:water good 3sgS.BE(4).nFut - drink(RDP)
'He continually drinks water.' (Street and Street, 1989)

The examples in (20) and (21) show that the subcategorization frames of the verbs cannot be predicted generally. While there is a certain regularity for valency matching, other factors also play a role. Certain causative lexical stems may combine with SIT(1) to form resultative verbs, as in (21b). Some intransitive classifier stems may combine with certain lexical stems and then only contribute aspectual information. Thus, the subcategorization frames of the combinations have to be listed in the lexicon, more precisely, in the XLE lexicon which determines the syntactic information.

Apart from the subcategorization frame, classifier and lexical stem combinations also determine other syntactic or semantic information together, for example in their interpretation of RR classifier stems. (22a) shows the Reflexive/Reciprocal classifier 15 which is the corresponding RR classifier for classifier 13. In combination with the lexical stem *ngkardu*, it forms a reflexive verb. This is the productive use of the RR classifier stems.

However, other examples such as (22b) exist in which the combination is ambiguous between a resultative reading and the productive reflexive reading. Finally (22c) is a purely lexicalized version in which only the resultative reading is available.

(22) a. bem - ngkardu
1sgS.15.nFut - see
'I saw myself.' (Nordlinger 2008)

b. mem-let
3sgS.HANDS:RR(10).nFut - stick
'It's already stuck up (e.g. on the wall).' (Nordlinger, 2011)
'It stuck itself up on the wall.' (Rachel Nordlinger, pc)

c. nhem - nham
1sgS.POKE:RR(21).nFut-fear
'I'm afraid.' (Seiss and Nordlinger, 2010)

Finally, classifier and lexical stems together determine how the object marker is interpreted. Murrinh-Patha has a considerable amount of so-called impersonal verbs (Walsh, 1987) in which the direct object marker actually denotes the subject, as can be seen in (23).

(23) a. pan - ngi - ngkawerr
3sgS.23.nFut - 1sgDO - terrify
'I'm terrified.' (Walsh, 1987)

b. dem - ngi - ralal?
3sgS.POKE:RR(21)nFut - 2sgDO - thirsty
'Are you thristy? ' (Nordlinger, 2011)

Summing up briefly, classifier and lexical stems together determine a range of syntactic features, such as subcategorization frames, and reflexivity and reciprocality, aspectual information such as the resultative reading and the mapping from thematic roles to grammatical functions as for the impersonal verbs. This makes detailed lexical entries tied to syntactic features necessary.

5.2 Modeling classifier plus lexical stem combinations

In the previous section I argued for the need of lexical entries for classifier and lexical stem combinations with detailed syntactic information. This section discusses the different possibilities of modeling the dependencies and the consequences for the division of work between syntax and morphology. I show that while it would be possible to model the dependencies in the morphology, it is more efficient and theoretically elegant to model them in the syntax.

(24) shows an excerpt from the XFST lexicons for the classifier and lexical stems used in (20). To model the long distance dependencies, flag diacritics are used to remember which classifier stem has been chosen. For example, the lexical stem *dharday* used in the examples in (20) can combine with the classifier stems 3 or 8 (among others), i.e. in the XFST implementation *dharday* needs to be listed with flag diacritics requiring the classifier stem to be either 3 or 8.

(24) Lexicon Classifer Stems
ngirra @P.CLASS.3@ : ngirra +class3 @P.CLASS.3@
mam @P.CLASS.8@ : mam +class8 @P.CLASS.8@
...
Lexicon Lexical Stems
dharday @R.CLASS.3@ : dharday +LS @R.CLASS.3@
dharday @R.CLASS.8@ : dharday +LS @R.CLASS.8@

While implementing the dependencies in XFST like this is possible, it faces various disadvantages over the implementation of these dependencies in the syntax. As can be seen, implementing the dependencies in XFST requires multiple entries for lexical stems when they can combine with various classifier stems. Moreover, the dependencies are stipulated as no explanation for the restrictions can be found in the morphology.

In contrast, when modeling the dependencies within XLE, the restrictions are tied to the different subcategorization frames and other syntactic or semantic information. For example, the morphology provides the output in (25) for the verbs in the examples in (20).

(25) a. ngirradhardaynu : ngirra+class3+1P+sg+Fut+dharday+LS+Fut2
b. mamdharday : mam+class8+3P+sg+nFut+3sgDO+dharday+LS

This output is interpretable by XLE when the lexical entries for the tags of the classifier stems are given as in (26). In this case, they just pass up the number of the classifier stem. These combine with the lexical entries for the lexical stem, for example as in (27) for the lexical stem *dharday*. This entry then specifies that *dharday* only needs a subject when combined with classifier stem 3 while *dharday* with classifier stem 8 needs a subject and an object.

(26) +class3 CS ($\uparrow$ ClassifierStem) = 3.
+class8 CS ($\uparrow$ ClassifierStem) = 8.

(27) +dharday LS $\{$ ($\uparrow$ PRED) = 'down $<$ ($\uparrow$ SUBJ) $>$'
($\uparrow$ ClassifierStem) =c 3
$|$ ($\uparrow$ PRED) = 'down $<$ ($\uparrow$ SUBJ)($\uparrow$ OBJ) $>$'
($\uparrow$ ClassifierStem) =c 8. $\}$

Even more syntactic information is needed for the interpretation of the impersonal verbs. As can be seen in (28), the morphological information is the same as for any other classifier plus lexical stem combination. However, the lexicon entry within XLE needs to specify that *ngkawerr* in combination with classifier 23 needs a subject only and that this combination is an impersonal verb.

(28) panngingkawerr : pan+class23+3P+sg+nFut+1sgDO+ngkawerr+LS

(29) ngkawerr LS ($\uparrow$ PRED) = 'terrify $<$ ($\uparrow$ SUBJ) $>$'
($\uparrow$ ClassifierStem) =c 23
($\uparrow$ Impersonal_Verb) = +.

The information ($\uparrow$ Impersonal_Verb) = + ensures that the morphological tag +1sgDO is interpreted as providing information about the subject, not as an object marker. For this purpose, the lexical entries for the tags providing information about the subject and object need to be complex. The tags for subject information, for example for singular number as in (30), only optionally provide information about the subject, they do not provide any information in the case where the lexical and classifier stem combination is an impersonal verb. The tag for the "object" marker, similarly, may provide information about the subject or the object, as in (31).

(30) +sg NUM { ($\uparrow$ SUBJ NUM) = sg
| ($\uparrow$ Impersonal_Verb) $\neg$= +
($\uparrow$ Impersonal_Verb) =c + }

(31) +1sgDO OBJ { ($\uparrow$ OBJ PRED) = 'PRO'
($\uparrow$ OBJ NUM) = sg
($\uparrow$ OBJ PERS) = 1
| ($\uparrow$ SUBJ PRED = 'PRO'
($\uparrow$ SUBJ NUM) = sg
($\uparrow$ SUBJ PERS) = 1 }

This is an example of a complex morphology-syntax interface, or complex lexical relation *L* in Butt and Kaplan's (2002) terms. For a motivation of this analysis and more details see Nordlinger (2010a).

Similar syntactic lexion entries can be defined for the examples involving RR classifier stems or other lexicalized combinations of classifier and lexical stems, as discussed in the previous section.

To sum up, while it would be possible to implement the dependencies between classifier and lexical stems in XFST, these dependencies are stipulative. As the combinations have to be listed in the XLE lexicon anyway, modeling the dependencies in XFST is unnecessary. Thus, although the combination of classifier and lexical stem is part of the word formation process, restricting the possible combinations is better left for the syntax, as the combinations are restricted by syntactic and semantic features.

6 Conclusion

This paper argued for a different treatment of morphologically and syntactically motivated dependencies in the Murrinh-Patha verbal template. Dependencies which encode morphological features and depend on the linear order and the template slots are modeled in the XFST morphology. This avoids the use of morphological form features in the f-structure and is thus true to LFG's lexicalist hypothesis.

On the other hand, the dependencies between classifier and lexical stems are modeled in the syntax. They do not depend on linear order, but rather on syntactic features such as valency, aspect, etc. Moreover, the semantic meaning of a verb is determined jointly by the classifier stem and the lexical stem so that both components need to be present in the syntax in order to be able to be passed on to the semantics. This shows that just because some morphemes combine to form a word, their restrictions are not always best treated in the morphology.

The division of work between morphology and syntax is made possible by the sophisticated morphology-syntax interface assumed in this paper. Due to the modular architecture, dependencies within a word can either be dealt with in the syntax or the morphology. This allows us to treat the phenomena in a computationally efficient and theoretically elegant way.

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A PARALLEL ANALYSIS OF HAVE-TYPE COPULAR CONSTRUCTIONS IN TWO HAVE-LESS INDO-EUROPEAN LANGUAGES

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Abstract

This paper presents data from two Indo-European languages, Irish and Hindi/Urdu, which do not use verbs for expressing possession (i.e., they do not have a verb comparable to the English verb *have*). Both of the languages use copula constructions. Hindi/Urdu combines the copula with either a genitive case marker or a postposition on the possessor noun phrase to construct possession. Irish achieves the same effect by combining one of two copula elements with a prepositional phrase. I argue that both languages differentiate between temporary and permanent instances, or stage-level and individual-level predication, of possession. The syntactic means for doing so do not overlap between the two: while Hindi/Urdu employs two distinct markers to differentiate between stage-level and individual-level predication, Irish uses two different copulas. A single parallel LFG analysis for both languages is presented based on the PREDLINK analysis. It is shown how the analysis is capable of serving as input to the semantics, which is modeled using Glue Semantics and which differentiates between stage-level and individual-level predication by means of a situation argument.

In particular, it is shown that the inalienable/alienable distinction previously applied to the Hindi/Urdu data is insufficient. The reanalysis presented here in terms of the stage-level vs. individual-level distinction can account for the data from Hindi/Urdu in a more complete way.

1 Introduction

There are languages that do not use verbs to express possession relations. In several languages ranging from Maltese (Comrie, 1989) to Hebrew (Zuckermann, 2009) to Irish to Hindi/Urdu, possession is mediated by the use of copula verbs together with noun phrases, prepositional phrases or other nominal categories. Languages that use verbs for possession are sometimes called *habere languages* (from Latin *habere* 'have'), whereas languages without such verbs are sometimes called *non-habere languages* (Zuckermann, 2009). Two languages of the latter kind are Irish and Hindi/Urdu, both Indo-European languages. The observation is that in both of these languages, there are distinct possibilities for constructing possession, so that a couple of differing research questions emerge: What governs the use of the different available constructions? How can these differences be formalized in a syntactic-semantic framework? This paper provides a thorough introduction of the data for Irish and Hindi/Urdu, examines the syntactic and semantic properties of the data, and eventually presents a novel, parallel analysis for *have*-type copula constructions that includes a semantic component.

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2 Data — General Introduction

In both Hindi/Urdu and Irish, two languages that do not use verbs for expressing possession. Possessive copular constructions (PCCs) are used to link the possessor to the possessee. This section merely gives a very brief overview of the data in both languages.

2.1 Hindi/Urdu Data

Schmidt (1999) mentions that there are two different constructions that express possession in Hindi/Urdu: 1) possessor phrase marked by genitive case marker *ka, ke, ki*; 2) possessor phrase marked by complex postposition *ke pas*.

Possessor Phrase Marked by *ka, ke, ki* Butt and King (2004) have shown that the genitive marker *ka, ke, ki* is a case clitic heading a case phrase (KP). Schmidt (1999) notes that sentences with possessor KPs marked by *ka, ke, ki* generally denote "inalienable" possession relations, such as kinship, body parts, reputation, landed property etc. In (1), some examples for possession relations involving the markers *ka, ke, ki* are given.[1]

(1) a.

nadya	ke	do	b^{h}ai	hɛ̃.
Nadya.F.S.Obl	Gen.M.P	two	brother.M.P	be.Pres.3.P

'Nadya has two brothers.'

b.

yasin	ki	bɑṛi	nak	hɛ.
Yassin.M.S.Obl	Gen.F.S	big.F.S	nose.F.S	be.Pres.3.S

'Yassin has a big nose.'

c.

is	tale	ki	koi	cabi	nɑhĩ	hɛ.
this.Obl	lock.M.S.Obl	Gen.F.S	any	key.F.S	not	be.Pres.3.S

'This lock has no key.' adapted from Schmidt (1999), p. 86

At first sight, it seems that Schmidt (1999)'s prediction is borne out by these examples. (1a) through (1c) all express relations of "inalienable" possession.

Mohanan (1994) has already given an account of the possessive markers *ka, ke, ki*. Using subjecthood tests involving reflexive pronouns and control, she showed that they mark genitive subjects. The nature of the other nominal constituents (e.g. *do b^{h}ai* 'two brothers' in (1a)), however, was not explained any further by Mohanan (1994). For the purpose of this paper, I assume that these nominals are predicative complements, and that the copula *ho* 'be' links this nominal predicate to its subject. This is in line with recent typological overviews of copula predication across languages (Stassen, 1997; Pustet, 2003). Note that these nominals cannot be objects, since passivization is not possible.

[1] In the glosses used throughout this paper, the following shorthands are used:
M - masculine, F - feminine, S - singular, P - Plural, 1/2/3 - 1st/2nd/3rd person, Pres - present tense, Past - past tense, Obl - oblique form, Gen - genitive case, Pron - pronoun, Poss - possessive, Art - article, Def - definite, Part - particle, Int - interrogative, Emph - emphatic.

Possessor Phrase Marked by *ke pas* Butt and King (2004) argue that *ke pas* is a complex postposition consisting of the oblique form of the genitive case clitic *ke* and the postposition *pas* 'near'. Sentences with possessor PPs marked by *ke pas* generally express "alienable" possession, i.e., (temporary) physical ownership, control of a tangible object, etc. In (2), some examples for "alienable" possession relations are given, involving the marker *ke pas*.

(2) a. nadya ke pas qɑlɑm hɛ.
Nadya.F.S.Obl Gen.Obl near pen.M.S be.Pres.3.S
'Nadya has a pen.'

b. d^{h}obi ke pas saikɑl hɛ.
washerman.M.S.Obl Gen.Obl near bicycle.F.S be.Pres.3.S
'The washerman has a bicycle.' from Schmidt (1999), p. 86

c. mere pas[2] do seb hɛ̃.
Pron.Poss.M.Obl near two apple.M.P be.Pres.3.P
'I have two apples.'

Again, at first sight, it seems that we find the predictions by Schmidt (1999) borne out by these examples, since they all express "alienable" possession as described above. We shall return to the Hindi/Urdu data in Section 4.

2.2 Irish Data

In Irish, there are two copula verbs: *is* and *bí*. Possession in Irish may be expressed by using either one of these together with a prepositional phrase (Ó Siadhail, 1989; Stenson, 1981): 1) the copula *is*: possessor PP marked by the preposition *le* 'with'; 2) the copula *bí*: possessor PP marked by the preposition *ag* 'at'.
The two Irish copulas have been linked to different levels of predication, namely *is* to individual-level and *bí* to stage-level predication (Stenson, 1981; Doherty, 1996); however, none of the sources attempt to give a conclusive overview of the data, which would motivate such an analysis.

The Copula *is* Irish is a verb-initial language; as such, copulas appear sentence-initially. The syntax of *is* is straightforward. The copula links a subject to a predicate complement. In PCCs, exemplified in (3), the predicate complements are realized as PPs marked by the preposition *le* 'with'. The subject occurs after the predicate and is not case marked, i.e., bears common case.[3]

(3) a. Is le Pádraig an carr nua.
be.Pres with Patrick.M.S Art.Def car.M.S new
'The new car is Patrick's.' adapted from Stenson (1981), p. 98

[2]The oblique possessive pronoun *mere* conveys a genitive meaning, which accounts for the lack of the oblique genitive case clitic *ke*.

[3]In Irish linguistics, the term 'common case' is used to refer to nominative/accusative case, since the two are homonymous in Irish.

b. Is liom an caisleán.
be.Pres with.1.S Art.Def castle.M.S
'The castle is mine.'

c. An leatsa an talamh chomh maith?
Part.Int with.2.S.Emph Art.Def ground.M.S as-well
'Is the ground yours as well?'

The Copula *bí* The copula *bí* may also be used in Irish to link a subject to a predicate complement. In PCCs involving the copula *bí*, the predicate complements again surface as PPs, marked by the preposition *ag* 'at'. Note that in copular clauses involving *bí*, the subject occurs postverbally, and the predicate complement occurs after the subject. The word order is thus different from PCCs involving *is*. Ramchand (1996) observes the same word order differences for closely-related Scottish-Gaelic.

(4) a. Tá[4] an carr nua ag Pádraig.
be.Pres.3.S Art.Def car.M.S new at Patrick.M.S
'Patrick has the new car.' adapted from Stenson (1981), p. 98

b. Tá peann agam.
be.Pres.3.S pen.M.S at.1.S
'I have a pen.'

2.3 Intermediate Summary

The data presented in Sections 2.1 and 2.2 pose several questions: How can we test the appropriate contexts of the constructions involved? What exactly governs the use of *ka, ke, ki* vs. *ke pas* and *is* vs. *bí* constructions in Hindi/Urdu and Irish, respectively? If there is a systematic semantic difference, how can that difference be formalized, and also implemented in a framework such as LFG?

3 Stage- and Individual-Level Predicates

The distinction of stage-level predicates (SLPs) versus individual-level predicates (ILPs) is grounded in the core semantic intuition that some predicates express rather essential, permanent, and/or immutable properties, while others involve transitory, inessential properties (Arche, 2006; Ogawa, 2001; Kratzer, 1995; Diesing, 1988). While this intuition has faced a substantial amount of criticism and counterexamples from a variety of researchers and language data (e.g., Jäger, 1999; Maienborn, 1999), the basic tendency of predicates falling into exactly these two categories has prevailed cross-linguistically (Arche, 2006; Ogawa, 2001).

[4]The form *tá* is a present tense form of the copula *bí*.

3.1 Carlson (1977) — The First Encounter

Carlson (1977) noticed that predicates differ in their acceptability when occurring, for example, after object NPs of English perception verbs, such as *see, notice, hear, smell* etc.:

(5) He saw John in the garden.

(6) He saw John naked. #He saw John intelligent.

(7) He saw John smoke a cigarette. #He saw John love Mary.

The generalization deduced by Carlson (1977) was that the unacceptable secondary predicates that occur after the object NPs of perception verbs (e.g., *intelligent, love Mary*) generally express permanent, inherent properties, while acceptable ones generally express transitory, coincidental properties. Basically, he analyzed sequences such as *saw John naked* as expressing a *seeing* action of a *stage* of the direct object *John*, and that stage is defined by the predicate following the direct object. If that predicate does not describe a stage, the sentence is not acceptable. Carlson (1977) called the predicates that are unacceptable in this context *individual-level predicates* (ILPs) and the acceptable ones *stage-level predicates* (SLPs).

3.2 Kratzer (1995) and the Situation Argument

To explain the above contrasts, several analyses were proposed over the years. One of the most influential approaches is Kratzer (1995). Here, it is assumed that the syntactic function of the copula is uniform across languages and constructions: the copula element merely links the subject and the predicate. The semantic function, however, differs: in languages such as English and German, both ILPs and SLPs can occur in the predicate of copula constructions. Kratzer (1995) therefore argued that in these languages, we find two homonymous copula verbs with respect to their semantics; while one copula embeds only stage-level, the other embeds only individual-level predicates:

(8) INTELLIGENT(Ravi) ‘Ravi is intelligent.’ (ILP)

(9) ∃s [IN-THE-GARDEN(Ravi, s)] ‘Ravi is in the garden.’ (SLP)

(8) depicts the semantics of an ILP. There is no additional argument besides the subject, and (8) predicates the property *intelligent* of the subject *Ravi*, thereby making a general, time-and-situation-independent statement about *Ravi*. (9), on the other hand, depicts the semantics of an SLP; it has an extra argument s, called the *situation argument*, which embeds *Ravi*’s property of being *in the garden* in some situation (Kratzer, 1995; Chierchia, 1995; Maienborn, 1999). (9) predicates the state *in the garden* of the subject the situation argument, thereby making *in the garden* time-and-situation-dependent.

3.3 Testing for ILPs and SLPs

Apart from the test involving perception verbs, which was part of Carlson's original motivation to assume the ILP/SLP contrast, other tests have been identified to decide the nature of a predicate. Here, I present a collection of these tests, identified e.g. in Carlson (1977), Diesing (1988) and Kratzer (1995).

The Temporal Modification Test While SLPs are generally good with temporal adverbials, ILPs tend to become unacceptable:

(10) a. John is in the garden right now.

b. John was angry yesterday.

c. #Ravi is intelligent today.

d. #Nadya was a vegetarian a few hours ago.

The Locative Modification Test SLPs generally accept locative modification, while ILPs do not:

(11) a. Ravi smokes a cigarette in the kitchen.

b. Sam shouted on the soccer field.

c. #Ravi is likeable in the kitchen.

d. #Nadya is a vegetarian on the soccer field.

The Lifetime Changing Test Changing the tense of a sentence has an effect on the perceived lifetime of the individual(s) affected by the predication, but only with ILPs:

(12) a. Sam was angry.
$\rightarrow$ *does not* necessarily imply that Sam does not exist anymore

b. John was in the garden.
$\rightarrow$ *does not* necessarily imply that John does not exist anymore

c. Ravi was intelligent.
$\rightarrow$ *implies* that Ravi does not exist anymore

d. Sam loved Mary.
$\rightarrow$ *implies* that Sam does not exist anymore

Summing up, there are several well-established tests that help in identifying stage- and individual-level predicates. In Section 4, we examine the Hindi/Urdu data in light of these tests, and in Section 5, we take a closer look at the Irish data.

3.4 Stage- and Individual-Level Predicates and Possession

Jackendoff (1983) notes that there are several distinct notions of possession. There is a well-known difference between alienable possession and inalienable possession; languages often distinguish verbs and constructions for these two categories. Moreover, Jackendoff also shows that alienable possession in turn further divides into ownership of objects and the tangible, temporary control of objects. Some past research has already focused on these two types of distinction regarding possession, and their connection to stage- vs. individual-level predicates (Ogawa, 2001; Kyunghwan, 1989). I will argue for a different take and present evidence for the assumption that, in Hindi/Urdu, the traditional distinction between inalienable and alienable possession is insufficient. As shown in the next section, the difference in the data can be explained for both Hindi/Urdu and Irish in a more complete fashion by assuming a situation argument à la Kratzer (1995), present in stage-level instances of possession (rendering the possession time-and-situation-dependent) and not present in individual-level instances (rendering the possession time-and-situation-independent).

4 A Closer Look at Hindi/Urdu

In this section, the Hindi/Urdu data is re-examined and tested, based on the standard tests for the ILP/SLP distinction (e.g. Carlson (1977), Diesing (1988) and Kratzer (1995); Section 3.3). The main argument is that the distinction between inalienable and alienable possession is insufficient to account for the data. The data can be accounted for in a more complete fashion by assuming the ILP/SLP distinction. A novel analysis of Hindi/Urdu PCCs is offered, whereby information on predication level must be part of the lexical entries of the possessive markers involved (*ka, ke, ki* and *ke pas*).

4.1 Applying the Predication Level Tests to Hindi/Urdu PCCs

If our predictions made above in Section 3.4 are correct, than we would expect instances of inalienable possession (those marked by *ka, ke, ki*) to pattern like individual-level predicates, and instances of alienable possession (marked by *ke pas*) to pattern like stage-level predicates.

Temporal Adverbials If we assume the Hindi/Urdu PCCs with *ka, ke, ki* to express individual-level possession, modifying them using temporal adverbials should render them ungrammatical or at least questionable. This prediction is borne out by the data shown below. All the sentences in (13) are judged as questionable by native speakers of Hindi/Urdu; without any context given, they are borderline sentences.[5]

[5]See Section 4.2, however, for a discussion of this statement.

(13) a. ??aj nadya ke do b^{h}ai hɛ̃.
today Nadya.F.S.Obl Gen.M.P two brother.M.P be.Pres.3.P
'Today, Nadya has two brothers.'

b. ??ɑb yasin ki bɑṛi nak hɛ.
now Yassin.M.S.Obl Gen.F.S big.F.S nose.F.S be.Pres.3.S
'Today, Yassin has a big nose.'

c. ??ɑb is tale ki koi cabi nɑhĩ hɛ.
now this.Obl lock.M.S.Obl Gen.F.S any key.F.S not be.Pres.3.S
'Today, this lock has no key.'

Conversely, the acceptability of the examples with the marker *ke pas* is not affected:

(14) a. aj nadya ke pas qɑlɑm hɛ.
today Nadya.F.S.Obl Gen.Obl near pen.M.S be.Pres.3.S
'Today, Nadya has a pen.'

b. aj d^{h}obi ke pas saikɑl hɛ.
today washerman.M.S.Obl Gen.Obl near bicycle.F.S be.Pres.3.S
'Today, the washerman has a bicycle.'

c. ɑb mere pas do seb hɛ̃.
now Pron.Poss.M.Obl near two apple.M.P be.Pres.3.P
'Now, I have two apples.'

If we assume *ka, ke, ki* marks ILPs of possession in Hindi/Urdu PCCs, then the data above is expected. It does not make sense to specify temporal adverbials when describing inherent possession. Assuming that there is no further contextual information given, we suppose that if Yassin had a big nose yesterday/3 months ago/when he was eight, he probably has a big nose today, and will have a big nose in the future.

Lifetime Effects The following sentences in (15) with the copula in its past form are acceptable. However, the past form of the copula has a lifetime effect on the possessor KP; without any further context given, the sentences seem to imply that the possessor or (part of) the possessee does not exist anymore.

(15) a. yasin ki bɑṛi nak thI
Yassin.M.S.Obl Gen.F.S big nose.F.S be.Past.F.S
'Yassin had a big nose.'
→ implies that Yassin is not alive anymore

b. nadya ke do b^{h}ai t^{h}e.
Nadya.F.S.Obl Gen.M.P two brother.M.P be.Past.M.P
'Nadya had two brothers.'
→ implies that Nadya is not alive anymore

On the other hand, the following examples with *ke pas* are not only acceptable; they also do not imply that the possessors/possessees do not exist anymore.

(16) a. nadya ke pas qɑlɑm t^ha.
Nadya.F.S.Obl Gen.Obl near pen.M.S be.Past.M.S
'Nadya had a pen.'

b. mere pas do seb t^he.
Pron.Poss.M.Obl near two apple.M.S be.Past.M.P
'I had two apples.'

Choice of the Possessee If *ka, ke, ki* are exclusively used for marking inherent, more permanent instances of possession, and *ke pas* is used exclusively for marking more coincidental, temporary ones, then we can make a prediction: exchanging them in a given context will have effects on the sentences in terms of acceptability. The prediction is borne out by examples such as the following.

(17) a. ??nadya ka qɑlɑm hɛ
Nadya.F.S.Obl Gen pen.M.S be.Pres
'Nadya has a pen.'

b. ??d^hobi ki saikɑl hɛ.
washerman.M.S.Obl Gen.M.S bicycle.F.S be.Pres.3.S
'The washerman has a bicycle.'

In unmarked contexts, there is no inherent possession relation between *nadya* and *qɑlɑm* or between *d^hobi* and *saikɑl*, but since *ka, ke, ki* can only mark inherent possession relations, the above sentences are questionable.

Context Construction Assume for (17a) that we are looking at a set of pens, and we specifically want to find out for a single one who it belongs to. In this context, the sentence becomes acceptable; see (18a). Similarly, (17b) is acceptable in a setting where we are looking at a set of bicycles, then point at one of them, and ask someone who it belongs to, getting (18b) as the answer.[6] This is not expected if we assume a simple binary *alienable/inalienable* dichotomy as in Schmidt (1999) or Mohanan (1994).

(18) a. nadya ka ye qɑlɑm hɛ
Nadya.F.S.Obl Gen.M.S this pen.M.S be.Pres
'Nadya owns this pen.'

b. d^hobi ki ye saikɑl hɛ.
washerman.M.S.Obl Gen.M.S this bicycle.F.S be.Pres.3.S
'The washerman owns this bicycle.'

[6]Note that in both examples, to accommodate the context, the Hindi/Urdu demonstrative *ye* 'this' is introduced, and that for both contexts, the English translations in (17) have to change to a definite possessee, since the possessee was introduced beforehand in the question.

4.2 Mohanan's Account (1994): Inalienable/Alienable Possession or Ownership/Control?

Mohanan (1994) has already given an account of the possessive markers *ka, ke, ki* and *ke pas*. Using subjecthood tests involving reflexive pronouns and control, she shows that both mark genitive subjects, although the exact nature of *ke pas* is not explained. More importantly, she explains the contrasts in the data based on an *inalienable vs. alienable* dichotomy, and not in terms of a *permanent vs. temporary* (or *individual-level vs. stage-level*) distinction. She argues that *ka, ke, ki* marks inalienable possession relations, while *ke pas* expresses purely material ownership. This seems plausible for examples such as (1a-1c). I argue that convention decides whether the inalienable/alienable distinction applies to a possession relation or not. Consider the following examples.

(19) a. yasin ki bɑṛi nak hɛ.
Yassin.M.S.Obl Gen.F.S big.F.S nose.F.S be.Pres.3.S
'Yassin has a big nose.'

b. aj yasin ki bɑṛi nak hɛ.
today yasin.M.S.Obl Gen.F.S big.F.S nose.F.S be.Pres.3.S
'Today, Yassin has a big nose.'

In (19a), we have a case of inalienable possession, which is between Yassin and his big nose. Since we know that the possession relation between the two is by convention inalienable, the *ka, ke, ki* marker is used. Assume for (19b) a context where Yassin's nose is swollen on that day due to an accident or plastic surgery. In (19b), the same possession relation is expressed, and even though we find a temporal adverbial here, convention selects the marker *ka, ke, ki*.

Questions arise, however, in light of data such as (17a-17b) vs. (18a-18b). In such examples, the convention selects *ke pas*, since generally, the possession relation between a person and a pen cannot be said to be inalienable. If someone utters the English sentence *Nadya has a pen.*, the first interpretation coming to mind is that Nadya has a pen at her disposal, not that she owns a pen. However, consider that in Section 17, it was noted that in certain contexts, it is possible to replace *ke pas* with *ka, ke, ki*. The relevant examples are given below in (20).

(20) a. nadya ke pas qɑlɑm hɛ.
Nadya.F.S.Obl Gen.Obl near pen.M.S be.Pres.3.S
'Nadya has a pen.'

b. nadya ka ye qɑlɑm hɛ
Nadya.F.S.Obl Gen.M.S this pen.M.S be.Pres
'Nadya owns this pen.'

The interpretation, by consequence, changes from *have something at one's disposal* to *own something*, but despite having *ka, ke, ki* in the sentence, it would be a far stretch to speak of inalienable possession: Nadya, being marked as a possessor by *ka, ke, ki*, *owns* a pen, but might lose it or break it. This shows that the distinction made in Hindi/Urdu does not seem to be only between inalienable vs. alienable, but between individual-level possession vs. stage-level possession.

When the convention does not select for inalienable vs. alienable possession, i.e., when the statement is neutral in that respect, the distinction is between ILP and SLP.

4.3 Interim Summary

After re-examining the Hindi/Urdu PCC data and applying the tests on predication level, it is safe to draw the following conclusions. Hindi/Urdu distinguishes not only between inalienable and alienable possession, but is also sensitive to the stage-level and individual-level distinction with respect to possession — *ka, ke, ki* marks ILP PCCs, while *ke pas* marks SLP PCCs. We have applied standard tests for predication level, and seen that these predictions are borne out by the data. Predication level is part of the lexical entry of the possessive marker that is involved in the construction; the alienable/inalienable dichotomy is not sufficient for explaining the data (see also Section 4.2).

5 A Closer Look at Irish

In the case of Irish, there seem to be multiple phenomena at work, as definiteness seems to play a role in the data. I argue that the facts are hard to explain without assuming an SLP vs. ILP contrast. I provide evidence for the copula *is* expressing ILPs and the copula *bí* expressing SLPs, using the previously established tests. Consequently, I argue that the information about the level of predication must be part of the lexical entries of the copulas.

An important observation in Irish is that the distinction between individual-level and stage-level predication is not always clearcut. As a starting point, consider the intuition expressed in the literature (Stenson, 1981; Doherty, 1996) that the copula *is* expresses ILPs and the copula *bí* expresses SLPs. Now, assume the following dialog:

(21) a. Tá carr nua amuigh.
be.Pres.3.S car.M.S new outside
'There is a new car outside.'

b. Is le Pádraig an carr nua.
be.Pres with Patrick.M.S Art.Def car.M.S new
'The new car is Patrick's.' ~ 'Patrick owns the new car.'

or ...

c. Tá an carr nua ag Pádraig.
be.Pres.3.S Art.Def car.M.S new at Patrick.M.S
'Patrick has the new car.' (he may or may not own it)

(21c) is in fact ambiguous between a reading where Patrick actually owns the car, and another reading where Patrick only has it at his disposition for some time, e.g. assuming he borrowed it from someone; see also Stenson (1981, p. 98). Irish PCCs that make use of the copula *is*, however, are never ambiguous in that respect, as they can only express the 'own' reading.

5.1 Definiteness

The choice of the copula *is* vs. the copula *bí* in Irish seems, however, to be influenced by definiteness: while the construction *bí ... ag* allows for different kinds of possessee, *is ... le* only allows for definite possessees. If there is an indefinite possessee involved, the construction *bí ... ag* has to be used (Aidan Doyle, p.c.; this is also noted by Stenson (1981, p. 98)). Assume a dialog as in (22).

(22) a. Tá caisleán agam in Éirinn.
be.Pres.3.S castle.M.S at.1.S in Ireland
'I own a castle in Ireland.'

b. #Is liom caisleán in Éirinn.
be.Pres with.1.S castle.M.S in Ireland
#'A castle is mine in Ireland.' ~ 'I own a castle in Ireland.'

c. An leatsa an talamh chomh maith?
Part.Int with.2.S.Emph Art.Def ground.M.S as-well
'Is the ground yours as well?' ~ 'Do you own the ground as well?'

or ...

d. An bhfuil an talamh agat chomh maith?
Part.Int be.Pres.Int.3.S Art.Def ground.M.S at.2.S as-well
'Do you own the ground as well?'

e. Is liomsa an talamh chomh maith!
be.Pres with.1.S.Emph Art.Def ground.M.S as-well
'The ground is mine as well!' ~ 'I own the gound as well!'

or ...

f. Tá an talamh agam chomh maith!
be.Pres.3.S Art.Def ground.M.S at.1.S as-well
'I own the ground as well!'

We have to use *bí ... ag* in (22a), as the possessee is indefinite. So, it looks like we have the same verb, *own*, in English, but two separate expressions in Irish. However, note further that in the English translations, we could substitute *have* for *own* in (22a) and (22b), but not in (22c) through (22f). So, there seem to be two English verbs *own*: "real" *own*, corresponding to Irish *is ... le*; and a "pseudo" *own* of sorts, corresponding to Irish *bí ... ag*. Importantly, when the PCC *is ... le* is not available, as is the case with indefinite possessees, the PCC *bí ... ag* has to be used. By consequence, the distinction between ILP and SLP cases of possession is blurred in these cases; see the example in (23).

(23) Tá carr agam.
be.Pres.3.S car.M.S at.1.S
'I have a car. / I own a car.' adapted from Stenson (1981), p. 98

I conclude that the copula *is* only admits ILPs, while the copula *bí* admits both SLPs and ILPs. This is in line with the observation above that *is ... le* corresponds to "real" *own* in English, while *tá ... ag* corresponds to "pseudo" *own*. The assumption is further supported by the predication level tests introduced above (see Section 5.2). The choice between the two depends on definiteness and on the predication level one wants to express. This is confirmed both by Doherty (1996) for Irish and Ramchand (1996) for closely-related Scottish Gaelic, who also acknowledges the fact that sentences with the copula *bí* may receive habitual interpretations. While Ramchand (1996) contributes the differences to the differing word order, I argue that the differences in the level of predication are lexically defined.

5.2 Applying the Predication Level Tests to Irish PCCs

Temporal Adverbials Irish PCCs with *is ... le* are judged as questionable by native speakers when modified with a temporal adverbial, while the acceptability of sentences with *bí ... ag* is not affected.

(24) a. ??Is le Pádraig an carr nua inniu.
be.Pres with Patrick.M.S Art.Def car.M.S new today
'Patrick has the new car today.'

b. ??Is le Seán an teach inniu.
be.Pres with John.M.S Art.Def house.M.S today
'John has the house today.'

(25) a. Tá an carr nua ag Pádraig inniu.
be.Pres.3.S Art.Def car.M.S new at Patrick.M.S today
'Patrick has the new car today.'

b. Tá an teach ag Seán inniu.
be.Pres.3.S Art.Def house.M.S new at John.M.S today
'John has the house today.'

The fact that (24a) and (24b) are questionable is expected if we assume that the copula *is* expresses ILPs. The copula *bí* can express SLPs of possession, which is why the examples in (25a) and (25b) are not affected.

Lifetime Effects We get lifetime effects when changing the tense of sentences with the *is ... le* construction; however, there is no lifetime effect when changing the tense of sentences with the *tá ... ag* construction:

(26) Ba le Pádraig an carr nua.
be.Past with Patrick.M.S Art.Def car.M.S new
'Patrick had the new car.'
→ implies that either Patrick or the car do not exist anymore

(27) Bhí an carr nua ag Pádraig.
be.Past.3.S Art.Def car.M.S new at Patrick.M.S
'Patrick had the new car.'
→ does not necessarily imply that Patrick or the car do not exist anymore

This observation is confirmed by Doherty (1996), giving the following examples:

(28) a. Ba dochtúir Seán.
be.Past doctor.M.S John.M.S
'John was a doctor.' adapted from Doherty (1996), p. 39

b. Bhí Seán ina dhochtúir.
be.Past.3.S John.M.S in-his doctor.M.S
'John was a doctor.' adapted from Doherty (1996), p. 39

Doherty (1996) mentions that while (28a) is unambiguous in that it only allows for the reading where the subject *Seán* has left the universe of discourse and is probably dead, the second sentence expresses a temporary reading, where the subject may have some other profession. Ramchand (1996, p. 179) gives a similar example for Scottish Gaelic.

5.3 Interim Summary

Irish distinguishes between stage-level and individual-level instances of possession; the copula *is* marks ILP PCCs, while *bí* marks either ILP or SLP PCCs. Standard tests for predication type can be applied, showing that the information on predication type is part of the lexical entry of the copula. The copula *bí* is (optionally) capable of embedding the relation between possessor and possessee within a situation, thereby rendering the possession expression time-and-situation-dependent ('have something at one's disposition' readings). The copula *is*, on the other hand, obligatorily expresses individual-level predicates of possession ('own something' readings).

6 Towards a Single Analysis for Both Languages

I assume the theory of Kratzer (1995) and account for the data from Hindi/Urdu and Irish based on the assumption of a situation argument for SLPs. I assume that for both languages, the information about the predication level is part of the lexical items. For Hindi/Urdu, these are the possessive markers *ka, ke, ki* (ILP) and *ke pas* (SLP); for Irish, the contrast is between the copula *is* (ILP) and the copula *bí* (ILP/SLP). It is these lexical items that supply or do not supply the situation argument. I assume LFG in combination with Glue Semantics (Dalrymple, 2001; Dalrymple et al., 1993).

6.1 The Analysis in Light of the Hindi/Urdu Data

The syntactic part of the analysis employs a PREDLINK analysis, which has been shown to be a desirable analysis of copula constructions (Sulger, 2009; Attia, 2008; Butt et al., 1999). The Hindi/Urdu copula *ho* links the subject to a PREDLINK grammatical function (GF). Mohanan (1994) (see also Section 4.2) has argued convincingly that there are genitive subjects in Hindi/Urdu, headed by case clitics that assign genitive case. She presents evidence for both *ka, ke, ki* and *ke pas* as case clitics marking subjects of genitive case; I assume this account. As a consequence, KPs headed by *ka, ke, ki* and PPs headed by *ke pas* are SUBJ in the f-structures.[7]

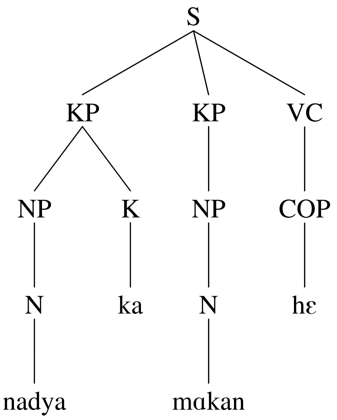
The copula merely links possessee and possessor; as a consequence, we have two homonymous copulas, one embedding ILPs, the other embedding SLPs. To construct the semantics, I assume the following mapping: the PREDLINK GF is rewritten as the possessee argument, while the SUBJ GF is rewritten as the possessor argument.

6.1.1 Urdu ILP PCCs

Let's take a simple ILP example such as the following:

(29) nadya ka mɑkan hɛ.
Nadya.F.S.Obl Gen.M.S mɑkan.M.S be.Pres.3.S
'Nadya has/owns a house.'

Since this example is neutral with respect to the inalienable/alienable dichotomy, it is sensitive to the ILP/SLP contrast. By choosing the *ka, ke, ki* marker, the ILP reading is selected (see Section 4.2). For reasons of space, I omit c-structure rules and f-structure annotation, but give the resulting structures in Figure (1).[8]



$$\left[\begin{array}{ll} \text{PRED} & \text{`ho<(}\uparrow\text{ SUBJ)(}\uparrow\text{ PREDLINK)>'} \\ \text{SUBJ} & \left[\begin{array}{l}\text{PRED `nadya'}\\ \text{CASE gen}\\ \text{NUM sg}\\ \text{GEND fem}\end{array}\right] \\ \text{PREDLINK} & \left[\begin{array}{l}\text{PRED `mɑkan'}\\ \text{CASE nom}\\ \text{NUM sg}\\ \text{GEND masc}\end{array}\right]\end{array}\right]$$

Figure 1: c- and f-structures for (29)

Below, I provide the lexical entries for (29). Notice that the copula *ho* in (30) is ambiguous between a reading not involving any situation argument (the first option in (30)), and a reading that does involve a situation argument (the second option in (30)). Notice further that the genitive case marker *ka* on the subject requires

[7]An alternative to this treatment, hinted at by both Ash Asudeh and Mohanan (1994), would be to assume that the possessor nominal sits in the specifier position of the possessee nominal, so that *nadya ka b^hai* forms a single NP. This would result in the copula being a one-place predicate, selecting only for a subject, and would nicely account for the agreement between the possessor nominal and the possessee nominal. However, initial investigation has shown that it is difficult to argue for the subjecthood of constituents such as *nadya ka b^hai*.

[8]As there are no pressing arguments for assuming a verb phrase in Hindi/Urdu, the clause structure is generally assumed to be a flat one (Mohanan, 1994; Butt, 1995).

the PREDLINK to be masculine singular.[9] To exclude subjects that are not marked by *ka, ke, ki* or *ke pas* from receiving the PCC analysis, I assume that the copula furthermore checks for either genitive case or *ke pas* on the subject.

(30) copula:

ho COP ($\uparrow$ PRED) = 'ho<SUBJ, PREDLINK>'

$\{\ \lambda x.\lambda y.have(x,y)$:

$(\uparrow \text{SUBJ})_\sigma \multimap [\ (\uparrow \text{PREDLINK})_\sigma \multimap \uparrow_\sigma]$

($\uparrow$ SUBJ CASE) =c gen

$|\ \lambda x.\lambda y.\lambda s.have(x,y,s)$:

$(\uparrow \text{SUBJ OBJ})_\sigma \multimap [\ (\uparrow \text{PREDLINK})_\sigma \multimap [\ (\uparrow \text{SUBJ})_\sigma \multimap \uparrow_\sigma]\ ]$

($\uparrow$ SUBJ PRED FN) =c ke pas $\}$

(31) proper noun *nadya* 'Nadya':

nadya N ($\uparrow$ PRED) = 'nadya'

$Nadya : \uparrow_\sigma$

(32) genitive case marker *ka*:

ka K ($\uparrow$ CASE) = gen

($\uparrow$ PREDLINK NUM) =c sg

($\uparrow$ PREDLINK GEND) =c masc

(33) common noun *makan* 'house':

makan N ($\uparrow$ PRED) = 'makan'

$house : \uparrow_\sigma$

The meaning constructor in (30) essentially says the following. Either consume the SUBJ resource and the PREDLINK resource to produce a semantic resource for the entire sentence; or consume the SUBJ OBJ resource, the PREDLINK resource and the SUBJ resource to produce a semantic resource for the entire sentence. The first disjunct is needed for ILP instances of PCCs that do not select a situation argument, while the second disjunct constructs SLP instances of PCCs with a situation argument. Assembling the meaning constructors in these entries, this produces the following desired meaning:

(34) $have(Nadya, house) : \uparrow_\sigma$

Note that to produce the right order in the meaning (semantic subject, then semantic object) the SUBJ GF is consumed first, then the PREDLINK GF; see (30). Since there is nothing in the sentence providing a situation argument, we do not end up with one in the semantic representation. This depicts the fact that we are dealing with an ILP here, predicating the inherent property of Yassin having a big nose independently of some situation.

[9] Hindi/Urdu displays agreement in gender and number between the subject and its predicate complement. In PCCs, the agreement is realized between the genitive case marker *ka, ke, ki* and the predicate.

6.1.2 Urdu SLP PCCs

A simple example for an Hindi/Urdu SLP PCCs is given below:

(35) nadya ke pas qɑlɑm hɛ.
Nadya.F.S.Obl Gen.Obl near pen.M.S be.Pres.3.S
'Nadya has a pen.'

Note that by convention there is no inalienable possession relation between Nadya and the pen. The contrast therefore has to be one of ILP/SLP, and by using *ke pas*, the SLP reading is chosen.

I provide c- and f-structures for (35) in Figure 2 below. Essentially, the genitive marker *ke pas* is a complex postposition (Butt and King, 2004). It consists of the oblique form of the genitive case marker, *ke*, and the postposition *pas* 'near'. The postposition *pas* contributes its own lexical semantics; the f-structure pays tribute to this fact in that *ke pas* is analyzed as a semantic preposition, carrying its own subcategorization frame and a PSEM feature (see also Ahmed (2009); but see Raza (2011) for a different take on *ke pas*).

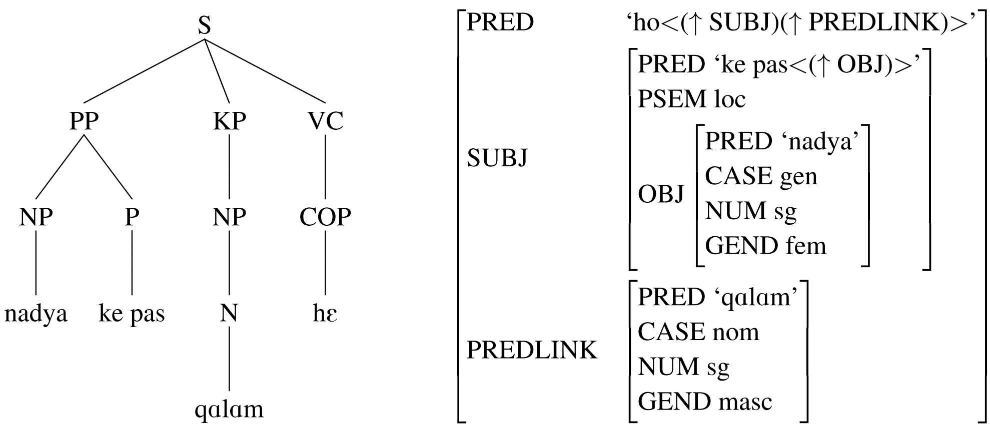


Figure 2: c- and f-structures for (35)

The lexical entries for the copula *ho* and the proper noun *nadya* were already given in (30) and (31), respectively. The remainder of the lexical entries for (35) are given below.

(36) complex postposition *ke pas*; this lexical entry supplies the situation argument to the semantics:

ke pas P (↑ PRED) = 'ke pas<OBJ>'
(↑ PSEM) = loc
$s : \uparrow_\sigma$

(37) common noun *qalam* 'pen':

qalam N (↑ PRED) = 'qɑlɑm'
$pen : \uparrow_\sigma$

The complex postposition *ke pas*, being the head of the SUBJ grammatical function, provides a situation argument to the semantics as the SUBJ is consumed by the meaning constructor in (29); the resulting semantic representation is:

(38) $\lambda s.have(Nadya, pen, s) : \uparrow_\sigma$

This semantic representation depicts the fact that we are dealing with a SLP here, predicating the coincidental property of Nadya having/holding a pen in the context of some situation.

6.2 The Analysis in Light of the Irish Data

For the syntactic analysis of Irish, a PREDLINK analysis is again assumed (Attia, 2008; Sulger, 2009). The copulas *is* and *bí* link the subject to a PREDLINK GF. The semantics are constructed using the following mapping: the PREDLINK GF is rewritten as the possessor argument, and the SUBJ GF is rewritten as the possessee argument. These rules are not identical to the ones employed for Hindi/Urdu. While the syntactic subject maps to the semantic subject, and the syntactic predicate maps to the semantic object in Hindi/Urdu, in Irish the syntactic subject maps to the semantic object, and the syntactic predicate maps to the semantic subject. This is because all subjecthood tests for Irish point towards the PPs (e.g. *le Pádraig, agam* in (23)/(18f)) being predicates to the copula, and towards the NPs (e.g. *an carr nua, caisleán* in (23)/(18a)) being subjects (Doherty, 1996; Ó Siadhail, 1989).

For space reasons, I cannot provide any f-structures or lexical entries here. In the case of Irish, the difference between ILP PCCs and SLP PCCs is between the two different copulas that are used (Section 5). Crucially, the copula *is* never supplies a situation argument, since it can only select ILP predicates. Conversely, the copula *bí* is ambiguous between supplying and not supplying a situation argument. The two sentences in (39) below may express identical readings, which is why they end up with the semantic representation in (40). Here, none of the copulas supply a situation argument.

(39) a.

Is	le	Pádraig	an	carr.
be.Pres	with	Patrick.M.S	Art.Def	car.M.S

‘The car is Patrick’s.’
or ...

b.

Tá	an	carr	ag	Pádraig.
be.Pres.3.S	Art.Def	car.M.S	at	Patrick.M.S

‘Patrick owns the car.’ (‘The car is Patrick’s.’)

(40) $have(Patrick, car) : \uparrow_\sigma$

The sentence in (39b) has, however, another reading, given in (41), where the copula *bí* does supply a situation argument, embedding the sentence in a specific situation, making it dependent on space/time; combining the meaning constructors in the lexical entries produces the meaning in (42).

(41) Tá an carr ag Pádraig.
be.Pres.3.S Art.Def car.M.S at Patrick.M.S
'Patrick has the car.' ('The car is at Patrick's disposition.')

(42) $\lambda s.have(Patrick, car, s) : \uparrow_\sigma$

7 Discussion and Summary

This paper presented a novel analysis for possessive copula constructions (PCC) in Hindi/Urdu and Irish in terms of the well-known stage- vs. individual-level distinction. It shows that both languages are sensitive to the ILP/SLP contrast, that both languages employ a combination of different lexical items to produce the desired predication, and that by employing the established PREDLINK analysis of LFG in combination with a Glue Semantics version of Kratzer's basic analysis of realizing the distinction between ILP vs. SLP via the absence vs. the presence of a situation argument, a unified analysis can be given.

An issue not addressed in this paper is when exactly convention selects inalienable possession relations in Hindi/Urdu (Section 4.2). I assume this is an issue of lexical semantics and world knowledge. If the speaker knows that there exists an inalienable possession relation between the possessor and the possessee, they will choose *ka, ke, ki* to indicate this fact; but they will have to infer this fact from both the possessor's possible inalienable possessees and the possessee's possible inalienable possessors.

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