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Miriam Butt, Tracy Holloway King (Editors)

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Contents

1 Editor's Note

The 2017 Conference on Lexical Functional Grammar was held at the University of Konstanz, Germany. The program committe for LFG17 were John Lowe and Ida Toivonen. We would like to thank them for coordinating a very efficient and effective review process and for an uncomplicated and prompt communication with the local organization team. As usual, thanks also go to the executive committee and the abstract and final paper reviewers, without whom the conference and the proceedings would not have been possible in this form.

There were quite a number of people involved in the local organization team. We would like to thank Tina Bögel, Annette Hautli-Janisz, Natalja Sander, Christin Schätzle, Sebastian Sulger, Stefano Quaglia, Irene Wolke and would like to single out Jessica Zipf for special thanks as she bore the brunt of much of the organization.

The table of contents lists all the papers presented at the conference. Some papers were not submitted to the proceedings. For these papers, we suggest contacting the authors directly. We note that all of the abstracts were peer-reviewed anonymously (double-blind reviewing) and that all of the papers submitted to the proceedings underwent an additional round of reviewing. We would like express our heartfelt thanks to all of the anonymous reviewers for the donation of their expertise and effort in what is often a very short turn-around time.

Hard Copy: All of the papers submitted to the LFG17 proceedings are available in one large pdf file, to be viewed and printed with Adobe Acrobat. The proceedings' file was created via pdflatex tools and a script written by Stefan Müller. We are highly indebted to him for the use of the script, along with the insults and curses traded as we made it work locally. We thank Emma Pease at CSLI Publications for having accompanied the LFG Proceedings over the years and making sure they become accessible and stay accessible. Finally, we thank Dikran Karagueuzian at CSLI Publications for his continuous support of our proceedings and our community.

Agreement: Interactions with Case and Raising

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Abstract

The goal of this paper is to describe verbal agreement in languages like Icelandic in which the finite verb agrees with the nominative SUBJ, if there is one; otherwise, it agrees with a nominative OBJ; otherwise, it shows 3rd person singular features in the default gender (neuter in Icelandic). Special attention is paid to agreement in raising constructions, the raising verb may agree with the nominative OBJ of its infinitival complement. Similar facts occur in English locative inversion (Bresnan, 1994). These facts support the claim that verbs do not specify the Person-Number-Gender (PNG) features of any particular GF in their lexical entries. Instead, they specify the clausal PNG features as the feature structure AGR(EEMENT), which is unified with the AGR of the appropriate GF satisfying a set of OT constraints (as in Alsina & Vigo, 2014).

1 Introduction

Whereas verb agreement in many languages can be described as an agreement relation in which the agreement trigger is always the subject, in other languages the trigger of verb agreement cannot be defined as the subject or any other specific grammatical function (GF), as the agreement trigger varies from one GF to another, if any, depending on different properties of the clause. An example of such a language is Icelandic, whose behavior with respect to verb agreement can be illustrated as follows (the agreement trigger is shown here in boldface):

(1) a. **Við** hjálpuðum stelpunum
we.nom *helped*.1.pl *girl*.dat.f.pl
'We helped the girls' (Sigurðsson, 2004)

b. Henni líkuðu **hestarnir**
she.dat *liked*.3.pl *horse*.nom.m.pl
'She liked the horses' (Sigurðsson, 2004)

c. Mér býður við setningafræði
I.dat *nauseated*.med.3.sg *by syntax*
'I am nauseated by syntax' (Zaenen et al., 1990)

The generalization that covers the agreement facts illustrated here is as follows (see Andrews, 1990; Sigurðsson, 1996, 2004; Zaenen et al., 1990, among others):

(2) **The Icelandic agreement facts**: The finite verb agrees with the nominative GF that is highest in the subject > non-subject hierarchy; if there is no nominative GF, the verb is in the third person singular form.

[†]The research presented in this paper is supported by research project *Highest Argument Agreement* (HAA), FFI2014-56735-P (Spanish Ministry of Economy and Competitiveness).

In (1a), the verb agrees with the subject, which is the only nominative GF in the clause; in (1b), the verb cannot agree with the subject, as it is in the dative case, but agrees instead with the object, which is nominative; in (1c), the verb does not agree with any GF, as the clause includes no nominative GF, and so is in its third person singular form.

These facts pose a problem for the standard LFG approach to agreement, according to which the agreement target, such as the verb in verb agreement, lexically specifies the GF that it agrees with, along with the features of person, number, gender, etc. of this GF. So, for example, the Latin verb form *amamus* 'we love' is claimed to lexically specify that its subject has the features of $\left[\text{PERS} \quad 1\right]$ and $\left[\text{NUM} \quad \text{PL}\right]$. And it is not only this verb form, but all finite verb forms in Latin that impose featural requirements on their subjects, and on no other GF. But what we see in Icelandic is that finite verb forms cannot impose featural requirements on a particular GF, because the morphological form of a verb may depend on the subject, on the object, or on neither the subject nor the object.

The goal of this paper is to propose an analysis of finite verb agreement in Icelandic. An essential element of this analysis is the idea that the features involved in agreement—typically, person, number, and gender—are grouped in a feature structure, referred to as AGR (for "agreement features"), present in the f-structure representation of nominal constituents, but also, crucially, in the f-structure representation of the clause. These features of the clause are normally overtly expressed on the finite verb, as well as on the agreement trigger, if there is one. In this we follow Alsina & Vigo (2014, 2017); Vigo (2016) and other work. In addition, we assume that there are well-formedness constraints on the f-structure that apply according to the principles of Optimality Theory (OT).

In section 2, we present the theory of agreement that we propose as an alternative to the standard LFG approach to agreement to account for the basic facts of agreement in Icelandic, arguing for the AGR feature structure and laying out the OT constraints adopted. We also bring out similarities with Hindi. In section 3, we show how this analysis provides an immediate account of the phenomenon of "long-distance agreement" in Icelandic, where the object of an infinitival complement can agree with the verb under which the infinitival complement is embedded. In section 4, we show how this analysis can be adapted to English with minimal changes so as to explain the agreement facts in locative inversion, as well as in non-inverted constructions. Finally, in section 5, we draw the main conclusions and make some comparisons with other theories.

2 An AGR-based theory of agreement

The two central elements of the theory of agreement to be presented are the AGR feature structure and the set of OT constraints that refer to it. Unless otherwise indicated, the data presented in this section is from Icelandic.

2.1 Arguments for AGR

The AGR feature bundle, as used in this theory, fulfils two functions: 1) it groups together the features involved in agreement and 2) it provides agreement targets (e.g. verbs and adjectives) with their own agreement features, separate from those of potential agreement triggers (typically, nouns and noun phrases). The former function is found in the INDEX feature of much work in HPSG (Pollard & Sag, 1994, among others); in this work, the representation of nouns and NPs is assumed to include this feature, which specifies the person, number, and gender of the noun or NP. The way agreement is handled in this line of work is by having the verb or other agreement target specify in its lexical entry one or more of the INDEX features of one of its GFs, but the verb does not have its own set of agreement features. The second function of AGR—that of giving the verb and the clause its own set of agreement features, separate from those of the agreement trigger—is proposed in Kathol (1999), within HPSG, and is used in LFG in Haug & Nikitina (2012) for the analysis of participial clauses in Latin. It is applied for the first time in an LFG work to the analysis of finite verb agreement in Alsina & Vigo (2014); see also Haug & Nikitina (2016); Vigo (2016); Alsina & Vigo (2017).[1] In these works, the f-structure of the verb and the clause includes an AGR feature structure that is structure-shared with the AGR of one of the GFs of that verb or clause.[2]

AGR is not linked to any particular GF at the lexical level, but may be linked to one at the f-structure level by means of OT constraints. For example, the lexical entries of the Icelandic verb forms *hjálpuðum* 'helped.1.pl' and *líkuðu* 'liked.3.pl' (used in (1a) and (1b), respectively) provide this information to the f-structure of the sentence:

(3) a. *hjálpudum* : $\begin{bmatrix} \text{PRED} & \text{'}\textit{help}\ \langle\ \text{arg arg}\ \rangle\text{'} \\ \text{TENSE} & \text{PAST} \\ \text{AGR} & \begin{bmatrix} \text{PERS} & 1 \\ \text{NUM} & \text{PL} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{CASE} & \text{DAT} \end{bmatrix} \end{bmatrix}$

b. *líkuðu* : $\begin{bmatrix} \text{PRED} & \text{'}\textit{like}\ \langle\ \text{arg arg}\ \rangle\text{'} \\ \text{TENSE} & \text{PAST} \\ \text{AGR} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{PL} \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{CASE} & \text{DAT} \end{bmatrix} \end{bmatrix}$

[1] The present theory does not deal with NP-internal agreement and could be enriched, if necessary, with an additional set of features such as CONCORD as in King & Dalrymple (2004). In their work, in the representation of NPs, INDEX is used as the equivalent of our AGR.

[2] For languages where verb forms show agreement with more than one GF in the sentence, we also assume that there is only one AGR bundle. For example, morphs that specifically target the object are linked to the AGR of the OBJ, not to the AGR of the clause.

One of the advantages of having AGR is that it allows us to avoid stipulating which GF each verb form must agree with. Which GF the verb agrees with follows from general principles.[3]

A second advantage afforded by AGR is that it also allows for a unique lexical representation of verb forms that alternate between agreement with the subject, agreement with the object, and agreement with no GF, e.g. auxiliary verbs like *vera* 'to be' and *hafa* 'to have'. This alternation is illustrated for the 3rd person plural *voru* in (4).

(4) a. **Drengirnir** voru/*var sýndir honum
the.boys.nom.m.pl *were*.3.pl/*sg *shown*.nom.m.pl *him*.dat
'The boys were shown to him' (based on Andrews, 1990)

b. Henni voru/*var gefnir/*gefin/*gefið **hestarnir**
she.dat *were*.3.pl/*sg *given*.nom.m.pl/*f.sg/*n.sg *horses*.nom.m.pl
'She was given horses' (based on Sigurðsson, 2004)

The form *voru* agrees with the subject, in (4a), or with the object, in (4b). The standard LFG approach would require us to have two diferent lexical entries for *voru* or a lexical entry with a disjunction of different sets of functional annotations, as in Butt & Sadler (2003). Using AGR we only need one lexical entry for each form, namely:

(5) *voru* : $\begin{bmatrix} \text{PRED} & \text{'}be\ \langle \text{arg} \rangle\text{'} \\ \text{AGR} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{PL} \end{bmatrix} \\ \text{TENSE} & \text{PAST} \end{bmatrix}$

A third advantage of having AGR in the representation of verbs and clauses is that it also allows us to explain cases of long-distance agreement, in which the verb agrees with the object of its complement (as we shall see in section 3).

2.2 OT constraints on AGR

We assume an OT-LFG approach where general constraints are applied to candidate f-structures. Candidates from the same input share the same meaning and for our purposes only differ with respect to agreement. We assume that all candidates comply with Consistency, Completeness, and Coherence (Bresnan, 2000; Kuhn, 2003; Prince & Smolensky, 2004).

[3]We are not concerned here with the morphological aspects of the verb forms involved. Current LFG approaches to morphology that deal with agreement include Bögel & Butt (2013); Butt & Sadler (2003); Dalrymple (2015); Kaplan & Butt (2002). Our approach to agreement is compatible with alternative approaches to morphology, such as the ones mentioned.

All clauses whose verb form agrees with some GF satisfy AGRSHARE, i.e. the requirement that the AGR features of the clause unify with those of a dependent GF.[4]

(6) AGRSHARE : $\begin{bmatrix} \text{AGR} & \boxed{1} \\ \text{GF} & \begin{bmatrix} \text{AGR} & \boxed{1} \end{bmatrix} \end{bmatrix}_f$

For f-structure f that maps to a constituent of category V

The choice of the agreeing GF (GF_{AGR}) is determined by a set of constraints. Languages differ in the ranking of the constraints that refer to GF_{AGR}.

In order to explain the facts of agreement in Icelandic, we need to block agreement with non-nominative GFs, even in the case of subjects. This task is performed by constraint *AGRCASE, which bars unifying the AGR of the verb with the AGR of a dependent GF that is not nominative:

(7) *AGRCASE : $*\begin{bmatrix} \text{AGR} & \boxed{1} \\ \text{GF} & \begin{bmatrix} \text{AGR} & \boxed{1} \\ \text{CASE} & \neg\text{NOM} \end{bmatrix} \end{bmatrix}_f$

For f-structure f that maps to a constituent of category V

As will be shown later, this formulation of the constraint is preferable to a formulation that requires GF_{AGR} to be nominative (i.e. caseless scenarios).

Given that in Icelandic there is only one nominative per sentence (leaving aside copular sentences, to be analyzed in §2.3), the application of both *AGRCASE and AGRSHARE guarantees that the verb agrees with a nominative GF if there is one. Usually this results in subject agreement, as nominative is assigned by default to the subject. Therefore, subject agreement in Icelandic is just a consequence of the interaction of case assignment rules and our constraints. But if the subject is non-nominative (a "quirky case subject"), the two constraints mentioned are satisfied by agreement with a nominative object.

When the clause lacks a nominative GF, we find the verb in the 3rd person singular neuter. Although finite verb forms in Icelandic do not show differences in terms of gender, participles do show gender agreement and the form they adopt when there is no nominative GF for them to agree with is the neuter singular form. We can account for the 3rd person singular neuter forms in such cases as a result of satisfying AGRDEF(AULT):

(8) AGRDEF : $\begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{SG} \\ \text{defgen} & \end{bmatrix} \end{bmatrix}_f$

For f-structure f that maps to a constituent of category V

[4] Identity of structure, or structure-sharing, in f-structures and in constraints on f-structures is signalled by means of the tag notation commonly used in HPSG.

AGRDEF constrains the features of the verb's AGR to be 3rd person singular and in the default gender (defgen) of the language. Given that there is no single gender value that can be universally considered to be the default gender, we assume that *defgen* is a placeholder that is replaced at the definition of the constraint by the appropriate attribute-value pair specific for every language: GEND = NEUT in Icelandic, GEND = MASC in Hindi, or no pair in English (as it lacks the GEND attribute), etc.

We provisionally propose the following ranking of the three constraints assumed so far:

(9) CONSTRAINT RANKING (PROVISIONAL):
*AGRCASE ≫ AGRSHARE ≫ AGRDEF

We shall now see how these constraints operate in selecting the grammatical verb form with a few examples. For each sentence, we need to consider the various competing candidates, which, as stated earlier, are f-structures. For ease of exposition we will use sentences in place of the corresponding f-structures, we only consider the more harmonic candidates and will start by seeing how the choice between the two verb forms in (4a) is decided. The following three sentences correspond to the three competing f-structures that we will consider.

(10) a. **Drengirnir** voru sýndir honum
the.boys.nom.m.pl *were*.3.pl *shown*.nom.m.pl *him*.dat
'The boys were shown to him'

b. * Drengirnir var sýnt honum
the.boys.nom.m.pl *was*.3.sg *shown*.nom.n.sg *him*.dat

c. * Drengirnir var sýndum **honum**
the.boys.nom.m.pl *was*.3.sg *shown*.dat.m.sg *him*.dat

The agreeing expression is shown in boldface: the nominative subject in (10a), the dative object in (10c), and there is no agreeing expression in (10b).[5] The optimization tableau is given in Tableau 1.

	*AGRCASE	AGRSHARE	AGRDEF
☞ (10a)			*
(10b)		*!	
(10c)	*!		*

Tableau 1: optimization for (10)

(10a) is selected as the grammatical structure, because the constraints violated by the alternative candidates are more highly ranked than the one it violates. (10c)

[5]The passive participle agrees in gender and number with its GF_{AGR} if there is one. In addition, it has a case specification which has to match that of the GF_{AGR}, as in (10) above, or be in the default nominative case if there is no GF_{AGR}, as in (12a).

is discarded because it violates the most highly ranked constraint of the three under consideration—*AGRCASE—as the verb agrees with a dative expression. (10b) is discarded because it violates the second constraint in ranking—AGRSHARE—given that the clausal AGR is not shared with that of any GF in the clause.[6] This leaves (10a) as the optimal candidate, even though it violates AGRDEF, the lowest ranking of the three. The f-structure of the optimal candidate is given in Figure 1.[7] The AGR of the clause is shared with that of a GF of the clause, satisfying AGRSHARE, and with that of a GF that is not non-nominative, satisfying *AGRCASE. The fact that its features are not 3rd person singular neuter causes a violation of the low ranking AGRDEF, which does not make the structure ungrammatical.

$$\begin{bmatrix} \text{PRED} & \text{`}\textit{be.shown}\ \langle\ \cancel{\text{arg}}\ \text{arg}_1\ \text{arg}_2\ \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`}\textit{boy}\text{'} \\ \text{AGR} & \boxed{1}\begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{PL} \\ \text{GEND} & \text{MASC} \end{bmatrix} \\ \text{CASE} & \text{NOM} \end{bmatrix}_2 \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{SG} \\ \text{GEND} & \text{MASC} \end{bmatrix} \\ \text{CASE} & \text{DAT} \end{bmatrix}_1 \end{bmatrix}$$

Figure 1: f-structure of (10a)

Let us consider now a structure in which the verb agrees with a nominative object, as in (1a), repeated here as (11a). The three competing candidates are: agreement with the nominative object, as in (11a), no agreement, in (11b), and agreement with the dative subject, in (11c).

(11) a. Henni líkuðu **hestarnir**
she.dat *liked*.3.pl *horse*.nom.m.pl
'She liked the horses.'

b. * Henni líkaði hestarnir
she.dat *liked*.3.sg *horse*.nom.m.pl

[6]The difference between (10b) and (10c) with respect to agreement is revealed by the form of the participle. On the assumption that the finite verb form and the participle share the same AGR features, the neuter singular form of the participle in (10b) indicates that there is no agreeing GF, whereas the dative masculine singular form in (10c) indicates that the agreeing GF is *honum*, dative masculine singular.

[7]In the f-structures represented in this paper we are using the following two notational conventions: Crossing out of the most promiment argument in the PRED value signals the suppression of the logical subject of the passive; the subscripted number in the PRED value show the correspondence of each argument with a GF.

c. * **Henni** líkaði hestarnir
she.dat *liked*.3.sg *horse*.nom.m.pl

As shown in the optimization tableau for (11), in Tableau 2, the violations of AGR-SHARE and *AGRCASE that (11b) and (11c), respectively, incur leave (16a) as the grammatical structure, in which neither of these constraints is violated. The f-structure of the grammatical (11a) is shown in Figure 2.

	*AGRCASE	AGRSHARE	AGRDEF
☞ (11a)			*
(11b)		*!	
(11c)	*!		*

Tableau 2: optimization for (11)

$$\begin{bmatrix} \text{PRED} & \text{`}\textit{like}\ \langle\ \text{arg}_1\ \text{arg}_2\ \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{SG} \\ \text{GEND} & \text{FEM} \end{bmatrix}_1 \\ \text{CASE} & \text{DAT} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`}\textit{horse}\text{'} \\ \text{AGR} & \boxed{1} \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{PL} \\ \text{GEND} & \text{MASC} \end{bmatrix}_2 \\ \text{CASE} & \text{NOM} \end{bmatrix} \end{bmatrix}$$

Figure 2: f-structure of (11a)

Finally, we need to consider the type of sentence where there is no trigger of agreement for the verb, i.e., the verb agrees with no GF. The two candidates to take into account are (12a), where the clause contains no GF whose AGR is structure-shared with that of the clause, and (12b), where the agreeing GF is the subject.

(12) a. Þeim var hjálpað
them.dat *was*.3.sg *helped*.nom.n.sg
'They were helped'

b. * **Þeim** voru hjálpaðum
them.dat *were*.3.pl *helped*.dat.m.pl

The corresponding tableau 3 indicates that (12a), despite not having any agreeing GF, is the optimal candidate. It shows that a grammatical structure can violate

AGRSHARE. In such a situation, the effects of AGRDEF are revealed, requiring the verb form to be in the 3rd person singular—other candidates, not shown here, with different AGR values (plural, 1st person, feminine, etc.), are ruled out because they violate AgrDef. The f-structure of the grammatical (12a) is given in Figure 3.

	*AGRCASE	AGRSHARE	AGRDEF
☞ (12a)		*	
(12b)	*!		*

Tableau 3: optimization for (12)

$$\begin{bmatrix} \text{PRED} & \text{`}\textit{be.helped}\ \langle\ \sout{\text{arg}}\ \text{arg}_1\ \rangle\text{'} \\ \text{AGR} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{SG} \\ \text{GEND} & \text{NEUT} \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{PL} \end{bmatrix}_1 \\ \text{CASE} & \text{DAT} \end{bmatrix} \end{bmatrix}$$

Figure 3: f-structure of (12a)

2.3 Subject agreement

Up to this point, we have not introduced a principle accounting for the observation that the verb agrees preferentially with the subject. So far, this fact follows from the combined effect of *AGRCASE, which excludes any non-nominative as the agreeing GF, and the principles of case assignment in Icelandic, by which the subject is assigned nominative case by default and co-occurring GFs are in other cases. The issue that we haven't yet addressed is what happens when there are two nominative GFs in the sentence. We find this in Icelandic copular sentences with two nominative GFs, i.e. subject and complement. In this situation the verb always agrees with its subject (leaving aside copular constructions in which the subject is *þetta* or *það*, to which we will return). See for example the following data from Sigurðsson, 1996:

(13) a. **Bítlarnir** **hafa**/*hefur lengi verið frægasta
the.Beatles.nom.m.pl *have*.3.pl/*sg *long been most.famous*
hljómsveitin
the.band.nom.m.sg
'The Beatles have long been the most famous band'

b. **Frægasta hljómsveitin hefur**/*hafa lengi verið
most.famous the.band.nom.m.sg *have*.3.sg/*pl *long been*
Bítlarnir
the.Beatles.nom.m.pl
'The most famous band has long been The Beatles'

The claim that in the presence of two nominative NPs finds support in the facts from Hindi. Some Hindi transitive sentences allow the subject to alternate between ergative case and nominative case, depending on the aspect of the verb (see Butt & King, 2004 for the full compexity of Hindi/Urdu case). Following the observations in Mohanan (1994, 2016), if the subject is ergative and there is a nominative object, the verb agrees with the object, as expected: (14). When the subject is nominative, the verb agrees with it, despite the presence of a nominative object: (15) (examples from Mohanan, 2016).

(14) ravii-ne / niinaa-ne **santraa** khaayaa/*khaaii
Ravi-erg.m / *Nina*-erg.f *orange*-nom.m *eat*.perf.m.sg/*f.sg
'Ravi/Nina ate orange(s)'

(15) **niinaa** santraa / roTii khaaegii/*khaaegaa
Nina-nom.f *orange*-nom.m / *bread*-nom.f *eat*.fut.f.sg/*m.sg
'Nina will eat orange/bread'

The preference for the subject as an agreement trigger is explained by positing a new principle named AGRSUBJ, defined as in (16) (informally, $\text{GF}_{\text{AGR}} = \text{SUBJ}$), and placing it in the provisional ranking of constraints in (17).

(16) AGRSUBJ : $\begin{bmatrix} \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{AGR} & \boxed{1} \end{bmatrix} \end{bmatrix}_f$
For f-structure f that maps to a constituent of category V

(17) CONSTRAINT RANKING (PROVISIONAL VERSION 2):
*AGRCASE ≫ AGRSUBJ ≫ AGRSHARE ≫ AGRDEF

In sentences with two nominatives, the choice between the two is settled in favor of the subject.[8]

The position of AGRSUBJ in the hierarchy in (17) is decided as follows. That constraint must rank below *AGRCASE because there is never agreement with a

[8]The person restriction reported in Sigurðsson (2004) can be interpreted as a prominence matching constraint: the most prominent case feature—nominative—may be aligned with the more prominent person features—first and second—only if they correspond to the most prominent argument at argument structure. By this constraint, the nominative object of *líka* 'like' cannot be first or second person. But the nominative complement of the copula, being the single and, therefore, most prominent argument of this verb is not prevented from being first or second person. Inverse agreement in copular clauses arises only when the object of the copula is *það* or *þetta*. We can assume that these forms are lexically specified for the features of AGR, as indicated in Sigurðsson (2004); and that they acquire these features through identity of AGR between a predicative element and its subject.

non-nominative subject. AGRSUBJ must rank higher than AGRDEF because agreement with a nominative subject is obligatory. In order to determine the relative ranking between AGRSUBJ and AGRSHARE, we can use evidence from Jónsson (2016): In some variants of Icelandic, lack of agreement is preferred over nominative object agreement, suggesting AGRDEF ≫ AGRSHARE in these variants, a reordering of constraints that shows an advantage of using an OT approach. Nominative subject agreement remains obligatory in these variants. Given that AGRSUBJ ≫ AGRDEF, we can deduce that AGRSUBJ ≫ AGRSHARE.

3 Raising and long-distance agreement

In raising constructions, the raising verb has two dependent GFs: the subject and the complement (the embedded clause). If the subject is nominative, we expect that the verb should agree with it. If it is not, the expectation would be that the verb agrees in the 3rd singular with its clausal complement. Facts such as (18) show that the verb does not necessarily have 3rd person singular features, but may have the features of the nominative object of the embedded clause, either in the active or the passive (Sigurðsson, 2004). The examples below correspond to the three most harmonic candidates: showing agreement with the object of the complement clause, (18a), showing agreement with no nominal GF, (18b), and showing agreement with the dative subject of the raising verb, (18c). The corresponding optimization is shown in Tableau 4.

(18) a. Henni eru taldir hafa verið sýndir
she.dat *are*.3.pl *believed*.nom.m.pl *have*.inf *been* *shown*.nom.m.pl
bilarnir
car.nom.m.pl
'She is believed to have been shown the cars'

b. * Henni er talið hafa verið sýndir
she.dat *is*.3.sg *believed*.nom.n.sg *have*.inf *been* *shown*.nom.m.pl
bilarnir
car.nom.m.pl

c. * **Henni** er talinni hafa verið sýndir
she.dat *is*.3.sg *believed*.dat.f.sg *have*.inf *been* *shown*.nom.m.pl
bilarnir
car.nom.m.pl

The f-structure of the grammatical (18a) is shown in Figure 4. The main points to highlight are the following: the AGR of the embedded clause is structure-shared with that of its nominative object, bearing in mind that the subject is dative and, therefore, prevented from agreeing; this is a type of covert agreement, as the verb of the embedded clause is an infinitive and, as such, does not express any agreement feature; the subject of the embedded clause undergoes raising, i.e. is structure-shared with the subject of the embedding clause; the AGR of the embedding clause

	*AGRCASE	AGRSUBJ	AGRSHARE	AGRDEF
☞ (18a)		**		**
(18b)		**	*!	
(18c)	*!*			**

Tableau 4: optimization for (18)

cannot be shared with that of its subject, which is dative, but instead is shared with that of its object—the complement clause. Nothing said so far prevents the sharing of the AGR of a clause with that of an embedded clause, and that is what happens here. The apparent long-distance agreement seen in (18a) is, in fact, a combination of two local agreement relations: the sharing of the AGR of the raising clause with the AGR of its infinitival complement and the sharing of this AGR with that of the object of the infinitive.

$$\begin{bmatrix}
\text{PRED} & \text{`}\textit{be.believed}\ \langle\ \cancel{\text{arg}}\ \text{arg}_1\ \rangle\text{'} \\
\text{AGR} & \boxed{1} \\
\text{SUBJ} & \boxed{2} \\
\text{OBJ} & \begin{bmatrix}
\text{PRED} & \text{`}\textit{be.shown}\ \langle\ \cancel{\text{arg}}\ \text{arg}_2\ \text{arg}_3\ \rangle\text{'} \\
\text{VFORM} & \text{INF} \\
\text{TENSE} & \text{PERF} \\
\text{AGR} & \boxed{1} \\
\text{SUBJ} & \boxed{2}\begin{bmatrix}
\text{PRED} & \text{`PRO'} \\
\text{AGR} & \begin{bmatrix}\text{PERS} & 3 \\ \text{NUM} & \text{SG} \\ \text{GEND} & \text{FEM}\end{bmatrix}_2 \\
\text{CASE} & \text{DAT}
\end{bmatrix} \\
\text{OBJ} & \begin{bmatrix}
\text{PRED} & \text{`}\textit{car}\text{'} \\
\text{AGR} & \boxed{1}\begin{bmatrix}\text{PERS} & 3 \\ \text{NUM} & \text{PL} \\ \text{GEND} & \text{MASC}\end{bmatrix}_3 \\
\text{CASE} & \text{NOM}
\end{bmatrix}
\end{bmatrix}_1
\end{bmatrix}$$

Figure 4: f-structure of (18a)

The facts of agreement in raising constructions such as these argue for formulating *AGRCASE as stated in (7), that is, as a negative constraint (the AGR of a dependent GF whose case is not nominative cannot be involved in AGR-sharing), rather than as a positive constraint (the AGR of a clause must be shared with that of a nominative dependent). There is no evidence that a complement clause is specified for case. So, although we cannot say that a complement clause is nominative (or any other case specification), we can say that it lacks case and therefore is not non-nominative (but see Butt (2014), where the infinitive complement clauses in a

similar construction in Hindi/Urdu bear nominative case).

When the clause embedded under a raising verb does not include a nominative argument, the raising verb shows the default 3rd person singular form, as in (19a). (19b) is the competing candidate in which both the raising verb and the infinitive agree with the dative subject. The optimization is given in Tableau 5.

(19) a. Þeim virðist hafa verið hjálpað
they.dat *seems*.3.sg *have*.inf *been helped*.nom.n.sg
'They seem to have been helped'

b. * **Þeim** virðast hafa verið hjálpaðum
they.dat *seems*.3.pl *have*.inf *been helped*.dat.m.pl

	*AGRCASE	AGRSUBJ	AGRSHARE	AGRDEF
☞ (19a)		**	*	
(19b)	*!*			**

Tableau 5: optimization for (19)

The facts of raising sentences are explained by the same set of constraints that we proposed for monoclausal structures. The agreement of the raising verb with the nominative object of the embedded clause is possible because the raising verb shares its AGR with that of the embedded clause, regardless whether there is a nominative object. However, not all embedded clauses allow their AGR to be shared with that of the embedding clause. The evidence indicates that the AGR of an embedded clause is only available for sharing with the AGR of the higher clause if there is raising-to-subject (RTS) from the embedded clause. Examples, like (20) and (21) do not allow agreement of the main clause verb with the nominative object of the embedded clause.

(20) Mér hefur/*hafa alltaf virst honum líka **bækur**
I.dat *has*.3.sg/*pl *often seemed he*.dat *like*.inf *book*.nom.m.pl
'It has often seemed to me that he likes books' (Schütze, 1997)

(21) Mér virðist/*?virðast stráknum líka **þessir bílar**
I.dat *seems*.3.sg/*?pl *the.boy*.dat.m.sg *like*.inf *these*.nom.pl *cars*.nom.pl
'It seems to me that the boy likes these cars' (Watanabe, 1993)

In examples (20) and (21) there is no RTS as the subject of the matrix clause is occupied by an argument of this verb. This is the crucial difference between these examples and the cases in which structure sharing is found between the matrix and the embedded AGRs.

In order to block the possibility of AGR-sharing across clauses without RTS, we posit the constraint Clausal Transparency (CLTRANS):[9]

[9]One could state this constraint by saying that cross-clausal sharing of AGR only occurs when

(22) CLTRANS : $\begin{bmatrix} \text{AGR} & \boxed{1} \\ \text{GF} & \left[\text{AGR} \quad \boxed{1}\right]_g \end{bmatrix}_f \rightarrow \begin{bmatrix} \text{SUBJ} & \boxed{2} \\ \text{GF} & \left[\text{GF} \quad \boxed{2}\right]_g \end{bmatrix}_f$
For f-structures f, g that map to constituents of category V.

The final ranking of OT constraints is assumed to be as follows:

(23) CONSTRAINT RANKING (FINAL):
CLTRANS, *AGRCASE $\gg$ AGRSUBJ $\gg$ AGRSHARE $\gg$ AGRDEF

The relative order of CLTRANS and *AGRCASE is impossible to determine as we have not found any instance in which either one is violated by an optimal candidate. We therefore assume both rank equally.

In order to see the effect of CLTRANS on a sentence like (20), let us consider the three candidates in (24): (24a), without sharing of the two clausal AGRs and with default agreement on the matrix AGR; (24b), without sharing of the clausal AGR and with agreement of the matrix verb with its dative subject; and (24c), with sharing of the clausal AGRs and with long-distance agreement. Tableau 6 shows that (24a) is the optimal candidate, as the other two candidates violate one of the two highest ranking constraints in (23).

(24) a. Mér hefur alltaf virst honum líka bækur
I.dat *has* *often seemed he*.dat *like*.inf *book*.nom.m.pl
'It has often seemed to me that he likes books'

b. * MÉR hef alltaf virst honum líka bækur
I.dat *have*.1.sg *often seemed he*.dat *like*.inf *book*.nom.m.pl

c. * Mér hafa alltaf virst honum líka **bækur**
I.dat *have*.3.pl *often seemed he*.dat *like*.inf *book*.nom.m.pl

	CLTRANS	*AGRCASE	AGRSUBJ	AGRSHARE	AGRDEF
☞ (24a)			**	*	*
(24b)		*!	*		**
(24c)	*!		**		**

Tableau 6: optimization for (24)

The analysis of long-distance agreement proposed here lends itself to accounting for other instances of long-distance agreement discussed in the literature. For example, there is a construction with long-distance agreement in Hindi/Urdu according to Bhatt (2005); Butt (2014) in which the infinitive may agree with its

the lower AGR is that of an XCOMP. However, we are using a reduced inventory of GFs that does not include COMP or XCOMP, as in Alsina (1996); Alsina et al. (2005); Patejuk & Przepiórkowski (2016). See Patejuk & Przepiórkowski (2016) for evidence against distinguishing XCOMP from OBJ as GFs.

nominative object and in turn with the subordinating verb. In this construction the infinitive reflects its AGR features by means of a suffix. Another phenomenon of long-distance agreement is discussed in Polinsky & Potsdam (2001) and Haug & Nikitina (2016) involving (optional) agreement of a verb with the absolutive argument of the complement clause in a structure without RTS in Tsez. A possible way to analyze these facts within the present approach is to assume AGR-sharing of the embedded clause and the embedding clause, as a result of a different position of CLTRANS in the hierarchy of constraints in Tsez. Developing the analysis of Hindi/Urdu and Tsez long-distance agreement is beyond the scope of this paper.

4 Agreement and locative inversion in English

Although English has traditionally been analyzed as a language with subject agreement, the facts of locative inversion (LocInv) indicate that English is not that different from Icelandic. When an oblique case locative appears in subject position, the verb agrees with the postverbal NP, which is analyzed as a complement, following Bresnan (1994).[10]

(25) In the swamp was/*were found **a child**

(26) In the swamp were/*was found **two children**

We assume as in Bresnan (1994) that the PP locatives are oblique case and the postverbal NPs in these constructions are direct case. We cannot analyze these constructions exactly like structures with quirky case subjects in Icelandic because the postverbal NP in English LocInv is not nominative. Although distinctions in terms of case on NPs in English are only found in pronouns and pronouns are pragmatically hard to use in the postverbal NP position of LocInv because of the presentational function of this position, which is inconsistent with the anaphoric function of pronouns, pronouns can be used deictically in this position and can only be used in their accusative (not in their nominative) form (Bresnan, 1994):

(27) Among the guests of honor was sitting HER [pointing]

It seems that the relevant distinction in terms of case for agreement in English is between direct and oblique case (not between nominative and non-nominative). In order to analyze the facts of English, we can assume that *AGRCASE is relegated to a low position in the hierarchy of constraints, so that it has no effect in English, and in its place in the ranking of constraints we can assume a *AGROBL constraint prohibiting agreement (AGR sharing) with an oblique case argument.

[10] Bresnan (1994, p. 95, footnote 31) notes that in rare instances, in this construction, the verb is found in the 3rd singular not agreeing with the postverbal NP, a possibility reported by a reviewer. The analysis within the present theory would imply that for some speakers the two lower-ranking constraints in (23), AGRSHARE and AGRDEF, rank equally, giving rise to two outcomes in free variation: an agreeing and a non-agreeing form.

With this difference with Icelandic, we can assume the rest of the theory unchanged for English. In order to explain the grammatical agreement form in (26), we can consider the competing candidates in (28): with agreement of the verb with the direct case object, (28a); without agreement, with the default morphology on the verb, (28b); with agreement with the oblique case subject, (28c). The competition is resolved as in Tableau 7 and the f-structure of the well-formed (28a) is given in Figure 5.

(28) a. In the swamp were found **two children**

b. * In the swamp was found two children

c. * **In the swamp** was found two children

	CLTRANS	*AGROBL	AGRSUBJ	AGRSHARE	AGRDEF
☞ (28a)			*		*
(28b)			*	*!	
(28c)		*!			

Tableau 7: optimization for (28)

$$\begin{bmatrix}
\text{PRED} & \text{`}\textit{be.found}\ \langle\ \sout{\text{arg}}\ \text{arg}_1\ \text{arg}_2\ \rangle\text{'} \\
\text{TENSE} & \text{PAST} \\
\text{AGR} & \boxed{1} \\
\text{SUBJ} & \begin{bmatrix}
\text{PRED} & \text{`}\textit{in}\ \langle\ \text{arg}_3\ \rangle\text{'} \\
\text{OBJ} & \begin{bmatrix}
\text{PRED} & \text{`}\textit{swamp}\text{'} \\
\text{AGR} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{SG} \end{bmatrix}
\end{bmatrix}_3 \\
\text{CASE} & \text{OBL}
\end{bmatrix}_2 \\
\text{OBJ} & \begin{bmatrix}
\text{PRED} & \text{`}\textit{child}\text{'} \\
\text{QUANT} & \text{NUMERAL} \\
\text{AGR} & \boxed{1}\begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{PL} \end{bmatrix} \\
\text{CASE} & \text{DIR}
\end{bmatrix}_1
\end{bmatrix}$$

Figure 5: f-structure of (28a)

The facts of LocInv in raising structures are also covered by our theory; the verb is correctly predicted to agree with the complement of the embedded clause if the raised subject is a locative PP: (29) and (30) (adapted from Bresnan, 1994).

(29) On the hill appears/*appear to be located **a cathedral**

(30) On the hill appear/*appears to be located **two towers**

As in Icelandic, sharing of AGRs across clauses is only possible if RTS is involved (as required by CLTRANS), as in (29) and (30). The candidates considered for (29) are given in (51) and the corresponding optimization in (52).

(31) a. On the hill appear to be located **two towers**
b. * On the hill appears to be located two towers
c. * **On the hill** appears to be located two towers

	CLTRANS	*AGROBL	AGRSUBJ	AGRSHARE	AGRDEF
☞ (31a)			**		**
(31b)			**	*!	
(31c)		*!*			

Tableau 8: optimization for (31)

5 Conclusion

The theory of agreement proposed in this paper rests on two fundamental ideas: a) the f-structure representation of both the clause and nominal expressions includes the feature matrix AGR containing the features involved in agreement (PERS, NUM, GEND, and others); and b) the value of the verbal AGR is determined by a set of OT constraints. The lexical entry of a finite verb form in languages like English, Icelandic, or Hindi specifies the features of AGR, but does not specify what GF this AGR corresponds to. Verbal agreement is the sharing of the verb's AGR with that of one of its dependent GFs. The job of the OT constraints is to ensure that the right GF is chosen to share its AGR with that of the clause it belongs to.

Some of the consequences of the theory are the following:

1. Agreement with nominative expressions in Icelandic:
   - High-ranking *AGRCASE excludes expressions with case values other than nominative for AGR sharing: this restricts eligible agreement triggers to nominative GFs and clauses (lacking in case values).[11]
   - AGRSUBJ breaks the tie in favor of the subject when two expressions are nominative.
2. Long-distance agreement:
   - Apparent long-distance agreement (a verb agreeing with the complement of an embedded clause) is a set of local agreement relations: the AGR of the main clause is shared with that of the embedded clause, which, in turn, is shared with the AGR of a complement.

[11] In English, *AGROBL, instead of *AGRCASE, leaves GFs with direct case (as well as those lacking in case) as potential triggers of agreement.

- The impression of long-distance agreement is enhanced by the fact that the AGR-sharing of an infinitival clause is covert agreement, i.e., not morphologically encoded.
- Cross-clausal AGR-sharing is restricted to RTS structures (CLTRANS).

3. Verbal features are 3rd sg when there is no agreement:

   - Agreement fails to arise when AGRSHARE cannot be satisfied: No available GF is nominative or a clause that undergoes RTS.
   - In the absence of AGR-sharing, AGRDEF requires the clausal AGR to be 3rd sg (neuter in Icelandic).
   - This 3rd sg form is exactly the same that is used when agreement with a 3rd sg constituent is required (not a homophonous form).

Proposals within LFG to account for the Icelandic agreement facts discussed here can be found in Andrews (1990) and Otoguro (2005). Space limitations prevent us from making an in-depth comparison of those proposals with the present one. One clear advantage of the present proposal is that, whereas both Andrews (1990) and Otoguro (2005) treat the verb form that is used in the absence of agreement as homophonous with the form that agrees in the 3rd person singular, the present proposal assumes that there is only one 3rd singular form. A verb form whose AGR includes the features of 3rd person and number singular can be used both when this AGR is shared with another AGR with the same features or when it is not shared with any AGR, as the result of AGRDEF.

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Fixing LFG to Account for Direct-Inverse Agreement: The Case of Plains Cree

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Abstract

The goal of this paper is to explain verbal agreement in Plains Cree (Algonquian), in which verb forms always agree with the most prominent argument with respect to person and other referential features, but adopt either direct or inverse morphology depending on which is the GF of the most prominent. Following Alsina & Vigo (2014), we adopt the AGR(EEMENT) bundle to represent person and other agreement features. We claim that direct agreement is an instance of subject agreement in this person-governed agreement system and that inverse agreement is an instance of object agreement. The complex facts of inflectional verbal morphology in Plains Cree argue for an approach to morphology in which inflectional affixes are the realization of the information found in the word-level f-structure.

1 Introduction

Our goal is to explain verbal agreement in a language with direct-inverse morphology, namely, a language in which morphology signals whether the verb agrees with its agent-like argument (direct) or its patient-like argument (inverse). For this, we have chosen Plains Cree (Algonquian) as the object of our analysis, which is proposed within an OT-LFG framework based on previous work of ours (Alsina & Vigo, 2014; Vigo, 2016), inspired by the works of Bresnan (2000) and Kuhn (2003). This choice is motivated because of the morphological complexity of the language and because there is evidence that direct-inverse morphology does not imply a change in the mapping of GFs to thematic roles in this language.

Our claim is that verbal agreement in Plains Cree provides further evidence for the need for AGR as the feature bundle that represents agreement features in a clause, as in Alsina & Vigo (2014, 2017). Under our analysis, Plains Cree direct forms signal subject-verb agreement, whereas inverse forms signal object-verb agreement. We assume a major division in agreement systems between case-governed systems and person-governed systems. In case-governed agreement systems the agreement trigger is required to be in a specific case (normally, the nominative), regardless of the GF that bears that case. Person-governed agreement systems choose the agreement trigger so that it is always the GF in the sentence that shows the most prominent person features. Both systems only differ in how agreement constraints are ranked in each one. This motivates the use of OT within a broader discussion of agreements systems.

Another claim of this paper is that verbal agreement in Plains Cree provides evidence that inflectional morphology is best analyzed as the realization of syntactic features rather than as the source of syntactic features. This implies a departure from the morpheme-based approach to morphology.

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This paper is organized as follows. In section (2) we present what we mean by direct-inverse agreement. This concept requires further discussion before moving forward to section (3), where the syntax of Plains Cree verbal agreement is analyzed. There we provide the discussion on how AGR, in conjunction with the constraints proposed, predicts Plains Cree data. In section (4) we discuss the morphology of Plains Cree in order to explain why some forms, although syntactically expected to be possible, are ungrammatical. There we explain our proposal on how to treat inflectional morphology. Finally in the last section we provide a summary of our conclusions and claims.

2 The polysemy of the term *direct-inverse morphology*

Languages that are claimed to have direct-inverse morphology do not have a uniform analysis regarding the role or function (or syntactico-semantic correlate) of this morphology. In what follows, we show that there are two types of languages with direct-inverse morphology (subsection 2.1) and which type Plains Cree belongs to (subsection 2.2).

2.1 Two types of languages with direct-inverse morphology

In one type of language, direct-inverse morphology signals a difference in the GF-argument alignment that is sensitive to the referential features of the arguments involved. In the direct form, the most prominent argument at argument structure (a-structure)—the most agentive argument, or A, for simplicity—maps onto the subject, provided it is also the most prominent argument at the referential level (MAX); this is the argument that agrees with the verb. In the inverse form, what changes is that it is not the most prominent argument at a-structure that maps onto the subject, but a non-agentive—or P—argument, which is the most prominent argument at the referential level.

This type of language is illustrated by Mapudungun according to the analysis of Arnold (1997). We can refer to the direct-inverse morphology in this type of language as *role-inverting direction morphology*. The diagram in Figure 1 shows a schema of how a-structure maps to each level of information in both forms.

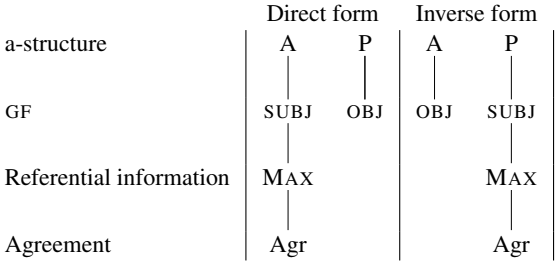

Figure 1: Mapping relations in Mapudungun (role-inverting direction morphology)

The second type of language is illustrated by Plains Cree following Dahlstrom (2014). We can refer to it as *agreement-inverting direction morphology*. The diagram in Figure 2 illustrates the mapping from a-structure to the rest of information levels.

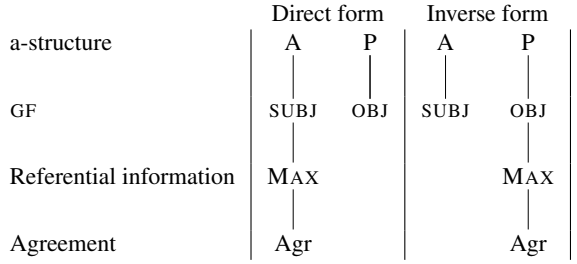

Figure 2: Mapping relations in Plains Cree (agreement-inverting direction morphology)

What is common to both types of languages with direct-inverse morphology is that agreement is with the MAX argument (maximally prominent at the referential level). They differ in that in languages with role-inverting direction morphology, the SUBJ is always assigned to the MAX argument, with the SUBJ mapping either to the A argument (direct) or to the P argument (inverse), and, in languages with agreement-inverting direction morphology, the SUBJ function is always assigned to the A argument (and the OBJ to the P), with agreement going with either the SUBJ or the OBJ depending on which is the MAX.

2.2 Arguments for an agreement-inversion analysis

In the remainder of this section we summarize the arguments in Dahlstrom (2014) in favor of the claim that direction morphology in Plains Cree does not affect the argument-GF mapping, but instead signals whether the agreeing GF is the SUBJ (direct) or the OBJ (inverse), i.e. as schematized in Figure 2.

As shown by Dahlstrom (2014), in Plains Cree there is a copy-to-object construction in which the main verb has an object which agrees in features with the subject of the embedded verb. This provides a test for the subjecthood of the embedded clause and another test for the objecthood of the matrix clause. Dahlstrom (2014) uses this construction as a means to prove that in Plains Cree the agent is the subject and the patient is the object, regardless whether the sentence is direct or inverse. Consider, for example, this case:

(1) nikiske:yima:w John e:kiwa:pamisk
know.dir.1→3 *John see*.perf.inv.3→2
'I know John saw you'

In (1) *John* is the patient of the matrix clause and the agent of the embedded clause. The copy-to-object construction requires *John* to be the object of the main

clause and the controller of the subject of the embedded clause. The fact that in the embedded clause inverse morphology is found does not prevent this, so it does not entail a realignment of the argument-to-GF mapping: *John* is the subject of the embedded clause.

The same construction also shows that the main clause patient is the object regardless of the direct or inverse morphology. Dahlstrom (2014) shows this with example (2); the subject of the embedded clause is controlled by the object of the main clause (a null pronoun) in spite of the inverse morphology (the distinction between proximate and obviative is explained later):

(2) namoya kiske:yimik o:hta:wiya e:sipwe:hte:t
not *know*.inv.obv→3 *his.father*.obv *leave*.3
'His father.OBV did not know that he.PROX had gone off'

There is a third test involving floating quantifiers, which are always oriented to the object; the argument targeted by the quantifiers does not change depending on whether the verb has direct or inverse morphology. The three tests show that direct-inverse morphology in Plains Cree is of the agreement-inverting type, and not of the role-inverting type. Therefore, the agent is always the subject of direct and inverse sentences in Plains Cree and the patient is always the object.

3 The syntax of verbal agreement in Plains Cree

Our analysis is restricted to Transitive Animate (TA) verbs in Plains Cree, i.e. verbs whose object is an animate entity. Intransitive verbs, both Animate and Inanimate, are not relevant to this paper, as they show agreement with their only argument. Transitive Inanimate verbs—those with an inanimate entity as their object—are subject to other rules that are not discussed here (see Dahlstrom, 2014). We also restrict our attention to forms in the *independent order*, roughly equivalent to the indicative mood in European languages.

TA verbs in Plains Cree are formed by a prefix that expresses person information, the stem, a *direction* suffix that signals whether the form is direct or inverse, and finally a suffix that expresses person and other referential information. The following examples illustrate this (Dahlstrom, 2014):

(3) a. ni- wa:pam -a: -na:n
1 *see* DIR 1.pl.excl
'We.EXCL see him'

b. ni- wa:pam -iko -na:n
1 *see* INV 1.pl.excl
'He sees us.EXCL'

The data in (3) shows that the person prefix *ni-* and the person-number suffix *-na:n* are used in both the direct and the inverse forms (note that in these examples

there is no affix signalling the 3rd person; see section 4 for the explanation of the distribution of affixes). In (3a) both refer to the subject of the sentence, whereas in (3b) the very same affixes refer to the object of the sentence. This situation shows that affixes in Plains Cree do not refer to a specific GF: the same affix can be used for either of the two core GFs (SUBJ and OBJ).

The affixes that are different between (3a) and (3b) are the direction affixes. The direct suffix signals that the SUBJ is more prominent than the OBJ in terms of referential features, where a 1st person plural, as a speech act participant (SAP), is more prominent than a 3rd person. The inverse suffix signals exactly the opposite: that the SUBJ is less prominent than the OBJ at the referential level.

Another aspect that must also be taken into account is that sometimes forms only express the features of only one GF, as in (3). In other occasions, the person prefix refers to one of the two core GFs while the person-number suffix refers to the other core GF, as explained in section 4. This is what we find in the paradigm that follows (from Dahlstrom, 2014), where the prefix is 2nd person and the person-number suffix is 3rd person:

(4) a. ki- se:kih -a: -w
2 *frighten* DIR 3.sg
'You.SG frighten him'

b. ki- se:kih -ikw -w
2 *frighten* INV 3.sg
'He frightens you.SG'

As we observed in (3), in paradigm (4) we find that the same affixes are associated to a different core GF depending on whether the construction is direct or inverse. The data in (4) also shows that the actual information of each GF is just partially provided by the morphology: notice that there is no explicit information signalling that the 2nd person is actually singular. The reason why it is singular is that if it was plural, *-w* would be excluded in favor of *-wa:w*, leaving the 3rd person GF morphologically unexpressed. The details on how this comes to be possible are discussed later in section 4.

The fact that affixes are not attributed to any GF, but express the features of one or another depending on the whole structure, is an argument for the claim that the AGR feature structure represents the agreement features of both the clause and its dependent GFs. AGR is a construct that resembles the INDEX feature in HPSG (Pollard & Sag, 1994) in that it groups under one single feature bundle the various features of GFs that are used in agreement, such as person, number, and gender (see also King & Dalrymple, 2004). However, our AGR also has the role of the AGR feature proposed by Kathol (1999) in HPSG and Haug & Nikitina (2012) in LFG, namely, to also represent the features of the clause (typically morphologically signalled by the verb). Our formalization of this construct is used in Alsina & Vigo (2014) and in Vigo (2016) for the facts of copular inversion in Romance languages.

As a first rule, we state that the AGR features of the clause must match those of an argument of the clause. This is captured by the OT constraint AGRSHARE, which has been argued to be necessary for the analysis of other languages (e.g. Icelandic, English; see Alsina & Vigo, 2014, 2017):

(5) AGRSHARE:
For an f-structure f that maps to a category V^0:

$$\begin{bmatrix} \text{AGR} & \boxed{1} \\ \text{GF} & \begin{bmatrix} \text{AGR} & \boxed{1} \end{bmatrix} \end{bmatrix}_f$$

All principles that refer to AGR in this paper refer to f-structures that map to a verb in the c-structure. For convenience, we refer to the GF where AGR unifies with AGR of the verbal GF (i.e. the GF in AGRSHARE) with the label GF_{AGR}.

As we are working within OT, this principle and all other principles that are presented in this work may be violated. In fact, the only conditions that we do not accept to be violable are the well-formedness conditions that define the concept of an f-structure, namely: Consistency, Completeness, and Coherence. In other languages, AGRSHARE may be violated by grammatical structures, resulting in structures that show no agreement (see Alsina & Vigo, 2017). However, lack of agreement is not found in Plains Cree, so we assume that AGRSHARE is always satisfied in the language. Therefore, we are not including this constraint in the OT tableaux that we provide in the discussion of the data that follows.

In section 1, we stated that we divide languages in two major groups regarding agreement: those in which agreement is governed by case and those in which agreement is governed by person features. In case-governed agreement systems, a high-ranking constraint bars AGR from unifying with any GF that has a case feature that is not the default case, usually the nominative or absolutive (i.e. *AGRCASE in Alsina & Vigo, 2017). Person-governed agreement systems, on the other hand, have a high-ranking constraint that must be satisfied by unifying the clausal AGR with the AGR of a GF that has a value for person that is prominent, usually an SAP argument. Plains Cree belongs to this latter group, in which AGRPERS is the relevant constraint:[1]

(6) AGRPERS:

$$\begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{PERS1} & + \end{bmatrix} \vee \begin{bmatrix} \text{PERS2} & + \end{bmatrix} \end{bmatrix}$$

A word must be said about how person features work in Plains Cree before moving on, so that the formalization of AGRPERS above is correctly understood. In Plains Cree, it is best to represent person as a set of two boolean features PERS1 and PERS2, which represent whether the GF refers to the speaker (PERS1) or to the addressee (PERS2). We need this because the 1st person plural inclusive in

[1] AGRPERS has also been posited for the analysis of agreement facts in languages like Spanish and Catalan (Alsina & Vigo, 2014; Vigo, 2016), and Dargwa Belyaev (2013).

Plains Cree works in some ways as if it was a 2nd person plural in the morphology, as discussed in section 4. The combinations of all possible values for PERS1 and PERS2 gives this set of representations for each possible person:

(7) a. 1st excl.: $\begin{bmatrix} \text{PERS1} & + \\ \text{PERS2} & - \end{bmatrix}$

b. 1st incl.: $\begin{bmatrix} \text{PERS1} & + \\ \text{PERS2} & + \end{bmatrix}$

c. 2nd: $\begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & + \end{bmatrix}$

d. 3rd: $\begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \end{bmatrix}$

Number, on the other hand, is represented as usual making use of NUM.

Let us analyze a case of direct agreement like (8). The two most relevant candidates are represented by their respective f-structures shown in Figures 3 (GF_{AGR} = SUBJ) and 4 (GF_{AGR} = OBJ). Following Kuhn (2003) and Vigo (2016), candidates always have the same meaning, which is defined by the OT input. In this paper we only discuss the candidates that are differentiated by the GF whose AGR is shared with that of the clause.

(8) ki- se:kih -a: -w
2 *frighten* DIR 3
'You.SG frighten him'

$$\begin{bmatrix} \text{PRED} & \text{`}\textit{frighten}\ \langle\ \text{arg}_1\ \text{arg}_2\ \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \boxed{1}\begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & + \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_1 \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_2 \end{bmatrix}$$

Figure 3: SUBJ-agreeing candidate

$$\begin{bmatrix} \text{PRED} & \text{`}\textit{frighten}\ \langle\ \text{arg}_1\ \text{arg}_2\ \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & + \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_1 \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \boxed{1}\begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_2 \end{bmatrix}$$

Figure 4: OBJ-agreeing candidate

The subject-agreeing candidate is chosen, as it satisfies AGRPERS due to the PERS2 feature of the subject being +. The object-agreeing candidate violates this constraint.

The inverse counterpart of (8) is shown in (9). The candidates are those in Figures 5 and 6 but the optimization gives the opposite result, namely that the optimal candidate is in this case the one in which $\text{GF}_{\text{AGR}} = \text{OBJ}$. The object-agreeing candidate satisfies AGRPERS, whereas the subject-agreeing candidate does not.

(9) ki- se:kih -ikw -w
2 *frighten* INV 3.sg
'He frightens you.SG'

$$\begin{bmatrix} \text{PRED} & \textit{`frighten} \langle \text{arg}_1\ \text{arg}_2 \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_1 \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \boxed{1} \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & + \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_2 \end{bmatrix}$$

Figure 5: OBJ-agreeing candidate

$$\begin{bmatrix} \text{PRED} & \textit{`frighten} \langle \text{arg}_1\ \text{arg}_2 \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \boxed{1} \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_1 \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & + \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_2 \end{bmatrix}$$

Figure 6: SUBJ-agreeing candidate

The conclusion that we draw here is that direct agreement is subject agreement and inverse agreement is object agreement.

The data that we have analyzed so far are cases of what is called in typological studies as *mixed scenarios* (Jacques & Antonov, 2014), i.e. sentences in which one of the core GFs is an SAP and the other one is not (a 3rd person). However, in our current state of affairs, our set of contraints assumes that 1st and 2nd persons rank equally for purposes of agreement (notice the logical disjunction in the definition of AGRPERS). Languages vary with respect to which of the two SAP arguments triggers verbal agreement in *local scenarios* (i.e. sentences in which both core GFs are SAPs). In some languages, SUBJ is invariably chosen (Chirag Dargwa: Belyaev, 2013). In other languages, the 1st person is always chosen as the agreement trigger (Nocte: Thompson, 1994; Japhug Rgyalrong: Jacques, 2010; Wobzi Lavrung: Lai, 2015). In yet other languages, the second person is always chosen as the agreement trigger (many Algonquian languages; Khaling Kiranti: Jacques & Antonov, 2014; Zúñiga, 2006). Plains Cree, as an Algonquian language, belongs to this latter group.

An example like (10a) includes the suffix *-iti*, which is assumed to be the inverse suffix specialized for local scenarios (LINV).

(10) a. ki- se:kih -iti -n
2 *frighten* LINV 1/2
'I frighten you.SG'

b. ki- se:kih -i -n
2 *frighten* LDIR 1/2
'You.SG frighten me'

A case like (10a) has two candidates, one in which GF_{AGR} = SUBJ, and another one in which GF_{AGR} = OBJ. Both candidates satisfy AGRPERS because both core GFs are SAPs. In order to capture why (10a) is an inverse sentence, we need a constraint like AGRPERS2, as defined below, which ranks equally to AGRPERS as there is no way to independently determine their relative ranking.

(11) AGRPERS2:
$$\begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{PERS2} & + \end{bmatrix} \end{bmatrix}$$

Including AGRPERS2 into the picture allows us to analyze (10a) as an inverse sentence, i.e. GF_{AGR} = OBJ, as indicated in Tableau 1.

	AGRPERS	AGRPERS2
☞ GF_{AGR} = OBJ		
GF_{AGR} = SUBJ		*!

Tableau 1: Optimization for (10a)

Case (10b) is an instance of direct agreement, precisely because of the same reason. The candidate in which GF_{AGR} = SUBJ is chosen because the optimal candidate as the subject is the 2nd person.

The third possible scenario is the so-called *non-local scenario*, i.e. sentences in which both core GFs are 3rd persons. In Algonquian languages, 3rd persons are divided into two distinct forms: the proximate and obviative. In non-local scenarios only one of the arguments may be singled out as the proximate argument, which corresponds to the protagonist of the discourse. 3rd persons that are not the proximate are obviative. With respect to agreement, the proximate ranks higher than the obviative, so it is the former that always gets to be the agreement trigger.[2] The data in (12) illustrate these claims:

(12) a. se:kih -e: -w
3.*frighten* DIR 3
'He.PROX frightens him.OBV'

[2]However, there are cases in which the sentence has no proximate argument, as some modifiers (e.g. 3rd person possessives) require the NP to be obviative regardless of its discursive status; when this happens, the direct form is usually found. (Dahlstrom, 2014; Jacques & Antonov, 2014; Zúñiga, 2006, 2008). Dahlstrom (2014) states that sentences in which both GFs are obviative and take the inverse are possible, but are "very rare". Zúñiga (2006, 2008) only cites direct forms for sentences in which both GFs are obviative.

b. se:kih -ikw -w
3.*frighten* INV 3
'He.OBV frightens him.PROX'

In order to cover these cases, we need a new constraint that bars agreement with an AGR that is obviative *AGROBV. It also ranks equally to AGRPERS and AGRPERS2, as there is no way to independently determine their relative ranking.

(13) *AGROBV:

$$*\begin{bmatrix} \text{AGR} & \begin{bmatrix} \text{OBV} & + \end{bmatrix} \end{bmatrix}$$

The OBV feature is only available for 3rd persons. Therefore, *AGROBV is only relevant in non-local scenarios; SAP arguments, lacking the feature, trivially satisfy it.

For the direct case (14), the candidate f-structures are those shown in Figures 7 (GF_{AGR} = SUBJ) and 8 (GF_{AGR} = OBJ).

(14) se:kih -e: -w
3.*frighten* DIR 3.sg
'He.PROX frightens him.OBV'

$$\begin{bmatrix} \text{PRED} & \text{`}\textit{frighten}\ \langle\ \text{arg}_1\ \text{arg}_2\ \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \boxed{1}\begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{OBV} & - \end{bmatrix} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{OBV} & + \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Figure 7: SUBJ-agreeing candidate

$$\begin{bmatrix} \text{PRED} & \text{`}\textit{frighten}\ \langle\ \text{arg}_1\ \text{arg}_2\ \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{OBV} & - \end{bmatrix} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \boxed{1}\begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{OBV} & + \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Figure 8: OBJ-agreeing candidate

The optimization is shown in Tableau 2 below.

	AGRPERS	AGRPERS2	*AGROBV
☞ GF_{AGR} = SUBJ	*	*	
GF_{AGR} = OBJ	*	*	*!

Tableau 2: Optimization for (14)

As expected, the optimal candidate is the one in which GF_{AGR} is the proximate subject, as the sentence is a direct sentence. Both candidates violate AGRPERS and

AGRPERS2, as is expected in a non-local scenario where no SAPs are found. The object-agreeing candidate is discarded due to the violation of *AGROBV.

For the non-local inverse form (15), the candidates are given in Figures 9 and 10. The optimization chooses the candidate in which GF_{AGR} = OBJ candidate as the other candidate (GF_{AGR} = SUBJ) violates *AGROBV. Therefore, inverse agreement is satisfactorily predicted. Tableau 3 illustrates this.

(15) se:kih -ikw -w
3.*frighten* INV 3
'He.OBV frightens him.PROX'

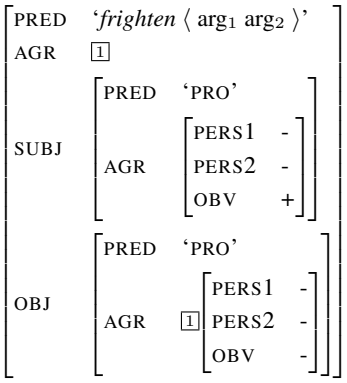

Figure 9: OBJ-agreeing candidate

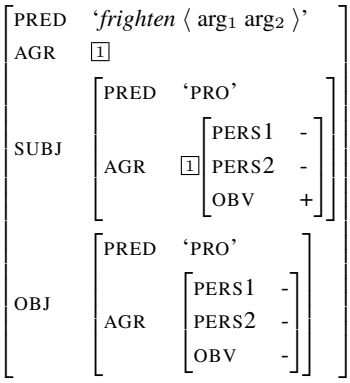

Figure 10: SUBJ-agreeing candidate

	AGRPERS	AGRPERS2	*AGROBV
☞ GF_{AGR} = OBJ	*	*	
GF_{AGR} = SUBJ	*	*	*!

Tableau 3: Optimization for (15)

In summary, we analyze direct agreement as subject agreement andinverse agreement as object agreement in Plains Cree. The correct form is determined by the OT constraints that we propose, so that the agreement trigger is always the SAP argument against any 3rd person argument, the 2nd person against any 1st person, and the proximate against the obviative among 3rd persons, regardless of the GFs involved.

4 The morphology of verbal agreement in Plains Cree

The syntactic analysis proposed in section 3 is not sufficient to give a complete picture of verbal agreement in Plains Cree. Otherwise, we would expect (16) to be

grammatical because its optimal f-structure is perfectly well-formed, as shown in Figure 11 (the candidate where GF_{AGR} = OBJ is discarded by AGRPERS).

(16) * ni- se:kih -a: -w
1 *frighten* DIR 3.sg
'We.EXCL/I frighten him'

$$\begin{bmatrix} \text{PRED} & \text{`}\textit{frighten}\ \langle\ \text{arg}_1\ \text{arg}_2\ \rangle\text{'} \\ \text{AGR} & \boxed{1} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \boxed{1}\begin{bmatrix} \text{PERS1} & + \\ \text{PERS2} & - \end{bmatrix} \end{bmatrix}_1 \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{AGR} & \begin{bmatrix} \text{PERS1} & - \\ \text{PERS2} & - \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}_2 \end{bmatrix}$$

Figure 11: Apparent f-structure of (16)

We would expect (16) to be grammatical, as *ni-* is a prefix expressing the 1st person singular or plural exclusive and *-w* a suffix expressing the 3rd person. The meaning of (16) should be the one provided above, given the presence of the direct suffix *-a:*.

The reason for the ungrammaticality of (16) is purely morphological. The distribution of inflectional affixes for TA verbs in Plains Cree can be described by reference to ordered lists—one for the person prefixes, another one for the direction suffixes, and another one for the person-number suffixes—according to which an affix is chosen from each list following a preference order. An affix higher in the list prevents the appearence of any that is lower. Figure 12 gives the person prefixes and person-number suffixes as ordered lists, based on Zúñiga (2008).[3]

PERSON PREFIXES	PERSON-NUMBER SUFFIXES
k(i)- '2nd sg./pl., 1st pl. incl.'	*-na:n* '1st pl. excl.'
n(i)- '1st sg, 1st pl. excl.'	*-naw* '1st pl. incl.'
	-wa:w '2nd pl.'
	-w '3rd sg.'
	-n '1st/2nd sg.'

Figure 12: Table based on Zúñiga (2008)

[3] As noted by a reviewer, the *o(t)-* 3rd person prefix that Zúñiga (2008) cites for sentences in the past tense is an archaic form that is no longer in use in normal speech. See the matrix verb form in (2) where both subject and object are 3rd person, and there is no prefix on the verb.

These facts are difficult to explain under a morpheme-based approach towards morphology, by which affixes are represented by lexical items akin to roots that provide syntactic information such as features of GFs. Under such an approach, *-w* would not just determine that "some GF is 3rd singular", but "one GF is 3rd singular and none is either 1st inclusive, 1st exclusive, or 2nd person plural". This complicates the lexical entries of each affix enormously.

We therefore adopt a realizational approach to inflectional morphology: inflectional affixes are the realization of syntactic features present in the word form, adapting the views of authors like Anderson (1992); Sells (2004); Spencer (2004); Stump (2001). As further developed in Alsina & Vigo (forthcoming), word forms are words understood as syntactic units (Spencer, 2013). Each word form includes, among other things, a phonological representation and a syntactic representation in the form of an f-structure (the word-level f-structure). Our morphological rules, which apply internally to the word form, check for the well-formed mapping of the word-level f-structure onto the phonological representation of the word form, potentially a morphologically complex form. Contrary to morpheme-based versions of LFG (Bresnan, 2001; Dalrymple, 2001; Falk, 2001), we assume that inflectional affixes do not have lexical entries akin to those of lexemes. This means that these affixes do not carry f-structure information. Instead, inflectional morphology is licensed on the basis of information at the word-level f-structure.

Unlike proposals like those by Dalrymple (2015); Sadler & Nordlinger (2004), we do not make use of m-features to represent morphological information.[4] M-features are necessary only for theory-internal reasons in order to constrain the set of available lexical entries (i.e. our word forms) for a given lexeme. These lexical entries contain, along with other information, a set of functional descriptions in the form of the functional annotations standard in LFG. A drawback of this approach is that the information encoded by m-features is mostly redundant with the information encoded by the f-descriptions: see, for instance, the correspondence between m-features and f-descriptions found in Dalrymple (2015, p. 79). This approach results in the positing of two intermediate steps in the mapping of a lexeme to its word form, namely the m-entry and the description function that maps the m-features onto a set of f-descriptions. Our approach, in contrast, allows us to dispense with these two intermediate steps, greatly simplifying the morphological component.

As a means to illustrate how our morphological rules look like and are used, let us briefly show how they can be used for explaining the formation of a regular English plural like *books*. The following rule adds the suffix *-s* to the base (represented as $\sqrt{}$) of any plural noun.

(17) For a nominal f-structure:
$$\left[\text{AGR} \quad \left[\text{NUM} \quad \text{PL}\right]\right] \rightarrow [_N \sqrt{}]\text{-}s$$

[4] Other realizational approaches to morphology are found in the computational literature, such as Butt et al. (1999); Karttunen (2003).

The lexeme BOOK, whose phonological representation is the base, corresponds to two word forms whose word-level f-structures are specified for the feature NUM. For the plural word form, the addition of the suffix *-s* is licensed. If the condition of rule (17) is not met (i.e. the noun is singular), no suffix is licensed. This renders a default rule or zero-morpheme unnecessary to predict the singular.

Morphological rules are checked in order within a block of rules from the first to the last, such that rule n is only applied if $n - 1$ cannot be applied. If a rule succesfully maps the features in the word-level f-structure to the phonological representation of the word form, evaluation of further rules stops at that point. Blocks of rules are independent to each other.

Let us now specify the rules for the inflectional affixes in Plains Cree, starting with the discussion of person prefixes. The rules that license them are listed below in (18). We assume that prefixes are licensed by the features of the top-level AGR.

(18) BLOCK P

i. $\left[\text{AGR} \quad \left[\text{PERS2} \quad +\right]\right] \rightarrow$ *ki-*$[_V \sqrt{\ }]$

ii. $\left[\text{AGR} \quad \left[\text{PERS1} \quad +\right]\right] \rightarrow$ *ni-*$[_V \sqrt{\ }]$

Rule (18i) licenses *ki-* whenever the verbal AGR is $\left[\text{PERS2} \quad +\right]$. Rule (18ii) licenses *ni-* whenever the verbal AGR is $\left[\text{PERS1} \quad +\right]$. In instances in which both rules are applicable (1st person inclusive), rule (18i) takes precedence over (18ii), *ki-* is licensed. There is no rule for 3rd person, i.e. no prefix is licensed.

In addition to the person-number affixes, Plains Cree has a set of direction suffixes which indicate whether the verb is direct or inverse. Their distribution is as follows:

(19) *Local suffixes (Both arguments are SAPs):*

a. DIRECT: 1st pers. object: *-i*

b. INVERSE: 1st pers. subject: *-iti*

(20) *Non-local and mixed suffixes:*

a. DIRECT: SAP subject, 3rd pers. object: *-a:* (mixed scenarios)

b. DIRECT: 3rd pers. obv. object: *-e:* (non-local scenarios)

c. INVERSE: 3rd pers. subject, 3rd pers. proximate or SAP object: *-ikw/iko* (common to mixed and non-local scenarios)

Block (21) provides the morphological rules for the set of direction suffixes.

(21) BLOCK DRCTN

i. $\text{GF}_{\text{AGR}} = \text{SUBJ}, \left[\text{OBJ} \quad \left[\text{AGR} \quad \begin{bmatrix}\text{PERS1} & + \\ \text{PERS2} & -\end{bmatrix}\right]\right] \rightarrow [_V \sqrt{}]$*-i*

ii. $\text{GF}_{\text{AGR}} = \text{OBJ}, \left[\text{SUBJ} \left[\text{AGR} \begin{bmatrix}\text{PERS1} & + \\ \text{PERS2} & -\end{bmatrix}\right]\right] \rightarrow [_V \sqrt{}]$-*iti*

iii. $\text{GF}_{\text{AGR}} = \text{SUBJ}, \left[\text{SUBJ} \left[\text{AGR} \left[\text{PERS1} \quad +\right] \vee \left[\text{PERS2} \quad +\right]\right]\right] \rightarrow [_V \sqrt{}]$-*a:*

iv. $\text{GF}_{\text{AGR}} = \text{SUBJ} \rightarrow [_V \sqrt{}]$-*e:*

v. $\text{GF}_{\text{AGR}} = \text{OBJ} \rightarrow [_V \sqrt{}]$-*ikw*/-*iko*

This theory states that direct morphology is nothing but affixes that spell out that GF_{AGR} = SUBJ. Conversely, the affixes that spell out GF_{AGR} = OBJ constitute inverse morphology in this theory.

The rules for the local direct and local inverse suffixes rank at the top of the block, namely (21i) and (21ii), respectively. These rules check whether the AGR unifies with the AGR of SUBJ (direct agreement) or of OBJ (inverse agreement). In the case of (21i), if the sentence is indeed a case of direct agreement, then the only way that the second condition (the object being a 1st plural exclusive) is met if the subject is 2nd person. The same mechanism, but switched around, is used in (21ii): if the sentence is a case of inverse agreement, then the only way the subject may be a 1st plural exclusive is for the object to be a 2nd person. If none of the rules for local scenarios can be applied, then (21iii) checks whether there is direct agreement and whether the subject is an SAP; as the local scenarios have already been discarded, the object cannot be an SAP, so this rule is applied only for mixed scenarios. Rule (21iv) covers the only other direct agreement case left, i.e. direct non-local scenarios. Finally, (21v) covers both mixed and non-local scenarios, which are the only cases left uncovered by all other higher ranking rules in the block.

The third and last block of rules considered here corresponds to the person-number suffixes. These rules are stated as follows; CGF is just a shorthand notation for any "core GF", i.e. SUBJ and OBJ. X represents the phonological representation of the direction suffix.

(22) BLOCK PN

i. $\left[\text{CGF} \left[\text{AGR} \begin{bmatrix}\text{PERS1} & + \\ \text{PERS2} & - \\ \text{NUM} & \text{PL}\end{bmatrix}\right]\right] \rightarrow [_V \sqrt{}][\text{X}]$-*na:n*

ii. $\left[\text{CGF} \left[\text{AGR} \begin{bmatrix}\text{PERS1} & + \\ \text{PERS2} & + \\ \text{NUM} & \text{PL}\end{bmatrix}\right]\right] \rightarrow [_V \sqrt{}][\text{X}]$-*naw*

iii. $\left[\text{CGF} \left[\text{AGR} \begin{bmatrix}\text{PERS2} & + \\ \text{NUM} & \text{PL}\end{bmatrix}\right]\right] \rightarrow [_V \sqrt{}][\text{X}]$-*wa:w*

iv. $\left[\text{CGF} \quad \left[\text{AGR} \quad \begin{bmatrix}\text{PERS1} & -\\ \text{PERS2} & -\end{bmatrix}\right]\right] \rightarrow [_V \surd][\text{X}]\text{-}w$

v. $[\,] \rightarrow [_V \surd][\text{X}]\text{-}n$

The elsewhere condition implies that the suffix *-n* is used when both subject and object are 1st and 2nd person singular.

In what follows, we illustrate how these rules apply to the morphology of a word like (23), whose word-level f-structure of which is shown in Figure 13.

(23) ni- se:kih -a: -na:n
1 *frighten* DIR 1.pl.excl
'We.EXCL frighten him'

$$\begin{bmatrix}\text{AGR} & \boxed{1} & & \\ \text{SUBJ} & \left[\text{AGR} \quad \boxed{1}\begin{bmatrix}\text{PERS1} & +\\ \text{PERS2} & -\\ \text{NUM} & \text{PL}\end{bmatrix}\right]_1 & & \\ \text{OBJ} & \left[\text{AGR} \quad \begin{bmatrix}\text{PERS1} & -\\ \text{PERS2} & -\\ \text{NUM} & \text{SG}\end{bmatrix}\right]_2 & & \end{bmatrix}$$

Figure 13: Word-level f-structure of (23)

The morphological rules check the information at the word-level f-structure in Figure 13. For the person prefix, the evaluation of rules is as follows:

(24) a. $\left[\text{AGR} \quad \left[\text{PERS2} \quad +\right]\right] \rightarrow ki\text{-}[_V \surd]$ NOT SATISFIED

b. $\left[\text{AGR} \quad \left[\text{PERS1} \quad +\right]\right] \rightarrow ni\text{-}[_V \surd]$ SATISFIED

(25) RESULT FOR BLOCK P: *ni-*

(24a) is not satisfied because the AGR of the verbal f-structure does not have the feature $\left[\text{PERS2} \quad +\right]$. (24b) is satisfied because the AGR of the verbal f-structure has the features $\left[\text{PERS1} \quad +\right]$. Evaluation stops here and *ni-* is licensed as the person prefix.

The direction suffix is determined as follows:

(26) a. $\text{GF}_{\text{AGR}} = \text{SUBJ}, \left[\text{OBJ} \quad \left[\text{AGR} \quad \begin{bmatrix}\text{PERS1} & +\\ \text{PERS2} & -\end{bmatrix}\right]\right] \rightarrow [_V \surd]\text{-}i$ NOT SATISFIED

b. $\text{GF}_{\text{AGR}} = \text{OBJ}, \left[\text{SUBJ} \left[\text{AGR} \begin{bmatrix}\text{PERS1} & + \\ \text{PERS2} & -\end{bmatrix}\right]\right] \rightarrow [_V \surd]$-*iti* NOT SATISFIED

c. $\text{GF}_{\text{AGR}} = \text{SUBJ}, \left[\text{SUBJ} \left[\text{AGR} \left[\text{PERS1} \quad +\right] \vee \left[\text{PERS2} \quad +\right]\right]\right] \rightarrow [_V \surd]$-*a:* SATISFIED

(27) RESULT FOR BLOCK DRTCN: *-a:*

The first rule (26a) is not satisfied because the second condition (that the object be 1st person) is not met by the f-structure. (26b) is not either because the first condition (GF_{AGR} = OBJ) is not met. (26c) is met by the word-level f-structure: there is subject agreement and the subject is an SAP. Evaluation stops here and *-a:* is licensed as the direction suffix.

Finally, for the person-number suffix the very first rule in the block is satisfied, as there is a core GF that is 1st person plural exclusive, namely SUBJ. No further rules are evaluated.

(28) $\left[\text{CGF} \left[\text{AGR} \begin{bmatrix}\text{PERS1} & + \\ \text{PERS2} & - \\ \text{NUM} & \text{PL}\end{bmatrix}\right]\right] \rightarrow [_V \surd]$[X]-*na:n* SATISFIED

(29) RESULT FOR BLOCK PN: *-na:n*

In summary, the three results are *ni-*, *-a:*, and *-na:n*, thus correctly predicting the morphology of (23) (repeated below as (30)):

(30) ni- se:kih -a: -na:n
1 *frighten* DIR 1.pl.excl
'We.EXCL frighten him'

Finally, a word must be said about the existence of other affixes (mainly suffixes) that have not been taken into consideration in this discussion. These have been ignored because they are not involved in the distribution of the agreement affixes. Three of them are the so-called *strong direct* suffix *-im* and the *strong inverse* suffixes *-wa:* and *-iyi* (Dahlstrom, 2014; Haude & Zúñiga, 2016; Zúñiga, 2006). Another affix we have not discussed is the 3rd person plural suffix *-ak*, which is always added after the person-number suffix if any GF is 3rd person plural; its analysis would only require adding a fourth block of affixes consisting in only one rule that checks for those features to license *-ak*.

5 Conclusions

Our conclusions can be classified in two major groups: those referring to syntactic issues and those referring to morphological issues.

Regarding syntax, the most important conclusion is that by means of assuming an AGR-based theory of agreement and a set of OT constraints, we provide a way

for languages to be grouped into two basic types with respect to agreement: case-governed agreement systems and person-governed agreement systems. The former have a high-ranking constraint barring agreement in a non-default case, whereas the latter have a high-ranking constraint that must be satisfied by some set of prominent person and other referential features.

Plains Cree belongs to the group of languages with a person-governed agreement system. Instances of direct and inverse agreement are explained as particular instances of subject agreement and object agreement, respectively, under a person-governed agreement system.

Regarding morphology, we show the need for an approach towards inflectional morphology in which affixes are just the realization of information present in the word-level f-structure. In this framework, morphological rules place the phonology of word forms in correspondence their word-level f-structures, thus requiring us to accept that word forms include f-structures as part of their representation.

This approach is shown to allow for a simple analysis of direct and inverse morphology in a language like Plains Cree, in which direct morphology spells out word-level f-structures in which GF_{AGR} = SUBJ and inverse morphology, word-level f-structures in which GF_{AGR} = OBJ. By means of ordered morphological rules we are able to provide for an analysis of person prefixes and person-number suffixes in Plains Cree, as well, thus explaining why some forms are ungrammatical only due to morphological issues despite having a well-formed f-structure.

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A Modular Approach to Evidentiality

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Abstract

Evidentiality is a well-established morphosyntactic category that has also received a lot of attention in the semantics literature over the last 15+ years. However, it has received scant attention in Lexical-Functional Grammar, despite the fact that LFG's modular Correspondence Architecture is particularly well-suited to illuminating the phenomenon. In particular, the theory makes possible an account of evidentiality that does not merely conflate the semantic category of evidentiality with its morphosyntactic realization, but which also does not create false equivalences between languages that mark evidentiality morphosyntactically and those that do not. In other words, it enables an account in which we can differentiate languages that morphosyntactically mark evidentiality from those that do not. Yet at the same time it also allows us to capture semantic commonalities between morphosyntactically marked evidentials and expression of evidentiality in languages, like English, that do demonstrate semantic evidentiality, but which do not have a dedicated morphosyntactic paradigm of *evidentials*. In this paper, we will first consider languages with obligatory, fully grammaticalized evidentiality. We then turn to English as an example of a languages that has the means to express evidentiality, but without fully grammaticalized or obligatory marking.

1 Introduction

Evidentiality is by now a well-established morphosyntactic category (Aikhenvald, 2004; Faller, 2002, 2012; Garrett, 2002; Murray, 2010; Matthewson & Glougie, In Press), with the earliest attestation often attributed to Boas (1911). Sample definitions include:

(1) Evidentials are devices used by speakers to mark the source and reliability of their knowledge. (Chafe & Nichols, 1986)

(2) Evidentiality is a linguistic category whose primary meaning is source of information. (Aikhenvald, 2004)

(3) Evidentials are expressions which indicate a speaker's source of justification for the speech act being made. (McCready, 2015)

Languages such as Tariana (Aikhenvald, 2003, 2004), Cherokee (Aikhenvald, 2004), Cheyenne (Murray, 2010, 2017), Quechua (Faller, 2002), and Tuyuca (Barnes, 1984) have fully grammaticalized evidentiality marking: Regular declarative statements carry mandatory morphological marking that indicates the type of information source upon which the statement is based.

Not all languages have such mandatory, morphological evidentiality marking. However, all languages have some means of marking sources of evidence

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or certainty about evidence, some examples from English being *apparently*, *someone told me that...*, *I saw that...*. In this paper, we try to develop an analysis that captures the commonalities between different types of evidentiality marking, while maintaining the important distinction between grammaticalized and non-grammaticalized evidentiality.

We first turn to a simple analysis of grammaticalized evidentiality, in general, and present sample analyses of grammaticalized evidentiality in Tariana and Cherokee, in particular. We then turn to non-grammaticalized evidentiality, with a focus on certain English verbs and some empirical studies that we and our collaborators have done on them. We lastly present a sample analysis of non-grammaticalized evidentiality in English.

2 Grammaticalized evidentiality

Many languages — about a quarter of the world's languages, according to Aikhenvald (2004) — overtly mark every statement for the type of evidence that the statement is based on. This type of obligatory evidentiality is typically marked with overt morphology and we call it *grammaticalized evidentiality*.

The Northwest Amazonian language Tariana, described in Aikhenvald (2003), is an example of a language with complex grammaticalized evidentiality marking. The Tariana evidentiality marking is illustrated by the following examples (from Aikhenvald 2003):

(4) tʃinu niwahã-**ka** dina
dog bit-VISUAL him
'The dog bit him (we have seen it).'

(5) tʃinu niwahã-**mahka** dina
dog bit-NON.VIS.SENSORY him
'The dog bit him (we have heard the noise).'

(6) tʃinu niwahã-**sika** dina
dog bit-INFERENCE him
'The dog bit him (he has a scar and I can make an inference).'

(7) tʃinu niwahã-**pidaka** dina
dog bit-REPORTED him
'The dog bit him (someone told me).'

The evidential morphemes in (4–7) mark direct visual evidence (*-ka*), direct non-visual evidence (*-mahka*), inferred evidence (*-sika*), and reported evidence (*-pidaka*).[1]

Cherokee (Aikhenvald, 2004) displays a different evidentiality system, which makes fewer distinctions than Tariana and simply distinguishes between firsthand evidence (*-ʌʔi*) and non-firsthand evidence (*-eʔi*):

[1]Tariana actually has two inferential evidentials, which Aikhenvald (2004) calls the *inferred* evidential (*-nihka*) and the *assumed* evidential (*-sika*). These two evidentials only occur in past tense and we believe they can be distinguished with the VISUAL feature (following suggestions by Aikhenvald on the distinct nature of the inferences involved), but we do not try to further distinguish them here.

(8) a. wesa u-tlis-**ʌʔi**
cat it-run-1ST.H.PAST
'A cat ran (I saw it running.)'

b. uyo ges-**ʌʔi**
spoiled be-1ST.H.PAST
'It was spoiled (I smelled it)'

(9) a. u-wonis-**eʔi**
he-speak-NON.1ST.H.PAST
'He spoke (someone told me)'

b. u-gahnan-**eʔi**
it-rain-NON.1ST.H.PAST
'It rained (I woke up, looked out and saw puddles of water)'

In languages such as Cherokee and Tariana, evidentiality is grammaticalized: It is an obligatory morphosyntactic category, on a par with tense and aspect. We propose that grammaticalized evidentiality is encoded at f-structure as well as at semantic structure. We discuss evidentiality at f-structure in section 2.1 and evidentiality at semantic structure in 2.2.

2.1 Evidentiality at f-structure

An f-structural analysis of grammaticalized evidentiality is motivated by cross-linguistic evidence that evidentiality is an active morphosyntactic feature that interacts with other syntactic features at f-structure. Aikhenvald (2004, Chapter 4) provides a thorough overview of how evidentiality interrelates with other morphosyntactic categories. In Takelma, for example, evidentiality is one of six tense/mood markers, and it is mutually exclusive with other tenses (Aikhenvald, 2014, 241). Also, in both Qiang (LaPolla, 2003; Aikhenvald, 2004) and Cheyenne (Murray, 2017, 34–38), the use of evidentials is restricted in subordinate clauses. The Qiang and Cheyenne facts motivate functional equations such as $\neg(\uparrow \text{CF EVIDENTIAL})$, where CF is a place holder for the grammatical function of the relative/conditional/dependent clause and EVIDENTIAL is a bundling feature that hosts evidential features (more details below).

Aikhenvald (2004, Chapter 2) provides a typological summary of grammaticalized evidentiality. Based on this summary, we propose that evidential languages make use of (a subset of) the following grammatical evidentiality f-structure features: [DIRECT $\pm$], [VISUAL $\pm$], [REPORTED $\pm$]. These three binary features go a long way towards capturing evidentiality marking cross-linguistically, although more features may prove necessary in order to cover the full typology. For example, some languages might call for a grammatical AUDITORY feature, which would then have to be added to our system. Further potential additional candidates are QUOTATIVE and SENSORY features. Nevertheless, grammaticalized evidentiality is quite restricted.

We will use the examples from Tariana (4–7) and Cherokee (8–9) above to illustrate how the features of our simple feature system combine to reflect different evidenitality markers.

The f-structural features of Tariana evidentiality morphology are given in (10):

(10)

1.	Visual evidence	*-ka*	[DIRECT +] [VISUAL +]
2.	Non-visual sensory evidence	*-mahka*	[DIRECT +] [VISUAL −]
3.	Reportative evidence	*-pidaka*	[DIRECT −] [REPORTED +]
4.	Inferred evidence	*-sika*	[DIRECT −] [REPORTED −]

The Tariana morphemes *-ka* and *-mahka* both indicate that the speaker has directly experienced the event expressed by the statement. The difference is that *-ka* indicates that the event was seen, and *-mahka* indicates that the event was not seen but instead directly experienced with one of the other senses (perhaps it was heard). The morpheme *-pidaka* and *-sika* are both used when the speaker has not directly experienced what the sentence expresses. *-pidaka* is used to convey something learned through a report, whereas *-sika* indicates that the information was inferred from some indirect evidence that was not reported.

The f-structural features of Cherokee evidentiality morphology are as follows:

(11)

1.	Firsthand evidence	*ʌʔi*	[DIRECT +]
2.	Non-firsthand evidence	*eʔi*	[DIRECT −]

The bipartite system of Cherokee distinguishes between what has and what has not been experienced firsthand. A positively valued [DIRECT] feature specifically indicates firsthand experience, and a negatively valued [DIRECT] features indicates non-firsthand experience.

The Tariana and Cherokee f-structural evidentiality features given in (10–11) serve to illustrate how our simple feature system can be used to model grammaticalized evidentiality cross-linguistically. Languages of course have the means to express much more nuanced details about information sources than our simple feature system conveys. This is done by means other than grammaticalized morphology and is modelled in the lexical entries and semantics (see sections 2.3 and 2.4), not with syntactic features in the f-structure. We next turn to the semantic content of these features.

2.2 Evidentiality at semantic structure

The evidentiality features in section 2.1 also express semantic content. We capture this content as modifiers on events in Glue Semantics (Dalrymple, 1999, 2001; Asudeh, 2012; Asudeh & Toivonen, 2012; Lowe, 2015). We introduce two new semantic structure features, EVIDENCE and EVIDENCE-HOLDER. The feature EVIDENCE is a secondary event variable that allows us to capture a relationship between the matrix event and another event that forms the evidentiary basis for the claims about the matrix event. EVIDENCE-HOLDER is a term from Murray (2017) that encodes the individual who bears a relationship to the evidential proposition (e.g., the person who witnessed the matrix event). Following Murray (2017), it is a kind of impure indexical[2] that normally defaults to the speaker. We define the semantics of the features [DIRECT ±], [VISUAL ±], and [REPORTED ±] as follows. Note that according to our proposal, the feature DIRECT is a kind of primary

[2]It is an 'impure' indexical because it flips interpretation in interrogatives, unlike pure indexicals.

feature that contributes a second meaning constructor that existentially closes off the secondary EVIDENCE event variable, while also allowing the features VISUAL and REPORTED to modify the information source event.[3]

(12) a. **[DIRECT +]**
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \leq \text{WITNESS}(e)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

$\lambda P \lambda e \exists e'.P(e)(e')$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

b. **[DIRECT −]**
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \not\leq \text{WITNESS}(e)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

$\lambda P \lambda e \exists e'.P(e)(e')$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

(13) a. **[VISUAL +]**
$\lambda \mathcal{P} \lambda i \lambda e \lambda e'.\mathcal{P}(i)(e)(e') \wedge see(e') \wedge i \leq \text{EXPERIENCER}(e')$
$[(\uparrow_\sigma \text{EVIDENCE-HOLDER} \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

b. **[VISUAL −]**
$\lambda \mathcal{P} \lambda i \lambda e \lambda e'.\mathcal{P}(i)(e)(e') \wedge \neg see(e') \wedge i \leq \text{EXPERIENCER}(e')$
$[(\uparrow_\sigma \text{EVIDENCE-HOLDER} \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

(14) a. **[REPORTED +]**
$\lambda \mathcal{P} \lambda i \lambda e \lambda e'.\mathcal{P}(i)(e)(e') \wedge report(e') \wedge i \leq \text{EXPERIENCER}(e')$
$[(\uparrow_\sigma \text{EVIDENCE-HOLDER} \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

b. **[REPORTED −]**
$\lambda \mathcal{P} \lambda i \lambda e \lambda e'.\mathcal{P}(i)(e)(e') \wedge \neg report(e') \wedge i \leq \text{EXPERIENCER}(e')$
$[(\uparrow_\sigma \text{EVIDENCE-HOLDER} \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

We use the operator $\leq$ to capture membership in a plurality (see, e.g., Link, 1983); i.e., the term $i \leq \text{WITNESS}(e)$ indicates that i is among the witnesses of event e.

We define the predicate on events WITNESS as follows:

(15) $\forall x \forall e.x \leq \text{WITNESS}(e) \leftrightarrow \exists e'.[x \leq \text{EXPERIENCER}(e') \wedge \text{STIMULUS}(e') = e]$

[3] As discussed in detail by Murray (2017), the evidential claim is actually a kind of conventional implicature, in the sense of Potts (2005), since it cannot be directly denied or challenged. We leave this detail aside here and note that it could easily be captured in an LFG setting using either the technique of Arnold & Sadler (2010) or that of Giorgolo & Asudeh (2011).

The EVIDENCE-HOLDER (normally the speaker) thus fails to be a witness under one of two conditions: Either there is no secondary event such that the event under consideration is the STIMULUS of that event (i.e., the event under consideration was not witnessed) or there is such a secondary event, but the evidence holder did not experience it themself (i.e., the evidence holder was not a witness, even if others were).

We next apply these semantic definitions of the features to sample analyses of Tariana and Cherokee. In what follows we capture the requirement that clauses must generally be marked for evidentiality in Tariana and Cherokee introducing a predicate $evidence$ in the meaning language terms for roots such that $evidence(e', e)$ is true iff event e' is evidence for the occurrence of event e.

2.3 Grammaticalized Evidentiality: Tariana[4]

2.3.1 Lexicon

(16) *niwahã-*

$(\uparrow \text{PRED}) = \text{'bite'}$
$(\uparrow \text{EVIDENTIAL})$
$\lambda y \lambda x \lambda e \lambda e'.bite(e) \wedge \text{AGENT}(e) = x \wedge \text{PATIENT}(e) = y \wedge evidence(e', e) :$
$(\uparrow_\sigma \text{ARG2}) \multimap (\uparrow_\sigma \text{ARG1}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
($speaker : (\uparrow_\sigma \text{EVIDENCE-HOLDER})$)

(17) *-ka*

$(\uparrow \text{EVIDENTIAL DIRECT}) = +$
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \leq \text{WITNESS}(e) :$
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$\lambda P \lambda e \exists e'.P(e)(e') :$
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$
$(\uparrow \text{EVIDENTIAL VISUAL}) = +$
$\lambda \mathcal{P} \lambda i \lambda e \lambda e'.\mathcal{P}(i)(e)(e') \wedge see(e') \wedge i \leq \text{EXPERIENCER}(e')$
$[(\uparrow_\sigma \text{EVIDENCE-HOLDER} \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

(18) *-mahka*

$(\uparrow \text{EVIDENTIAL DIRECT}) = +$
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \leq \text{WITNESS}(e) :$
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$\lambda P \lambda e \exists e'.P(e)(e') :$
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$
$(\uparrow \text{EVIDENTIAL VISUAL}) = -$
$\lambda \mathcal{P} \lambda i \lambda e \lambda e'.\mathcal{P}(i)(e)(e') \wedge \neg see(e') \wedge i \leq \text{EXPERIENCER}(e')$
$[(\uparrow_\sigma \text{EVIDENCE-HOLDER} \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

[4]We assume throughout that something like the theory of argument structure of Asudeh & Giorgolo (2012) and the mapping theory of Findlay (2016) and Asudeh et al. (2014) are operating in the background, such that we have a connected semantic structure and such that Glue meaning constructors make reference to arguments in semantic structure that are mapped from grammatical functions in f-structure. Nothing crucial hinges on this.

(19) *-pidaka*

$(\uparrow \text{EVIDENTIAL DIRECT}) = -$
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \not\leq \text{WITNESS}(e)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

$\lambda P \lambda e \exists e'.P(e)(e')$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

$(\uparrow \text{EVIDENTIAL REPORTED}) = +$
$\lambda \mathcal{P} \lambda i \lambda e \lambda e'.\mathcal{P}(i)(e)(e') \wedge \mathit{report}(e') \wedge i \leq \text{EXPERIENCER}(e')$
$[(\uparrow_\sigma \text{EVIDENCE-HOLDER} \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

(20) *-sika*

$(\uparrow \text{EVIDENTIAL DIRECT}) = -$
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \not\leq \text{WITNESS}(e)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

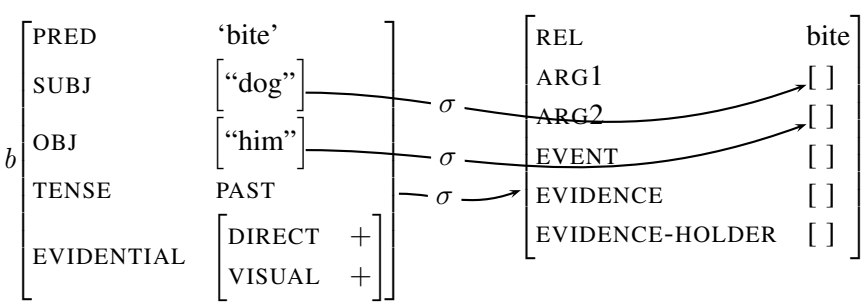
$\lambda P \lambda e \exists e'.P(e)(e')$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

$(\uparrow \text{EVIDENTIAL REPORTED}) = -$
$\lambda \mathcal{P} \lambda i \lambda e \lambda e'.\mathcal{P}(i)(e)(e') \wedge \neg \mathit{report}(e') \wedge i \leq \text{EXPERIENCER}(e')$
$[(\uparrow_\sigma \text{EVIDENCE-HOLDER} \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$

2.3.2 F-structure and semantic structure

(21) tʃinu niwahãka dina
'The dog bit him (we have seen it).'

(22)



2.3.3 Glue proof (conclusion)[5]

(23)
$$\frac{\vdots}{\exists e \exists e'.\mathit{bite}(e) \wedge \text{AGENT}(e) = \mathit{dog} \wedge \text{PATIENT}(e) = \mathsf{antecedent}(\overline{x}) \wedge \mathit{evidence}(e', e) \wedge \mathit{speaker} \leq \text{WITNESS}(e) \wedge \mathit{see}(e') \wedge \mathit{speaker} \leq \text{EXPERIENCER}(e') : b_\sigma}$$

[5]The term $\mathsf{antecedent}(\overline{x})$ stands for whatever mechanism resolves anaphoric reference, whether it is the simple direct variable binding of Dalrymple (2001) and Asudeh (2004, 2012) or the much more sophisticated PCDRT approach of Haug (2014), as adapted to an LFG setting by Haug et al. (2017), or something else.

Note that, as a result of the meaning postulate that defines WITNESS in (15) above, there will be a further entailment that the STIMULUS of the seeing event is the biting event.

2.4 Grammaticalized Evidentiality: Cherokee

2.4.1 Lexicon

(24) *-gahnan-* $(\uparrow \text{PRED}) = \text{`rain'}$
$\lambda e \lambda e'.rain(e) \wedge evidence(e', e)$:
$(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$(\ speaker : (\uparrow_\sigma \text{EVIDENCE-HOLDER})\ )$

(25) *-ʌʔi* $(\uparrow \text{DIRECT}) = +$
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \leq \text{WITNESS}(e)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$\lambda P \lambda e \exists e'.P(e)(e')$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

(26) *-eʔi* $(\uparrow \text{DIRECT}) = -$
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \not\leq \text{WITNESS}(e)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$\lambda P \lambda e \exists e'.P(e)(e')$:
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

2.4.2 F-structure and semantic structure

(27) ugahnaneʔi
'It rained (I woke up, looked out and saw puddles of water)'

(28)
$$r\begin{bmatrix} \text{PRED} & \text{`rain'} \\ \text{SUBJ} & \begin{bmatrix} \text{PERS} & 3 \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{TENSE} & \text{PAST} \\ \text{EVIDENTIAL} & \begin{bmatrix} \text{DIRECT} & - \end{bmatrix} \end{bmatrix} \xrightarrow{\sigma} \begin{bmatrix} \text{REL} & \text{rain} \\ \text{EVENT} & [\ ] \\ \text{EVIDENCE} & [\ ] \\ \text{EVIDENCE-HOLDER} & [\ ] \end{bmatrix}$$

2.4.3 Glue proof (conclusion)

(29)
$$\frac{\vdots}{\exists e \exists e'.rain(e) \wedge evidence(e', e) \wedge i \not\leq \text{WITNESS}(e) : r_\sigma}$$

3 Non-grammaticalized evidentiality

We have so far focused on grammaticalized evidentiality. However, evidential codings are not necessarily part of grammaticalized morphosyntax; evidential and non-evidential languages alike have at their disposal a variety of ways to express sources of information. Speakers mark sources through the use of phrases such as *I heard that...* and *According to Karim...*, and also adverbs such as *reportedly* and *seemingly*. Languages with grammaticalized evidentiality can use lexical means in addition to their morphosyntactic evidentials. Languages without grammaticalized evidentiality express evidentiality lexically, often in subtle and sophisticated ways (see, e.g., Patrick & Van Bogaert 2007; Faller 2017). Non-grammaticalized evidentiality partially overlaps with grammaticalized evidentiality, and it is not always obvious whether a marker is grammaticalized or not (see, e.g., Van Bogaert & Leuschner 2015 and the papers in Diewald & Smirnova 2010). We capture the commonalities between different types of evidentiality at semantic structure and with Glue proofs. English does not have true grammaticalized evidentiality as defined by Aikhenvald (2004). However, we will discuss English copy-raising and perceptual resemblance verbs as an example of non-grammaticalized evidentiality.

3.1 English copy-raising and perceptual resemblance verbs

This section concerns English copy-raising verbs (*seem, appear*) and perceptual resemblance verbs (*look, sound, smell, taste, feel*). The copy-raising verbs and perceptual resemblance verbs share a common alternation where one alternant has the structure in (30) and the other the structure in (31):

(30) Non-expletive subject + verb + like/as if/as though + finite clause containing a pronominal copy of the matrix subject
Example: *Jenny looks like she has been playing football.*

(31) Expletive subject + verb + like/as if/as though + finite clause
Example: *It looks like Jenny has been playing football.*

The verbs *seem, appear, look,* etc. also have other uses, but we limit our discussion to the uses in (30–31) here.[6] Copy-raising verbs differ from perceptual resemblance verbs in that perceptual resemblance verbs refer to specific senses, whereas copy raising verbs are more general. Also, copy raising verbs demand a pronominal copy in the subordinate clause but perceptual resemblance verbs do not (Asudeh & Toivonen, 2007, 2012; Asudeh, 2012). These distinctions are not important to the points made in this paper.

Copy-raised/non-expletive subjects (the main subject of examples of the type in (30)) are interpreted as the perceptual source (PSOURCE) of evidence for the proposition denoted by the subordinate clause (Rogers, 1972; Asudeh & Toivonen, 2007, 2012).[7] Example (32) indicates that the evidence that Sarah is tired comes from Sarah herself. This is not necessarily true for example (33), where the fact

[6] For a recent thorough overview of perception verbs, see Poortvliet (2017).

[7] This seems similar to what Murray (2017) calls the *evidential base*.

that Sarah is tired could be inferred from some other source of evidence than Sarah herself. For example, perhaps a messy living room could be evidence that Sarah is tired.

(32) Sarah looks like she's tired.

(33) It looks like Sarah is tired.

This subject-as-perceptual-source generalization led Asudeh & Toivonen (2012), Rett & Hyams (2014), and Chapman et al. (2015a,b) to suggest that copy raising encodes *direct evidentiality*, but we will argue below that these verbs in fact encode *indirect* evidentiality. However, why think that these verbs encode evidentiality at all? How much do copy-raising and perceptual resemblance verbs (we'll refer to the full class of verbs as PSOURCE verbs here) have in common with what is traditionally called evidentiality marking?

Chafe (1986) characterizes evidentiality as follows: "'Evidentiality' can be used broadly to cover any linguistic expression of attitudes toward kowledge." The PSOURCE verbs convey that the evidence for the suboridinate clause is indirect (as will be discussed), and they also say something about the type of evidence – visual (*look*), aural (*sound*), unspecified (*seem*), etc. According to Chafe's definition, and also the definitions of evidentiality given in the introduction, these verbs would be classified as evidentiality marking elements. However, according to stricter definitions, PSOURCE verbs would not be considered evidentiality markers. As noted above, Aikhenvald (2004, Chapter 1) restricts linguistic evidentiality to obligatory marking, and PSOURCE verbs are of course never obligatorily used. Furthermore, Anderson (1986) posits that evidentials are not themselves the main predication of the clause; instead, they are an additional specification added to a statement. PSOURCE verbs would then not be evidential markers, as they can stand as main predicates.

In what follows, we assume that PSOURCE verbs mark evidentiality broadly construed, but they are not grammaticalized, morphosyntactic, mandatory evidentials such as those found in Tariana and Cherokee. The evidential contributions of PSOURCE verbs are seen in the lexicon and at semantic structure, not at f-structure. We argue below that copy raising and perceptual resemblance actually mark *indirect*, not direct evidentiality.

3.2 The evidentiality of perceptual resemblance verbs

The indirect evidentiality of verbs such as *seem like*, *look like*, etc., becomes apparent when they are contrasted with other verbs. Compare (34) to (35–36), for example:

(34) Sara saw Margaret laugh.

(35) It looked to Sara like Margaret laughed.

(36) Margaret looked to Sara like she laughed.

Examples (34–36) all convey that Sara has visual evidence that indicates that Margaret laughed. In example (34), Sara directly saw the event of Margaret laughing. Sara has *direct* evidence that Margaret laughed. In (35–36), Sara saw something

which led her to infer that Margaret laughed. Sara has *indirect* evidence that Margaret laughed. It is possible to continue (35–36) with *...but Margaret was in fact not laughing.* This is contradictory in the context of (34), as expected, since (34) indicates that there was direct evidence that Margaret laughed. It is not possible to see Margaret laugh if she is not laughing (barring unusual situations such as hallucinations), but it is possible that it might look (from afar, perhaps) like Margaret is laughing, although she is in fact not laughing. The verbs *see* and *look like* thus encode visual and direct/indirect information, characteristics that are familiar from the literature on evidentiality. Similarly, *hear* and *sound like* both encode aural information, but they differ in that *sound like* signals indirect information whereas *hear* signals direct information when it is used in example like *I heard Carmela praise Sue*. When *see* and *hear* are used with a *that*-complement (e.g., *I heard that Carmela praised Sue*), the evidence for the information in the complement can be either direct or indirect.

Example (36) further specifies that the visual indirect evidence that Margaret laughed came from Margaret. This kind of identification of the *specific* source of evidence is not common for true evidentials (Doran, 2015), but it does seem to occur sometimes. In Maaka, for example, evidential markers can be attached to NPs, and the implication is that there is evidence from the NP that hosts the morpheme (Storch & Coly, 2014):

(37) làa nàmáa-**dìyà** sáy mìnè-póDí-ní gè-gòrkù-wà
child this-JOINT:VIS must 1pl-remove:TEL-OBJ-3sg:MASC LOC-village-DEF
'This child [whom we can both see], we must chase him from the village.'

Storch & Coly (2014) explain: "...the suffix *-dìyá* [...] indicates that both speakers and hearer know or see the participant in question." See also Gutiérrez & Matthewson (2012) for a discussion of evidential determiners in Nivacle and St'át'imcets. These determiners mark the familiarity of the referents of noun phrases.

The evidentiary information signalled by perceptual resemblance examples such as (36) is quite complex. Even though there is only *indirect* evidence for the subordinate clause, that evidence may *directly* come from the subject. In (36), Sara has indirect evidence that Margaret laughed. Sara got this evidence from a perception of Margaret. The evidence in these examples comes from the subject, but, especially with the verb *sound*, the speaker does not necessarily have direct evidence from the subject In the attested example in (38), for example, the speaker has not directly heard Dinah:

(38) "I hope we can also arrange a walk with our dogs as I would love to meet Dinah —
she sounds like she is a real character." (www)

In this case, the speaker has not heard Dinah directly. However, based on what the speaker has heard *about* Dinah, it is reasonable to infer that she is a real character.

Examples similar to (38) led Heycock (1994) and Landau (2011) to reject the subject-as-PSOURCE hypothesis. We believe that the hypothesis is in fact correct,

but the verb *sound* allows for a bit of a roundabout interpretation. *X sounds like* ... is felicitous even if the speaker has not directly heard X. Hearing a description of X is enough. Heycock points out that example (39) is acceptable in context (40):

(39) Your car sounds like it needs tuning very badly.

(40) Context: In a long distance call, Y has just described to X the bizarre noises that Y's car is making.

It is indeed acceptable, but that does not refute the subject-as-PSOURCE hypothesis. The sentence is acceptable because the speaker has received reported evidence about the engine of the car. In context (40), (39) can be paraphrased as: "Based on what I heard from you about your car, I come to the conclusion that the car needs tuning very badly." Note that in the same context, sentence (41) would not be felicitous:

(41) #Your mechanic sounds like he needs to tune your car.

If we accept the subject-as-PSOURCE hypothesis, the unacceptability of (41) is unsurprising (Asudeh & Toivonen, 2012). In order for (41) to be acceptable, there would need to be some direct aural evidence from or previous mention of a mechanic, but there hasn't been in the given context.

Additionally, Rett & Hyams (2014) and Chapman et al. (2015a,b) provide experimental evidence supporting the subject-as-PSOURCE hypothesis. In the following section, we present a further experiment that supports the direct/indirect distinction in examples like (34–36) above.

3.3 Experiment

There is an important relationship between reliability/trustworthiness and evidentiality: direct evidentiality is considered more reliable information than indirect evidentiality (see, e.g., Faller 2002; Aikhenvald 2004, Chapter 10; McCready 2015; Lesage et al. 2015; Matthewson 2015; Matthewson & Glougie In Press). If *see/hear* signal direct evidence and *look/sound* signal indirect evidence, then the *see/hear* statements should convey that the evidence is more reliable, more certain than when *look/sound* is used. Sentences like (34) should therefore be taken as clearer evidence than (35–36) that Margaret laughed. Together with Lisa Sullivan, we tested this hypothesis in a series of simple experiments with native English speakers (Asudeh et al., 2017). These experiments are described briefly below.

We wanted to test whether and how participants' truth value judgements of subordinate clauses differed depending on the matrix clause. For example, do participants judge it more likely that Sue decorated the office when presented with (42–43) than when presented with sentences of the other types (44–47)?

(42) Pete saw Sue decorate the office.

(43) Pete heard Sue decorate the office.

(44) It looked like Sue was decorating the office.

(45) It sounded like Sue was decorat-

ing the office.

(46) Sue looked like she was decorating the office.

(47) Sue sounded like she was decorating the office.

In order to test this, we conducted offline psycholinguistic experiments using the methods of Lesage et al. (2015). In an anonymous web-based questionnaire, native speakers of English were asked to rate the likelihood that a sentence is true, given that another sentence is true. The instructions were: "You will be asked to read pairs of sentences. Assume that the first sentence is true and judge the likelihood of the second sentence using a 5 point scale (where 1 = "I have no idea" and 5 = "It is true")." To illustrate: for the examples in (42–47), participants would be asked to judge how likely it was that Sue decorated the office.

We analyzed the results of 69 voluntary participants. We excluded non-native speakers and participants that did not complete the survey. The results of our study are presented below. Perceptual resemblance examples with a non-expletive subject are coded as *cr-look* and *cr-sound*, whereas expletive-subject alternants are coded as *it-look* and *it-sound*.

(48)

	Example	Mean	SD
see	"Ron saw the kids playing"	**4.59**	0.69
cr-look	"The kids looked like they were playing"	**3.54**	0.96
it-look	"It looked like the kids were playing"	**3.59**	0.85

An analysis of variance (ANOVA) on these scores yielded significant variation among conditions, ANOVA $F(2,206) = 34.3$, $p < 0.01$. A post hoc Tukey test showed that *see* differed significantly from both *it-look* and *cr-look* at $p < 0.01$. However, *it-look* and *cr-look* were not different from each other (Tukey HSD post hoc test: $p = 0.93$).

(49)

	Example	Mean	SD
hear	"Paul heard the dog barking"	**4.49**	0.74
cr-sound	"The dog sounded like it was barking"	**3.86**	0.94
it-sound	"It sounded like the dog was barking"	**3.84**	0.79

An analysis of variance (ANOVA) on these scores yielded significant variation among conditions, ANOVA $F(2,205) = 13.89$, $p < 0.01$. A post hoc Tukey test showed that *see* differed significantly from both *it-sound* and *cr-sound* at $p < 0.01$. However, *it-sound* and *cr-sound* were not different from each other (Tukey HSD post hoc test: $p = 0.996$).

In sum, *see/hear* examples were ranked higher than *look like/sound like* examples. Furthermore, perceptual resemblance examples with a non-expletive subject were ranked the same as expletive-subject alternants. We interpret the results as being consistent with the hypothesis that perceptual resemblance verbs do not encode direct evidence: even if it looks like Sue is tired, it is not certain that Sue actually is tired.

Our study replicated the study in Lesage et al. (2015), and further showed no difference between expletive-subject examples and non-expletive-subject examples. However, we had two worries. The first was that perhaps our stimuli were

somehow problematic. The second was that perhaps our method was not sensitive enough to detect a difference between expletive-subject examples and non-expletive-subject examples. We therefore conducted one additional study using the same method as the study above but different stimuli, as well as two additional studies using a two alternative forced-choice (2AFC) method. There was a total of 631 participants in the follow-up studies. The results of the follow-up studies were consistent with the study above (for details, see Asudeh et al. 2017).

4 Non-grammaticalized evidentiality in English

We now turn to an analysis of non-grammaticalized evidentiality in English, given the considerations of the previous section. In addition to the fact that the Tariana and Cherokee grammaticalized evidentials above were associated with bound morphemes whereas English has non-grammaticized lexical evidentiality, there is another key difference: In English, the claim of indirect evidence, captured by the WITNESS predicate, concerns the event in the *like*-complement of the verb, not the matrix event. That is, in order to capture the fact that a matrix non-expletive subject in copy raising and perceptual resemblance is directly perceived while allowing the complement clause itself to constitute indirect evidence, we treat the matrix subject as the PSOURCE (Asudeh & Toivonen, 2007, 2012) but apply the WITNESS function to the complement event, rather than the matrix event. Lastly, it should be noted that the evidentiary basis in English PSOURCE verbs is reversed in the *evidence* predicate, since it is the matrix event that serves as evidence for the claim in the complement clause. For example, in the sentence *John sounds like he is upset*, it is the sound of John that serves as evidence of the fact that he is like he is upset.

In the lexical entries in section 4.1 below, we have made explicit the mappings from grammatical functions to arguments in semantic structure for clarity. The shared ARG1 in the semantic structure below is a consequence of the standard raising equation in the entry for *sounds* and the equalities mapping the SUBJ grammatical functions of *sounds* and *like* to their respective ARG1s in semantic structure. The full Glue proof for example (53) is given in the appendix.

Notice that the material in the second and third meaning constructors in the lexical entries for *sounds* and *seems* are identical to the information contributed by the grammaticalized evidentiality feature [DIRECT $-$] above. This captures the commonality between non-grammaticalized evidentiality in English copy-raising verbs (e.g., *seems*) and perceptual resemblance verbs (e.g., *sounds*), on the one hand, and grammaticalized evidentiality in languages like Tariana and Cherokee, on the other. Moreover, notice that the optional identification of the speaker as the EVIDENCE-HOLDER in these lexical entries also parallels the information in the Tariana and Cherokee verb entries above. Thus, we have achieved analogous semantic treatment of (relevant aspects of) English, Tariana, and Cherokee, while maintaining the morphosyntactic difference between English and Tariana/Cherokee in the f-structure, as promised above.

4.1 Lexicon[8]

(50) *sounds*

$(\uparrow \text{PRED}) = \text{`sound'}$
$(\uparrow \text{SUBJ}) = (\uparrow \text{XCOMP SUBJ})$
$(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{ARG1})$
$(\uparrow \text{XCOMP})_\sigma = (\uparrow_\sigma \text{ARG2})$
$\lambda x \lambda P \lambda e \lambda e'.sound(e) \wedge \text{PSOURCE}(e) = aural(x) \wedge P(x)(e') \wedge evidence(e, e') :$
$(\uparrow_\sigma \text{ARG1}) \multimap [(\uparrow_\sigma \text{ARG1}) \multimap (\uparrow_\sigma \text{ARG2 EVENT}) \multimap (\uparrow_\sigma \text{ARG2})] \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \not\leq \text{WITNESS}(e') :$
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$\lambda P \lambda e \exists e'.P(e)(e') :$
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$
$(\ speaker : (\uparrow_\sigma \text{EVIDENCE-HOLDER})\ )$

(51) *seems*

$(\uparrow \text{PRED}) = \text{`seem'}$
$(\uparrow \text{SUBJ}) = (\uparrow \text{XCOMP SUBJ})$
$(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{ARG1})$
$(\uparrow \text{XCOMP})_\sigma = (\uparrow_\sigma \text{ARG2})$
$\lambda x \lambda P \lambda e \lambda e'.seem(e) \wedge \text{PSOURCE}(e) = x \wedge P(x)(e') \wedge evidence(e, e') :$
$(\uparrow_\sigma \text{ARG1}) \multimap [(\uparrow_\sigma \text{ARG1}) \multimap (\uparrow_\sigma \text{ARG2 EVENT}) \multimap (\uparrow_\sigma \text{ARG2})] \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$\lambda P \lambda i \lambda e \lambda e'.P(e)(e') \wedge i \not\leq \text{WITNESS}(e') :$
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{EVIDENCE-HOLDER}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma$
$\lambda P \lambda e \exists e'.P(e)(e') :$
$[(\uparrow_\sigma \text{EVENT}) \multimap (\uparrow_\sigma \text{EVIDENCE}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$
$(\ speaker : (\uparrow_\sigma \text{EVIDENCE-HOLDER})\ )$

(52) *like*

$(\uparrow \text{PRED}) = \text{`like'}$
$(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{ARG1})$
$(\uparrow \text{COMP})_\sigma = (\uparrow_\sigma \text{ARG2})$
$\lambda x \lambda e' \lambda P \lambda e.P(e) \wedge x \leq \text{PARTICIPANTS}(e') \wedge e \sim e' :$
$(\uparrow_\sigma \text{ARG1}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap$
$[(\uparrow_\sigma \text{ARG2 EVENT}) \multimap (\uparrow_\sigma \text{ARG2})] \multimap (\uparrow_\sigma \text{ARG2 EVENT}) \multimap (\uparrow_\sigma \text{ARG2})$
$\lambda p.p : (\uparrow_\sigma \text{ARG2}) \multimap \uparrow_\sigma$

4.2 F-structure and semantic structure

(53) John sounds like he is upset.

[8]The operator $\sim$ in the lexical entry for *like* is a similarity operator between events; see Asudeh (2012).

(54) **F-structure**

$$s\begin{bmatrix}\text{PRED} & \text{'sound'} \\ \text{SUBJ} & j\boxed{\text{"John"}} \\ \text{XCOMP} & l\begin{bmatrix}\text{PRED} & \text{'like'} \\ \text{SUBJ} & \\ \text{COMP} & u\begin{bmatrix}\text{PRED} & \text{'upset'} \\ \text{SUBJ} & p\boxed{\text{"he"}}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

(55) **Semantic structure**

$$s_\sigma\begin{bmatrix}\text{REL} & \text{sound} \\ \text{ARG1} & j_\sigma[\ ] \\ \text{ARG2} & l_\sigma\begin{bmatrix}\text{REL} & \text{like} \\ \text{ARG1} & \\ \text{ARG2} & u_\sigma\begin{bmatrix}\text{REL} & \text{upset} \\ \text{ARG1} & [\ ] \\ \text{EVENT} & [\ ]\end{bmatrix} \\ \text{EVENT} & [\ ]\end{bmatrix} \\ \text{EVENT} & [\ ] \\ \text{EVIDENCE} & [\ ] \\ \text{EVID.-HOLDER} & [\ ]\end{bmatrix}$$

4.3 Glue proof (conclusion)

(56)
$$\frac{\vdots}{\begin{array}{l}\exists e \exists e'.sound(e) \wedge \textsc{Psource}(e) = aural(john) \wedge \\ \quad \exists e''.[upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge \\ \quad john \leq \textsc{participants}(e') \wedge e'' \sim e'] \wedge \\ \quad evidence(e, e') \wedge speaker \not\leq \textsc{witness}(e') : s\end{array}}$$

5 Conclusion

It is a commonplace in the literature on evidentiality to bemoan conflation of grammaticalized evidentiality and non-grammaticalized evidentiality (see, for example, Aikhenvald 2004 for particularly extensive discussion). We agree that it would be a mistake to conflate true evidentiality with mere "evidential strategies" (Aikhenvald, 2004; Murray, 2017). But it also seems unsatisfactory to make no connection between grammaticalized and non-grammaticalized evidentiality. We have attempted to both maintain the divide and bridge it by: 1. Defining a small stock of f-structure evidential features for grammaticalized evidentiality; 2. Associating these features

with semantic content; 3. Associating that same semantic content appropriately with non-grammaticalized evidentiality Our semantics here has been only rudimentary and does little to capture the true subtleties of evidential semantics (see Murray 2017 for a recent thorough treatment using Update Semantics). Yet it is sufficient to demonstrate that, in a modular architecture, the very same semantic information can be directly associated with morphosyntactic features such that the grammar can make reference to these features (grammaticalized evidentiality) or can be captured directly in lexical entries without introduction of such features, such that there are no morphosyntactic interactions with the rest of the grammar (non-grammaticalized evidentiality).

Our treatment of evidentiality can be compared to standard LFG/Glue analyses of tense (Butt et al., 1996; Dalrymple, 2001; Frank & Zaenen, 2002; Bary & Haug, 2011). Tense is an interpreted grammatical feature and as such it is modelled in the lexicon, in f-structure, in morphological structure (Butt et al., 1996; Frank & Zaenen, 2002), and also in the semantics (Bary & Haug, 2011). But the morphosyntactic tense features that occur in the f-structure are restricted to syntactically relevant aspects, and additional temporal information occurs in the Glue meaning language. This information is much less restricted. For example, words like *yesterday* or *two weeks ago* can be added to a sentence in addition to a grammatical past tense marker. This leads to an overlap between f-structure and semantics, potentially reflected in the semantic structure, but the overlap is not complete. In the same way, there is a partial overlap between f-structure and semantic structure with regards to evidential marking in languages with grammaticalized evidentiality. However, the f-structural evidentiality features are heavily restricted to represent only morphosyntactically relevant information, whereas the evidential information at semantic structure, and in the Glue meaning language that works with features from this level of structure, is richer and more flexible. For example, a REPORTED evidential feature in the f-structure can be complemented lexically by information about where the report came from, and this information would be modelled in semantic structure.

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Appendix: Sample Glue proof

(53) John sounds like he is upset.

$$s\left[\begin{array}{ll}\text{REL} & \text{sound}\\ \text{ARG1} & j\,[\,]\\ \text{ARG2} & l\left[\begin{array}{ll}\text{REL} & \text{like}\\ \text{ARG1} & \\ \text{ARG2} & u\left[\begin{array}{ll}\text{REL} & \text{upset}\\ \text{ARG1} & p\,[\,]\\ \text{EVENT} & e3\,[\,]\end{array}\right]\\ \text{EVENT} & e2\,[\,]\end{array}\right]\\ \text{EVENT} & e1\,[\,]\\ \text{EVIDENCE} & e0\,[\,]\\ \text{EVID.-HOLDER} & i\,[\,]\end{array}\right]$$

like.1
$\lambda x\lambda e'\lambda P\lambda e''.P(e'') \wedge$
$x \leq \textsc{part}(e') \wedge e'' \sim e' :$
$j \multimap e2 \multimap [e3 \multimap u] \multimap [e3 \multimap u]$ $\quad [v : j]^1$

$\lambda e'\lambda P\lambda e''.P(e'') \wedge$
$v \leq \textsc{part}(e') \wedge e'' \sim e' :$
$e2 \multimap [e3 \multimap u] \multimap [e3 \multimap u]$ $\quad [e''' : e2]^2$

$\lambda P\lambda e''.P(e'') \wedge$
$v \leq \textsc{part}(e''') \wedge e'' \sim e''' :$
$[e3 \multimap u] \multimap [e3 \multimap u]$

upset
$\lambda x\lambda e.upset(e) \wedge$
$\textsc{exp}(e) = x :$
$p \multimap e3 \multimap u$

he
$\mathsf{ant}(\overline{x}) :$
p

$\lambda e.upset(e) \wedge \textsc{exp}(e) = \mathsf{ant}(\overline{x}) :$
$e3 \multimap u$

like.2
$\lambda p.p :$
$u \multimap l$

$\lambda e''.upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge v \leq \textsc{part}(e''') \wedge e'' \sim e''' : e3 \multimap u$

$\exists e''.upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge v \leq \textsc{part}(e''') \wedge e'' \sim e''' : u$ $\exists e[\text{tense}]$

$\exists e''.upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge v \leq \textsc{part}(e''') \wedge e'' \sim e''' : l$

$\lambda e'''\exists e''.upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge v \leq \textsc{part}(e''') \wedge e'' \sim e''' : e2 \multimap l$ $\multimap_{\mathcal{I},2}$

$\lambda v\lambda e'''\exists e''.upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge v \leq \textsc{part}(e''') \wedge e'' \sim e''' : j \multimap e2 \multimap l$ $\multimap_{\mathcal{I},1}$

sounds.1
$\lambda x\lambda P\lambda e\lambda e'.sound(e) \wedge \textsc{psource}(e) = aural(x) \wedge$
$P(x)(e') \wedge evidence(e, e') :$
$j \multimap [j \multimap e2 \multimap l] \multimap e1 \multimap e0 \multimap s$

John
$john :$
j

$\lambda P\lambda e\lambda e'.sound(e) \wedge \textsc{psource}(e) = aural(john) \wedge$
$P(john)(e') \wedge evidence(e, e') : [j \multimap e2 \multimap l] \multimap e1 \multimap e0 \multimap s$

sounds.2
$\lambda P\lambda i\lambda e\lambda e'.P(e)(e') \wedge i \not\leq \textsc{witness}(e') :$
$[e1 \multimap e0 \multimap s] \multimap i \multimap e1 \multimap e0 \multimap s$

$\lambda e\lambda e'.sound(e) \wedge \textsc{psource}(e) = aural(john) \wedge \exists e''.[upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge$
$john \leq \textsc{part}(e') \wedge e'' \sim e'] \wedge evidence(e, e') : e1 \multimap e0 \multimap s$

sounds.4
$speaker :$
i

$\lambda i\lambda e\lambda e'.sound(e) \wedge \textsc{psource}(e) = aural(john) \wedge \exists e''.[upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge$
$john \leq \textsc{part}(e') \wedge e'' \sim e'] \wedge evidence(e, e') \wedge i \not\leq \textsc{witness}(e') : i \multimap e1 \multimap e0 \multimap s$

sounds.3
$\lambda P\lambda e\exists e'.P(e)(e') :$
$[e1 \multimap e0 \multimap s] \multimap e1 \multimap s$

$\lambda e\exists e'.sound(e) \wedge \textsc{psource}(e) = aural(john) \wedge \exists e''.[upset(e'') \wedge \textsc{exp}(e'') = \mathsf{ant}(\overline{x}) \wedge john \leq \textsc{part}(e') \wedge e'' \sim e'] \wedge evidence(e, e') \wedge speaker \not\leq \textsc{witness}(e') : e1 \multimap e0 \multimap s$

$\exists e\exists e'.sound(e) \wedge \textsc{psource}(e) = aural(john) \wedge \exists e''.[upset(e'') \wedge \textsc{exp}(e'') = \mathsf{antecedent}(\overline{x}) \wedge john \leq \textsc{participants}(e') \wedge e'' \sim e'] \wedge evidence(e, e') \wedge speaker \not\leq \textsc{witness}(e') : s$ $\exists e[\text{tense}]$

Information Structure Conditions on the Agreement Controller in Dargwa

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Abstract

Much of the current debate on the syntax of Dargwa is centered around the problem of gender agreement on auxiliaries. This type of agreement is exceptional in that it is not exclusively controlled by the absolutive argument, but can be alternatively controlled by either subject or object in transitive clauses (like person agreement). In this paper, I investigate discourse conditions on the choice of agreement controller in Kubachi Dargwa, and provide some new data from Ashti Dargwa that clarify the status of the agreement controller. I show that while the hypothesis that the controller of gender agreement is topical is generally correct in the case of agent agreement, it does not apply to patient agreement, where the topicality of both core arguments is roughly equal. On the syntactic side, agreement with the patient seems to promote it to syntactic pivot status. This suggests an analysis along the lines of Falk (2006), treating Dargwa as a language where core arguments can receive pivot status independently of their grammatical function.

1 Dargwa: General information

Dargwa[1] is a group of East Caucasian languages that are characterized by a complex agreement system. In addition to gender agreement, which, typically for East Caucasian languages, at clause level is mostly controlled by the absolutive argument, Dargwa also has person agreement, whose resolution is determined by complex rules that refer to both grammatical functions and the relative position of arguments on the person hierarchy.

Much of the current debate on the syntax of Dargwa is centered around the problem of gender agreement on auxiliaries. This type of agreement is exceptional in that it is not exclusively controlled by the absolutive argument, but can be alternatively controlled by either subject or object in transitive clauses (like person agreement). This involves two main issues:

- factors determining the choice of subject or object as agreement controller;
- the syntactic nature of the agreement alternation.

As to the former question, the majority of authors (van den Berg 2001; Sumbatova 2014) agree that control of gender agreement is somehow connected to topicality, although the exact type of topic thus coded is seldom made explicit. Elements of this approach can even be traced back to some traditional grammars, in particular Magometov (1963), who likens subject agreeement to active voice and object agreement to passive voice. The only exception is an upcoming paper Ganenkov (forthcoming), where it is shown that the agreement controller at least cannot be sentence topic, and the discourse topic interpretation is also put into doubt.

In syntax, the most elaborate analysis is that of Sumbatova and Lander (2014), who propose treating gender agreement as a result of a kind of Backward Control

1. The research presented in this paper is supported by research project "Highest Argument Agreement (HAA)". Reference code: FFI2014-56735-P (Spanish Ministry of Economy and Competitiveness).

construction, where the auxiliary heads its own clause with a zero subject which, in turn, is coreferential with either subject or object of the lower clause headed by the lexical verb. In Belyaev (2016) and Belyaev (2017), I have argued against this interpretation, at least in the case of Ashti Dargwa, in favour of a simpler solution, where the alternation between two types of 3rd person arguments (topical vs. non-topical) is integrated into the person hierarchy as a kind of obviation. Thus the hierarchy for Ashti is changed from the standard $1, 2 \succ 3$ to the Algonquian-style $1, 2 \succ 3 \succ 3'$, where 3 is the "proximate" and $3'$ is the "obviate". Finally, Ganenkov (forthcoming) has argued for a hybrid solution, where absolutive control is syntactically neutral and monoclausal, while ergative control involves a biclausal structure much along the lines of Sumbatova and Lander (2014).

While both pieces of the puzzle are far from being resolved, the main purpose of this paper is to test the topicality hypothesis on the data of Kubachi Dargwa.[2] Using Givón's (1983) diagnostics, I demonstrate that subject agreement seems to correlate with topic status of the subject, while object agreement considerably less so. This suggests that the topicality hypothesis is on the right track, even though the correlation is not deterministic, especially in the case of direct objects. At the same time, I invoke some new data of Ashti that show that gender agreement is in some contexts independent from person agreement, and its controller does have a privileged syntactic status in certain contexts. Therefore, the analysis of Belyaev (2016) should be revised. I propose a tentative analysis in terms of Falk's (2006) notion of the PIVOT (PIV).

2 Gender agreement of the auxiliary

A general desription of the rules of gender and person agreement, including the patterns observed in Kubachi and Ashti, can be found in Belyaev (2013). Overall, person agreement is based on the person hierarchy, while gender agreement at clause level is always controlled by the absolutive ($\mathcal{S}/\mathcal{P}$) argument.

There is, however, one key exception to the gender agreement pattern: auxiliaries in periphrastic verb forms. In many varieties, including Standard Dargwa (van den Berg 2001), Tanti (Sumbatova 2014; Sumbatova and Lander 2014) and Kubachi (Magometov 1963), some 3rd person auxiliaries can agree alternatively with the absolutive or the ergative:[3]

(1) murad-li t'ant'i-b qali b-irq'.u.le=sa-**j**
M.-ERG in.T.-N house N-building=COP-M

(2) murad-li t'ant'i-b qali b-irq'.u-le=sa-**b**
=COP-N

2. Both Kubachi and Ashti are dialects of the same Dargwa language, of which Kubachi is the larger and central variety; according to local traditions, Ashti speakers migrated from the Kubachi area some 500 years ago. The study is based on Kubachi due to more texts available, and more forms displaying the phenomenon in question.

3. Glossing follows the Leipzig rules (`https://www.eva.mpg.de/lingua/resources/glossing-rules.php`), with the following additions: ATTR — attributive; COP — copula; EL — elative; IN — inessive; LAT — lative; MSD — masdar (verbal noun); NPL — neuter plural; PCVB — participle-converb; PRET — preterite.

'**Murad** is building **a house** in Tanti.'

In Sumbatova (2014), this pattern in Tanti Dargwa has been given an elaborate syntactic explanation. According to Sumbatova's analysis, the auxiliary heads its own clausal layer, with a zero absolutive subject. This subject is coreferent to either subject or DO of the core clause. Thus, every finite predication involves a relation of Backward Control (Polinsky and Potsdam 2002). Thus (2) represents the structure of (1),[4], while (2) stands for (2).

(1′) [$\Delta_{i(ABS)}$ [**murad-li**$_i$ t'ant'i-b qali b-irq'-u-le] =sa-**j**]

(2′) [$\Delta_{i(ABS)}$ [murad-li t'ant'i-b **qali**$_i$ b-irq'-u-le] =sa-**b**]

In (2), the zero absolutive in the upper tier is coreferential with the ergative subject of the lower tier: hence, the auxiliary has the agreement features of the agent, while actually agreeing with the upper absolutive. In contrast, in (2), the zero absolutive is coreferential with the object; hence, the auxiliary ahs the gender and number features of the patient.

In Belyaev (2016), I have shown that there are problems for this analysis in Ashti. In addition to various implementational difficulties, as well as the irrelevance of some diagnostica, such as adverb agreement, the main issue is that in Ashti, whenever a clause has both person and gender agreement on the auxiliary, the latter has to follow the former. This seems to suggest that they are essentially two aspects of the same phenomenon. Since there is no strong evidence in favour of a split in clause structure, I proposed a different analysis involving a split between 3rd person participants based on prominence, essentially a kind of obviation. Gender features on the auxiliary reflect the features of the hierarchical ("person") agreement controller, and accordingly, the only required modification to the analysis of Ashti is the extension of the person hierarchy to $1, 2 \succ 3 \succ 3'$, where 3 is the proximate ("topical") 3rd person, while $3'$ is the obviate ("non-topical") 3rd person.

But while the similarity with proximate-obviative systems seems clear enough, what still remains mysterious is the nature of the distinction between subject and object controllers. Native speaker judgements suggest that in Ashti, like in Tanti, it has something to do with topicality, but such anecdotal evidence is hardly acceptable. Research in the area of information structure and discourse has provided us with some robust diagnostics and statistical techniques that allow a more rigorous evaluation of this hypothesis.

3 Motivation for agreement: Earlier studies

There have been several proposals in the literature on how exactly the controllers are selected. Perhaps the earliest is found in Magometov's (1963) grammar of Kubachi, where agent agreement is likened to "active voice" and patient agreement, to "passive voice". Since passive voice generally correlates with topicality of the patient, this description may be viewed as a distant precursor of the more recent accounts, although there is no explicit discourse or information structure-based explanation.

4. The use of Δ for the zero argument, as well as other notation decisions, are from Sumbatova (2014).

The first author to explicitly connect gender agreement with topicality was van den Berg (2001) in her sketch of Standard Dargwa, where she claimed that agreement with $\mathcal{A}$ was the default option, while agreement with $\mathcal{P}$ could only occur if P has topic status. It is not mentioned whether the term *topic* here is understood as discourse or sentence topic.

Sumbatova and Lander (2014) further developed the topicality hypothesis, proposing a symmetrical version of the account: subject agreement occurs when the subject is "more topical than the direct object", while object agreement occurs when the object is "more topical than the subject". Unlike van den Berg (2001), these authors explicitly discuss different senses of the term *topic* and conclude that the controller in Dargwa cannot be a sentence topic, but must be a discourse topic.

In his upcoming paper, Ganenkov (forthcoming) attempst to demonstrate that the topicality hypothesis cannot be true in any sense of the term. First, he shows that in Standard Dargwa texts, gender agreement on the axuiliary is often controlled by NPs which cannot ever be understood as sentence topics, such as quantified NPs like 'more than two persons' and lexical components of complex predicates. He also finds little evidence for the status of discourse topic, and his eventual conclusion is, in a sense, opposite to van den Berg's approach. He concludes that:

- $\mathcal{P}$ agreement is a syntactically and pragmatically neutral, "default" structure.
- $\mathcal{A}$ agreement is a two-level structure reminiscent of the analysis of Sumbatova (2014). However, Ganenkov shows that a raising structure is more appropriate than a control structure here.

As for the latter structure, Ganenkov bases his analysis on a typological comparison with so-called biabsolutive constructions in other East Caucasian languages, where both arguments appear in the absolutive case, unlike the standard ergative pattern:

(3) Avar (Forker 2012, 79)

a. ergative

niže-c:a χ:er b-eg-ule-b b-ugo
we-ERG hay N-fork-PTCP-N N-be.PRS

'We are forking the hay.'

b. biabsolutive

[emen$_i$ [$\Delta_{i(ERG)}$ ču$_j$ b-ec:u-le-w] w-ugo]
father horse N-praise-PTCP-M M-be.PRS

'Father praises the horse.'

The main motivation for this comparison is that biabsolutives, like Dargwa ergative agreement constructions, also show a tendency for topicality or another kind of promotion of the agent. Dargwa languages do not have biabsolutives; hence, the Dargwa ergative gender agreement pattern can be viewed as a "backward" version of the biabsolutive pattern, which is also viewed by many authors as involving a kind of biclausal raising structure (Kazenin 1998).

However, I believe that this comparison, at best, represents a distant typological analogy, and there are far too many differences between the two constructions to argue for any structural similarity between them. First, the difference in discourse frequency is striking. While no exact text counts are available in the literature, it is universally accepted as a given fact that this construction is fairly minor in discourse compared to the canonical ergative pattern. This is definitely not the case for ergative gender agreement in Dargwa, which appears in the overwhelming majority of narrative clauses; it is rather the absolutive pattern, which Ganenov considers as more basic and syntactically simple, that is "marked" in this sense (see specific numbers below).

Second, the two constructions differ in their treatment of dative subjects of experiencer predicates. Biabsolutive constructions cannot generally be used with such verbs, with the known (partial) exception of Lak (Gagliardi et al. 2014). In contrast, in all Dargwa varieties I am aware of, control of gender agreement is available for dative subjects to the same extent as for ergative subjects.

Finally, the biabsolutive construction generally shows a number of strict syntactic restrictions on extraction, formation of non-finite forms, and topic/focus marking. There are no known strict constraints of this kind (or any other syntactic constraints, for that matter) that apply to $\mathcal{A}$ agreement but not to $\mathcal{P}$ agreement.

To sum up, $\mathcal{A}$ vs. $\mathcal{P}$ agreement seem to be much less structurally opposed than ergative vs. biabsolutive. It seems that the main motivation for the biclausal analysis still remains the desire to preserve a universal rule of gender agreement tied to the absolutive argument. In my view, such a line of argumentation is misguided and logically incoherent. If taking absolutive control of gender as dogma leads us to implausibly complex structures like the ones proposed by Sumbatova (2014), this dogma should rather be abandoned.

At the same time, an adequate syntactic account of the facts cannot be provided unless we come to an understanding of the motivation for the choice of agreement controller. Since the dominant hypotheses connect it to topicality, it seems worthwhile to test this hypothesis based on natural texts.

3.1 The study of Kubachi

3.1.1 Corpus

For a pilot study, I have analyzed a published collection of stories about Mullah Nasruddin in Kubachi (Šamov 1994). This corpus is rater balanced in that the texts are quite homogeneous in genre and follow a similar narrative structure. Thus, to the extent that narratives are concerned, these texts can be viewed as a rather typical examples of their genre.

I have analyzed a total of 484 finite sentences. The actual number of clauses is much higher, because Kubachi, like other Dargwa languages, makes heavy use of converbs in narratives. I have chose to only consider finite clauses for the purpose of simplicity, as the agreement alternation under consideration can only occur in finite contexts in Kubachi. There are a number of additional requirements that significantly narrow the total sample of sentences. The verb in the clause must:

- be transitive (intransitive verbs can show no competition between controllers);
- stand in a periphrastic form with gender agreement (which in most cases means 3rd person forms, with the exception of so-called *existential* periphrastic forms, very rare in texts);
- have two arguments of different gender/number (so that the controller can be clearly identified).

Applying these three constraints to our sample leads to only 44 relevant sentences. This might seem like a very low number, but it is actually not that low for a language where the distinction in question is rather peripheral. For example, Gildea (1994), in his study of inverse-like markers in Carib of Surinam, operates with a sample of 53 clauses in total. In spite of the small sample, the picture that emerges from the numbers is rather consistent picture.

The total frequencies of $\mathcal{A}$ ("direct") vs. $\mathcal{P}$ ("inverse") agreement in the sample are provided in Table 1.

Pattern	**Frequency**
$\mathcal{A}$	29(66%)
$\mathcal{P}$	15(34%)
Total	44(100%)

Table 1: Total frequency of agreement patterns in Kubachi

The predominance of $\mathcal{A}$ agreement suggests that we are indeed dealing with some feature that is more typical of subjects by default, which may well be topicality. I support the motivation of Sumbatova and Lander (2014) and Ganenkov (forthcoming) in their negative evaluation of the possibility that the controller may be sentence topic. All of their counterarguments apply in Kubachi. In particular, nominal components of complex predicates, obviously not referencing any entity,[5] sometimes trigger gender agreement:

(4) " hej, aχmaχ:-e " uk'-ul žuwab b-aq:-ib=sa-**b** malla-dil
hey fool-PL [M]say.IPFV-CVB answer N-bring.PFV-PTCP=3-N mullah-ERG
'Hey, you fools — gave **the answer** the Mullah.'

(5) q'ut' d-a:q'-ib=sa-**d** juldaš:-a-dil uc:a
knock NPL-do.PFV-PTCP=3-NPL friend-PL-ERG door
'The friends knocked (lit. did **a knock**) on the door.'

5. It might be possible that topicalization of nominal components of complex predicates is related to some sort of prediate topicalization or scene-setting, see Mohanan (1994). However, while this could be the case in (4), it is less plausible for (6), which is the first mention of ablution in the text, and definitely not plausible for (5), where knocking is never mentioned before, never mentioned later, and is in general a minor event in the overall narative.

(6)	qˤa̰mil	t’ṵj-la	**dacala**	d-aːq’-ib-žu-**d**	a-sa-**d**
	left	leg-GEN	ablution	NPL-do.PFV-PTCP-ATTR-NPL	NEG-3-NPL

‘I have not done **the ablution** of my left leg.’

In the examples (4–6), the copula has neuter singular agreement features. In all of the examples, the ergative subject is masculine or human plural; hence, neuter agreement suggests that the controller is the absolutive component of the compound verb. Gender assignment in Dargwa is semantic overall and based on the semantic features of the referent of the NP: if human, masculine or feminine are selected based on biological gender; if nonhuman, neuter is always selected.[6] Accordingly, nouns referring to abstract notions such as ‘answer’ or ‘ablution’ are always neuter. Furthermore, the verbal prefix in all examples agrees in neuter singular, which unambiguously identifies the object as having neuter singular agreement features.

Discourse topic, however, is a much more fluid concept based more on text frequency than any strict constraints on individual sentences. Therefore, the possibility that we are dealing with discourse topics still remains. To test for this, I have used two classic diagnostics from Givón (1983): **Referential Distance (RD)** and **Topic Persistence (TP)**. The former (RD) denotes the distance in clauses to the previous mention of the same referent, and typically has three values, which I will also use: 1 (mentioned in previous clause), $2/3$ (mentioned 2 or 3 clauses before), > 3 (mentioned more than three clauses before, or first mention). The latter (TP) represents the other side of topicality: the availability of the referent for further reference. It stands for the number of times the referent is mentioned in the next 10 clauses. Again, the convention is to collapse the whole range to two values: $0–2$ vs. $3+$.

Apart from absolute values, relative values are also used for RD, thus yielding three values: $\mathcal{A} > \mathcal{P}$ (RD of agent higher than that of patient), $\mathcal{A} > \mathcal{P}$ (RD of agent and patient equal) $\mathcal{A} < \mathcal{P}$ (RD of agent lower than that of patient).

3.1.2 Referential Distance

The data for RD calculations are provided in Table 2. This and the subsequent table should be read as follows. The two groups of columns represent clauses where gender agreement is with $\mathcal{A}$ (“direct” pattern) and with $\mathcal{P}$ (“inverse” pattern). Each of these is then subdivided into columns where the number of clauses with the given RD for $\mathcal{A}$ and $\mathcal{P}$ is displayed. Thus, in Table 2, there are 19 $\mathcal{A}$-agreeing clauses where $\mathcal{P}$ has the RD value of > 3, 4 $\mathcal{P}$-agreeing clauses where $\mathcal{A}$ has the RD value of 1, etc.

6. Mass nouns always trigger neuter plural agreement instead of neuter singular, without having any plural morphology. The distinction between mass and count nouns is to some extent lexical; this is the only part of the Dargwa gender system where agreement cannot be predicted based on the meaning alone.

	$\mathcal{A}$ agreement		$\mathcal{P}$ agreement	
	$\mathcal{A}$	$\mathcal{P}$	$\mathcal{A}$	$\mathcal{P}$
> 3	9 (31%)	19 (66%)	6 (40%)	4 (27%)
2/3	7 (24%)	4 (14%)	5 (33%)	5 (33%)
1	13 (45%)	6 (20%)	4 (27%)	6 (40%)
	29 (100%)	29 (100%)	15 (100%)	15 (100%)

Table 2: Absolute RD values

From this table we can see that the "direct" ($\mathcal{A}$-agreeing) pattern does show a preference for more topical $\mathcal{A}$s. The majority of $\mathcal{A}$s have the RD of 1, while for $\mathcal{P}$ it is the other way around, with the majority having RD of > 3.

In contrast, the "inverse" numbers do not show a higher topicality of either argument. The number of topical $\mathcal{P}$s is marginally higher than topical $\mathcal{A}$s, but the difference is probably not statistically significant, and certainly not to the extent that is found in other direct-inverse systems found in the literature, e.g. Kutenai (Dryer 1994).

Analyzing comparative RD gives similar results (Table 3). The "direct" pattern shows a clear preference for topical $\mathcal{A}$s, while in the "inverse" pattern, the status of both arguments is roughly equal, with a small preference for topical $\mathcal{P}$.

	$\mathcal{A}$ agreement	$\mathcal{P}$ agreement
$\mathcal{A} > \mathcal{P}$	3 (10%)	5 (33%)
$\mathcal{A} = \mathcal{P}$	13 (45%)	8 (54%)
$\mathcal{P} > \mathcal{A}$	13 (45%)	2 (13%)
	29 (100%)	15 (100%)

Table 3: Comparative RD

To conclude, RD shows that while the "direct" pattern is associated with topical $\mathcal{A}$, this is not the case for the "inverse" pattern, which does not show a clear preference for any argument. However, on average, "inverse" constructions will be more frequently used when $\mathcal{P}$ is topicalized. This may be what gives one the impression that $\mathcal{P}$ controlling agreement is topical.

3.1.3 Topic Persistence

The counts for Topic Persistence give a similar picture to Referential Distance.

	$\mathcal{A}$ agreement		$\mathcal{P}$ agreement	
	$\mathcal{A}$	$\mathcal{P}$	$\mathcal{A}$	$\mathcal{P}$
$0-2$	16 (55%)	26 (90%)	14 (93%)	11 (73%)
$3+$	13 (45%)	3 (10%)	1 (7%)	4 (27%)
	29 (100%)	29 (100%)	15 (100%)	15 (100%)

Table 4: TP values

"Direct" clauses clearly favour persistence of $\mathcal{A}$. In the "inverse", $\mathcal{A}$ is significantly less persistent while P is slightly more persistent.

3.1.4 Referential Distance and Topic Persistence: Conclusions

The evidence from spoken texts shows that there is a difference between "direct" and "inverse" patterns in terms of relative discourse topicality of the arguments. In the "direct" pattern, the agent is significantly more topical than the patient. In contrast, the "inverse" pattern does not display any preference for topical patient. It does seem to slightly disprefer topical $\mathcal{A}$s, especially as seen from Topic Persistence, but still not to the extent of a full syntactic demotion.

Therefore, paradoxically, the statistics seems to support Ganenkov's conclusion that the patient agreement pattern is less marked, rather than van den Berg's "default $\mathcal{A}$" hypothesis, even though the "direct" pattern is more frequent in the texts. However, this pragmatic asymmetry cannot by itself serve as evidence for a syntactic asymmetry.

4 Syntax of inverse in Ashti

It is generally agreed upon that the person agreement controller does not have special syntactic status in Dargwa. This suggest an analysis that does not tie person agreement to a particular grammatical function, but either relegates it to a separate level of structure (Belyaev 2013) or, in a simpler way, describes it through the sharing of AGR (Belyaev 2016).

The status of the copular controller is less clear. In previous work (Belyaev 2016), I assumed that it behaved like a person controller due to the fact that when the auxiliary expresses both 1/2 person and gender agreement, the two have to match. However, direct evidence on the syntactic status of auxiliary gender agreement is difficult to obtain due to the fact that Dargwa languages have very few true syntactically constrained long-distance dependencies. At the very least, it is clear that the change in gender agreement does not involve any syntactic demotion of the agent and detransitivization of the clause. This is readily seen by contrast with the antipassive (7), where gender agreement does shift from patient to the agent, but where this change is accompanied by a change in case marking, and the verb is truly detransitivized.

(7) a. bec'.li-dil q'$^{w\varsigma}$i̱l-i **d**-uk-ini
wolf-ERG cow-PL NPL-eat.IPFV-PRET.3

b. bec' (q'$^{w\varsigma}$i̱l-a-d) **b**-uk-ini
wolf cow-PL-ERG N-eat.IPFV-PRET.3
'The wolf ate cows.'

The antipassive in Ashti (and Dargwa in general) is possible for all verbs in the imperfective aspect. It has no special morphological marking. In the antipassive construction, the agent (ergative in canonical transitive predications) stands in the absolutive and accordingly triggers all verbal agreement; the verb itself becomes intransitive. The patient may be expressed by the ergative, but this ergative has no core argument status; among other things, it cannot trigger person agreement.[7] Thus, while there is no overt marking of detransitivization on the verb, case marking unambiguously encodes the change in grammatical function. No such change happens under agreement alternation.

However, luckily, it seems that Ashti does have a syntactic construction which is sensitive to the syntactic prominence of clausal arguments: same-subject converbs.

4.0.1 Same-subject converbs and agreement

Like other East Caucasian languages, Dargwa languages have perfective and imperfective so-called *simple converbs* which perform a wide range of functions, both marking manner/temporal subordination and serving as a kind of substitute for coordination in discourse. Dargwa has no conjunction-based coordination strategy for clauses.

Converbs are generally varying-subject (Nedjalkov 1995), i.e. can have either the same subject as the main clause or a different subject, as in (8).

(8) [$\varnothing_{i/j}$ a:s **d-ič:-ib**], ʔa̱li$_i$ uniwersitet-li ke:χ^w-i
money NPL-give.PFV-PCVB A. university-IN[LAT] enter.PFV-PRET.3
'After (s/he$_{i/j}$) **gave** money, Ali entered the university.'

In most Dargwa varieties, converbal clauses can be center-embedded, with some interpretational restrictions. However, Ashti is special in that center embedding also enforces the same-subject constraint on the converbal clause. In normal circumstances, i.e. with a finite synthetic main verb with no gender agreement slot, the subject ($\mathcal{A}/\mathcal{S}$ argument) of the converbal clause has to be the same as the subject of the main clause:

(9) ʔa̱li$_i$, [$\varnothing_{i/*j}$ a:s **d-ič:-ib**], uniwersitet-li ke:χ^w-i
A. money NPL-give.PFV-PCVB university-IN[LAT] enter.PFV-PRET.3
'Ali, **having given** money, entered the university.'

If the main clause contains a periphrastic form and the auxiliary has a gender slot, the same pattern is observed when the auxiliary agrees with $\mathcal{A}$ (which is the

7. Since the antipassive has no morphological marking of its own, this process could be viewed as a kind of verbal lability. See Sumbatova and Lander (2014) for convincing arguments against such an analysis.

unmarked and most frequent case). However, if auxiliary in the main clause agrees with $\mathcal{P}$ (hence the "inverse" pattern is observed), the subject reference in the converbal clause switches to $\mathcal{P}$:

(10) a. rasul.li-j, [qili-j w-id.až-ib.ži.la], pat'imat j-ulħ-unni
R.-DAT house.IN-EL M-go.away.PFV-since P. F-see.PFV-PRF
a-sa-**w** / * a-sa-**j**
NEG-3-M NEG-COP-F
'Since **he** left home, **Rasul** has not seen Patimat.'

b. rasul.li-j, [qili-j j-id.až-ib.ži.la], pat'imat j-ulħ-unni
R.-DAT house.IN-EL F-go.away.PFV-since P. F-see.PFV-PRF
a-sa-**j** / * a-sa-**w**
NEG-3-F NEG-COP-M
'Since **she** left home, Rasul has not seen **Patimat**.'

Given that the same-subject restriction on embedded converbs is generally very strong in Ashti, these data are significant. They demonstrate that when $\mathcal{P}$ triggers gender agreement on the auxiliary, it does get promoted to a higher syntactic status, although this cannot be the canonical subject as case marking is left unchanged.

It is important to observe that this behaviour is not observed for person agreement, i.e. the subject of center-embedded converbal clauses has to be coreferent with $\mathcal{A}$ even if the verb agrees with $\mathcal{P}$ according to the person hierarchy:

(11) pat'imat.li-j, [qil sąq'-ų̈n-mu:til], du ų̈lħ-unni
P.-DAT house.IN[LAT] come.PFV-PCVB-when I [M]see.PFV-PRF
a-da
NEG-1SG
'Patimat did not see **me** when (she) came home.'

Hence, person agreement and gender agreement of the auxiliary are not part of the same system after all, and the analysis in Belyaev (2016) has to be revised. While person agreement is hierarchical, gender agreement of the auxiliary is a special alternation which only occurs in 3rd person predications and which seems to promote the agreement controller to the status of syntactic pivot.

Thus, although discourse data suggest that $\mathcal{P}$ agreement is the pragmatically unmarked case, syntactically it is the other way around: clauses with $\mathcal{A}$ agreement pattern in the same way as synthetic clauses or clauses with 1/2 person agreement, while in clauses with $\mathcal{P}$ agreement the patient is promoted to subject-like status.

5 Sketch analysis

5.1 Gender controller as pivot

As data from only one construction cannot be used to argue in favour of a full-fledged analysis, in this section I will only provide a brief sketch of how I believe this situation

can be handled in LFG. Even though auxiliary gender agreement does seem to involve a kind of promotion, I see no need to go back to the biclausal analysis of Sumbatova (2014) or the more moderate version of Ganenkov (forthcoming). For describing the Ashti "inverse", the approach of Falk (2006) can be used which distinguishes between the traditional subject (renamed by Falk to $\widehat{\text{GF}}$, i.e. "most prominent argument"), object (OBJ), and a special grammatical function pivot (PIV). The pivot is structure shared with one of the core arguments in the following way:

- in syntactically accusative languages, $\widehat{\text{GF}}$ = PIV;
- in syntactically ergative languages, $\widehat{\text{GF}}$ = PIV in transitive clauses, OBJ = PIV in intransitive clauses.

Dargwa languages do not display any major features of syntactic accusativity. Most grammatical features are either tied to the traditional subject ($\mathcal{A}/\mathcal{P}$), or depend on the thematic or person hierarchy rather than grammatical function. The only feature of Dargwa grammar that is unquestionably ergative is gender agreement (apart from the auxiliary), which is always with the absolutive. But this pattern can be treated as morphologically triggered by absolutive case on the controller; assigning a special status to the absolutive argument is not required.

Therefore, the grammatical function PIV in Dargwa does not have to be identified with $\mathcal{S}/\mathcal{P}$, as in syntactically ergative languages. Neither do we have to assume that Dargwa is always accusative. A possible analysis is the following: PIV defaults to $\widehat{\text{GF}}$, but can switch to OBJ in constructions with an agreeing auxiliary. Notably, Falk does provide such a possibility for "topic-prominent" languages such as Acehnese, for which he proposes the following equation defining PIV:

(12) $(\uparrow \textsc{piv}) = (\uparrow \textsc{df})$

Thus the pivot is identified with a discourse function DF, although in the case of Ashti, as discussed in this paper, the identity of this DF is far from being clear.

Under this analysis, person agreement system stays the same as described in Belyaev (2016), namely, AGR is freely assigned to $\mathcal{A}$ or $\mathcal{P}$, and the result is then evaluated using a system of OT constraints.

5.2 Formalization

The description of agreement in Dargwa can be simplified by adopting the following templates (Asudeh, Dalrymple, and Toivonen 2013):

(13)
$$\begin{aligned}
&\textsc{@pers_agr} := && \{(\uparrow \textsc{agr}) = (\uparrow \widehat{\text{GF}}\ \textsc{agr}) \mid \\
&&& (\uparrow \textsc{agr}) = (\uparrow \textsc{piv agr})\} \\
&\textsc{@gend_agr}(_\textsc{gend}, _\textsc{num}) := && \Big(\uparrow \underset{(\rightarrow \textsc{case}) =_c \textsc{abs}}{\text{GF}} \textsc{agr gend}\Big) =_c _\textsc{gend} \\
&&& \Big(\uparrow \underset{(\rightarrow \textsc{case}) =_c \textsc{abs}}{\text{GF}} \textsc{agr num}\Big) =_c _\textsc{num}
\end{aligned}$$

The job of the person template is to ensure that person agreement is limited to core arguments. The syntactic components itself does not care about the controller of

person agreement: it is disjunctively assigned to subject or object. The hierarchical aspect of agreement is modeled as in Belyaev (2013, 2016) via a set of OT constraints on the person features and grammatical function of the argument whose AGR features are shared.

The template in (13) template can be introduced at the I node to ensure that it only applies to finite clauses:

(14) $\text{IP} \rightarrow \underset{\uparrow=\downarrow}{\text{S}} \quad \underset{\uparrow=\downarrow}{\underset{@\text{PERS\_AGR}}{\text{I}}}$

The gender template is added to all clause-level elements that contain gender agreement slots, e.g.:

(15) *wac'a-c:i-w* N
$(\uparrow \text{PRED}) = \text{`forest'}$
$(\uparrow \text{AGR GEND}) = \text{NEUT}$
$(\uparrow \text{AGR NUM}) = \text{SG}$
$@\text{GEND\_AGR}(\text{M}, \text{SG})$

For the agreeing auxiliaries, a separate template is required as they are not connected to the absolutive argument but rather to the pivot:

(16) $@\text{PIV\_AGR}(\text{\_GEND}, \text{\_NUM}) :=$
$(\uparrow \text{PIV AGR GEND}) =_c \text{\_GEND}$
$(\uparrow \text{PIV AGR NUM}) =_c \text{\_NUM}$

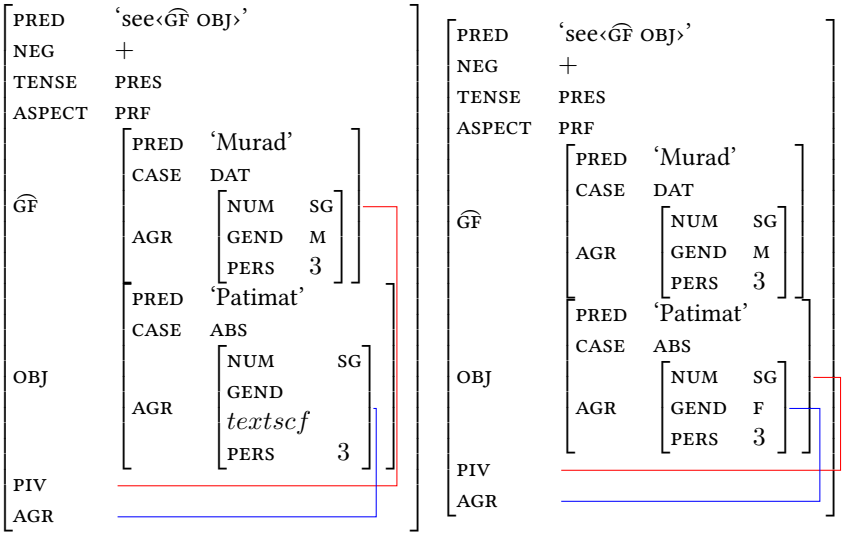
Certainly, this may be viewed as less economical than having a single rule for all gender agreement. However, stipulation of a biclausal structure is hardly better. Furthermore, separate rules are already required for NP-internal gender agreement (such as adjectives with their heads), which does not require the controller to stand in the absolutive case.

With these templates, the entries for the 2nd person marker and the 3rd person auxiliary with a gender slot will have the following form:

(17) *=di* I
$(\uparrow \text{TENSE}) = \text{PRES}$
$(\uparrow \text{AGR PERS}) = 2$
$(\uparrow \text{AGR NUM}) = \text{SG}$
$(\uparrow \text{PIV}) = (\uparrow \widehat{\text{GF}})$

=sa-j I
$(\uparrow \text{TENSE}) = \text{PRES}$
$(\uparrow \text{AGR PERS}) = 3$
$@\text{PIV\_AGR}(\text{F}, \text{SG})$
$\{ (\uparrow \text{PIV}) = (\uparrow \widehat{\text{GF}}) \mid$
$(\uparrow \text{PIV}) = (\uparrow \text{OBJ}) \}$

Below, side by side, are shown the examples of subject and object agreement following this analysis:



5.3 Further questions

This interpretation of the data leads to new questions. First, why is 1/2 person agreement "glued" to gender agreement when both are present on auxiliary?

(18) a. u-dil t'ut' sa.q:-ib-zi-**w=di** / *sa.q:-ib-zi-b(=di)
thou-ERG bread N-bring.PFV-PCVB-ATTR-M=2SG -N(=2SG)
'You (m.) have brought bread.'

b. dam hantaj‹b›ug-un=da [u-dil t'ut' sa.q:-ib-zi-**b**
me.DAT ‹N›forget.PFV-PRF=1 thou-ERG bread bring-PCVB-ATTR-N
b-uχ-ni]
N-be.PFV-MSD
'I have forgotten that you've brought **the bread**.'

In Belyaev (2016), this was explained by assigning person and auxiliary gender agreement to the same syntacic mechanism, but we have seen that this cannot be the case. It rather seems that the presence of 1st and 2nd person features somehow blocks the syntactic machinery involved in gender agreement.

Furthermore, there is no explanation for asymmetry between $\mathcal{A}$ and $\mathcal{P}$ agreement observed above, both in their pragmatic function and in $\mathcal{A}$ being the default pivot. A more explanatory approach would be desirable, but requires additional evidence; this preliminary treatment may be viewed as only one step towards an ultimate solution.

6 Conclusion

In this paper, I have analyzed two main questions related to the mystery of variable gender agreement on auxiliaries in Ashti and Kubachi Dargwa. First, I have provided

an evaluation of the topicality hypothesis of gender agreement based on a corpus of Kubachi texts. The texts demonstrate that while topicality does seem to determine agent agreement, it does not play a significant role in patient agreement, pointing to an asymmetry between the two types. Second, I have provided a reevaluation of the syntactic status of agreement in Ashti, showing that the controller of gender agreement is assigned syntactic pivot status. A tentative LFG analysis is provided, but many questions remain for further research.

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In Defense of COMP: Complementation in Moksha Mordvin

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Abstract

In this paper, we argue that an adequate description of Moksha Mordvin[1] complement clauses requires preserving the traditional LFG distinction between OBJ and COMP grammatical functions. Most clausal complements in Moksha belong to one of the two major types: clauses headed by deverbal nouns (nominalizations) and finite complement clauses introduced by complementizers. The behaviour of nominalized clauses mostly corresponds to the behaviour of nominal arguments, such that they can be distributed between the grammatical functions SUBJ, OBJ, and OBL, without the need for an extra COMP function. Similarly, the majority of finite complements can be viewed as SUBJ, OBJ and OBL depending on the case form of their proforms and quantificational modifiers and the presence of object agreement on the verb. However, a subset of verbs does not fit into this classification: on the one hand, their complements do not trigger object agreement; on the other hand, they cannot be viewed as SUBJ or OBJ, because they cannot be replaced by nominal proforms and cannot be accompanied by any quantificational modifiers. We conclude that an additional grammatical function COMP must be used to account for the behaviour of these complement clauses.

1 Introduction

The status of complement clauses has been subject to debate in recent LFG literature. In early LFG (Kaplan and Bresnan 1982), finite complements were viewed as belonging to a special grammatical function (GF) COMP, reserved for clausal arguments and distinct from such nominal argument GFs as SUBJ, OBJ, and OBL_θ. However, this was never an integral part of the framework, nor was sufficient empirical support for this analysis originally provided; hence, many authors (Alsina, Mohanan, and Mohanan 2005; Forst 2006; Patejuk and Przepiórkowski 2016) have argued, from different evidence, that COMP is a redundant GF, and all clausal arguments can be assimilated to the core GFs. A different line of reasoning maintains that while some or even most complement clauses indeed behave like ordinary subjects, objects, and obliques, others display different behaviour and do require a special GF (Dalrymple and Lødrup 2000; Lødrup 2004). Lødrup (2012) has even extended the use of COMP to some *nominal* arguments in Norwegian, thus depriving it of some of its redundancy as a special GF for clauses.

In light of this debate it is interesting to consider data from languages where verbal arguments are encoded by agreement markers on the verb, which thus signal their belonging to the argument structure of the latter. In some Uralic languages direct objects can optionally trigger verbal agreement marker, as e.g. in Moksha-Mordvin.

Moksha Mordvin[2] is a language of the Finno-Ugric branch of the Uralic lan-

1. This research has been supported by RFBR, grant no. 16-06-00226.

2. Glosses follow the Leipzig Rules (`https://www.eva.mpg.de/lingua/resources/glossing-rules.php`), with the addition of the abbreviations ADD: additive, CN: connegative,

guage family. Among Finno-Ugric languages, it is characterized by a rather elaborate system of verb morphology. In particular, Moksha distinguishes between subject-only (SU) and subject-object (SO) verb agreement markers (Koljadënkov and Zavodova, 1962; Molnár, 2001). While all intransitive verbs use the SU agreement set (1), transitive verbs may vary between SO (2) and SU (3) marking depending on the marking of the direct object (nominative or definite genitive), which, in turn, is regulated by a complex set of patterns, similarly to other instances of Differential Object Marking (Dalrymple and Nikolaeva 2011).

(1) *son* ***sa-s'*** *kud-u*
s/he[NOM] come-PST.3SG house-LAT

'S/he **came** (SU) home.'

(2) *son* ***s'uc'-əz'ə*** *id'-ənc*
s/he[NOM] scold-PST.3SG.O.3SG.S child-3SG.POSS.SG.GEN

'S/he **scolded** (SO) the child.'

(3) *son* ***s'uc'-əs'*** *c'ora-n'ɛ*
s/he[NOM] scold-PST.3SG boy-DIM

'S/he **scolded** (SU) a boy.'

The choice of the agreement pattern is regulated by the definiteness and animacy of the DO, aspectual properties of the verb etc. (Bartens 1999, 125). Compare Molnár (2001), É. Kiss (2004) for Hungarian, Nikolaeva (1999) for Khanty, Nikolaeva (2014) for Nenets. For the rules of DOM and agreement in Moksha, see Toldova (in press) and Kozlov (in press).

Moksha is also notable for a rather diverse array of clause combining strategies; in particular, complement clauses can be expressed either as finite CPs (see below) or nominalized verb forms (4–5) that occur with a wide variety of case markers:

(4) *mon* *falu* *jukšn'ə-sa* *šava-n'ɛ-t'n'ə-n'*
I[NOM] always forget.HAB-NPST-3SG.O.1SG.S plate-DIM-DEF.PL-GEN
šta-kšn'ə-ma-t'
wash-HAB-NMLZ-DEF.SG.GEN

'I always forget (SO) **to wash** (nmlz.) dishes.'

DIM: diminutive, EL: elative, EXST: existential verb, HAB: habitual, ILL: illative, IN: inessive, LAT: lative, NPST: nonpast, O: direct object (person-number marker), PQP: pluperfect, PROL: prolative case, PRON: pronominal, S: subject (person-number marker), TMPR: temporal case.

(5) *paša* *s'iz'-s'* ***tonafn'-əma-stə-nzə***
Paul[NOM] be.tired-NPST.3SG learn-NMLZ-EL-3SG.POSS

'Paul is tired (SU) **of studying** (nmlz.).'

Transitive verbs can either take the SO agreement markers or SU, depending on the matrix verb and the semantics of the complement clause. Thus, 'know' generally uses the SO pattern (6) while 'promise', the SU pattern (7):

(6) *učit'əl'-s'* ***soda-si-n'ə*** / **soda-s'* [***što***
teacher-DEF.SG[NOM] know-NPST.3PL.O.3SG.S know-NPST.3SG COMP
pet'ɛ *er'* *mejn'ɛ* *vor'g-əčn'-i* *urok-stə*]
Peter every what.TMPR run.away-IPFV-NPST.3SG class-EL

'The teacher **knows** (SO) **that** Peter always misses classes.'

(7) *paša* ***abəščanda-s'*** / **abəščanda-z'ə* [***što***
Paul[NOM] promise-PST.3SG promise-PST.3SG.O.3SG.S COMP
iļ'caman' *kud-u*]
accompany.NPST.1SG.O.3SG.S house-LAT

'Paul **promised** (SU) **that** he would accompany me home.'

The indirect object complements do not trigger verbal agreement, like nominal indirect objects:

(8) *sosec'* ***ken'ɛr'čn'-i*** [***što*** *mi-z'ə*
neighbour.DEF.SG[NOM] rejoice.HAB-NPST.3SG COMP sell-PST.3SG.O.3SG.S
traks-ənc *pitn'i-stə*]
cow-3SG.POSS.SG.GEN expensive-EL

'My neighbour **is glad** (SU) **that** he has sold the cow at a high price.'

In this paper, we claim that the constructions exemplified above have the following structure. Nominalizations are NPs occupying the corresponding standard grammatical functions SUBJ, OBJ and OBL_θ, while all finite complements are CPs at c-structure. At the same time, most finite complements show no major differences from noun phrases in their f-structure behaviour: finite complements following the SO pattern are OBJ, while many finite complements following the SU pattern behave like SUBJ or OBL_θ in terms of f-structure. However, a small but significant class of complements does not display nominal properties and has to be viewed as occupying a separate grammatical function COMP.

In other words, our aim is to demonstrate that complementation in Moksha is neither reducible to the standard nominal grammatical functions SUBJ, OBJ and OBL_θ nor to the distinction between c-structure categories. Rather, both a separate

grammatical function COMP and the distinction between NP and CP are required in order to provide an adequate analysis. In terms of LFG, we are going to show that Moksha complementation involves the following oppositions: NP vs. CP at the c-structure, and SUBJ vs. OBJ vs. OBL_θ vs. COMP at f-structure.

2 The system of complementation

We will first consider the syntactic properties of nominalizations and finite complement clauses. We will analyze their morphological properties and their syntactic properties such as the external distribution and the internal structure.

2.1 Nominalizations

One of the non-finite complementation strategies is the nominalization in *-ma*.[3] In terms of c-structure, nominalizations are clearly NPs. First, they take all the nominal inflectional markers, including case and possessive markers (9) and nominal plural markers (10):

(9) *mon* ***ken'ɛ'r'd'-an*** [*son'* ***sa-ma-də-nzə***]
I[NOM] be.happy-NPST.1SG s/he.OBL come-NMLZ-ABL-3SG.POSS

'I **am glad** (SU) **of** his **coming**.'

(10) *mon* ***tonad-ən'*** [*son'* ***sa-kšn'ə-ma-nzə-ndi***]
I[NOM] be.accustomed-PST.1SG s/he.OBL come-HAB-NMLZ-3SG.POSS.PL-DAT

'I **am accustomed** (SU) **to** his **visits** (lit. his **comings**).'

Second, nominalizations have external nominal distribution. This means that they can be used as complements of postpositions (11) and they can be promoted to the subject in passive (12).

(11) *mon* ***atkəz-an*** [*es'* *šta-ma-z'ə-n'* ***ez-də***]
I[NOM] refuse-NPST.1SG self wash-NMLZ-1SG.POSS-GEN in-ABL

'I **refuse** (SU) to wash myself.'

(12) *ičkəz'də* ***mar'a-v-s'*** / *mar'a-v-s't'* ***raka-ma-s'***
from.afar hear-PASS-PST.3SG hear-PASS-PST.3PL laugh-NMLZ-DEF.SG[NOM]
i ***mora-ma-s'***
and sing-NMLZ-DEF.SG[NOM]

'**Laugh** and **singing was heard** (SU) from afar.'

3. For the purposes of this paper, we exclude infinitival complements from consideration.

Another feature of nominalized DOs is obligatory SO agreement. In the DO position of transitive verbs nominalizations trigger SO agreement and occur in genitive case (13).

(13) *mon* *kel'k-**sa*** [*t'ɛ* *s't'ix-t'* ***azəndə-ma-t'***]
I[NOM] like-NPST.3SG.O.1SG.S this poem-DEF.GEN tell-NMLZ-DEF.SG.GEN

'I **like** (SO) **to tell** this poem.'

Third, nominalizations are internally structured as NPs. This is observed in their internal word order, DO marking, and the encoding of modifiers. Nominalizations have verb-final word order (SOV), unlike the basic word order in independent sentences, which is SVO. This conforms to the predominantly head-final NP syntax (15), see Plešak (in press).

(14) a. *son* ***juksta-z'ə*** [***šava-n'ɛ-n'*** / ****šava-n'ɛ-t***
s/he[NOM] forget-PST.3SG.O.3SG.S dish-DIM-GEN dish-DIM-PL
šta-ma-t']
wash-NMLZ-DEF.SG.GEN

'S/he **forgot** (SO) to wash **the dishes**.'

b. *son* *šta-j* *šava-n'ɛ-t*
s/he[NOM] wash-NPST.3SG dish-DIM-PL

'S/he washes (SU) dishes.'

(15) *baba-z'ə* *kaja-s'* *lɛm* ***vas'ɛ-n'*** ***tar'elka-s***
grandmother-1SG.POSS.SG[NOM] pour-PST.3SG soup Basil-GEN plate-ILL

'My grandmother poured (SU) some soup **into Basil's plate**.'
(Plešak in press, ex. 72)

DOs in independent clauses occur either in the definite genitive, or in the nominative. However, nominalizations take the DO in the *in*definite genitive, like NP possessors, cf. (14a) and (15). In contrast, nominative DOs are not allowed, unlike in finite clauses (14b).

Another nominal feature is the possibility of using adjectives to modify nominalized clauses (16). This possibility is banned in finite clauses.

(16) *mon* *iz'-in'ə* ***uč-ə*** *ton'* *is'ak* / ***is'akən'***
I[NOM] NEG.PST-PST.3.O.1SG.S wait-CN you.OBL yesterday yesterday's
sa-ma-c'ə-n'
come-NMLZ-2SG.POSS.SG-GEN

'I didn't **expect** (SO) you to come **yesterday**.' (lit. 'I didn't expect your yesterday's coming')

Thus, nominalizations have both morphological and syntactic properties of NPs, in what concerns their internal structure and external distribution. Free variation between nominal and verbal encoding of internal constituents, such as the possibility of alternatively using adjectives or adverbs (16), means that nominalizations in Moksha have a mixed structure, with a clausal layer (of category S, since Moskha shows no evidence of a VP constituent) embedded under a nominal layer. The analysis of Bresnan and Mugane (2006), and similar analyses involving "category sharing", seem adequate for Moksha.

Other grammatical features of nominalizations show that they can be assimilated into the grammatical functions SUBJ, OBJ and OBL at f-structure. Nominative-marked nominalizations can be treated as SUBJs. Nominalizations in the definite genitive (which in Moksha can mark DOs), when they serve as arguments of matrix verbs, can be promoted to subject in passive constructions and trigger object agreement on the verb, which clearly classifies them as OBJ. In oblique cases, nominalizations, like oblique NPs, are not coindexed on the verb in any way, and are distributionally indistinguishable from oblique NPs, hence their GF can be treated as OBL; there is no need to stipulate a special GF.

Hence, we conclude that at f-structure, nominalization can be assimilated to SUBJ, OBJ and OBL; there is no need for a separate function COMP.

2.2 Finite complements

2.2.1 C-structure status

Unlike nominalizations, finite complement clauses are definitely not NPs. They do not have nominal morphology. In terms of external distribution, finite clauses do not behave like NPs: they can only be clause-level arguments and cannot serve as complements of adpositions or nominal dependents.

The internal syntax of finite complement clauses is also different from that of NPs. First, word order in complement clauses is free, like in independent sentences, consider (17) and (18):

(17) a. *vas'ɛ* *lɛd'-i* *tišə*
Basil[NOM] mow-NPST.3.SG grass[NOM]

b. *tišə* *lɛd'-i* *vas'ɛ*
grass[NOM] mow-NPST.3SG Basil[NOM]

'Basil is mowing (SU) the lawn (lit. grass).' (Toldova 2017).

(18) a. *mon* *iz'-in'ə* ***n'ɛj-ə*** [***štobə*** *vas'ɛ*
I[NOM] NEG.PST-PST.3.O.1SG.S see-CN COMP Vasya[NOM]
st'ixətvər'en'ijə *tonafn'-əl'*]
poem learn-PQP.3SG

b. *mon* *iz'-in'ə* ***n'ɛj-ə*** [***štobə*** *vas'ɛ*
I[NOM] NEG.PST-PST.3.O.1SG.S see-CN COMP Vasya[NOM]
tonafn'-əl' *st'ixətvər'en'ijə*]
learn-PQP.3SG poem

'I didn't **see** (SO) Basil learn the poem.'

Second, DOs in complement clauses cannot be marked with the indefinite genitive, while unmarked DOs are allowed (19), exactly as in independent sentences.

(19) *son* *n'ɛj-s'* ***pin'ə***/ **pin'ə-n'*
s/he[NOM] see-PST.3.SG dog dog-GEN

'S/he saw (SU) **a dog**.' (Toldova 2017)

The verb can be modified by adverbs only; adjectives in adverbial function are not grammatical.

Thus in c-structure finite complements should thus be treated as CPs displaying fully clausal internal structure.

2.3 F-structure status: SU vs. SO agreement with finite complements

In spite of their non-nominal c-structure syntax, most clausal complements introduced by the subordinators *što*, *štobə* 'that', *koda* 'how', *məz'ardə* 'when' can be assimilated to the grammatical functions OBJ and OBL_θ.

Complement-taking predicates (CTPs) that take the complementizers *što* 'that' and *məz'ardə* 'when' can be used in both SU and SO patterns, as shown above in (6–7). In the case of transitive CTPs, whether the complement can trigger object agreement is largely lexically determined by the verb, and mostly correlates with factivity. Factive complements can be roughly defined as those complements whose truth value is presupposed to be true, see Kiparsky and Kiparsky (1970) and later work. The presupposed information cannot be negated by the same speaker in the subsequent context. Thus, the verb *know* is infelicitous in sentences like (20), because it often introduces presupposition of the truth of its complement. By contrast, verbs like *think* and *suppose* do not have such a presupposition; they introduce non-factive complements.

(20) He thinks / # knows that Joan has left, but that is not true.

Factivity seems to play the crucial role while determining the choice of the agreement pattern of CTPs in Moksha-Mordvin.[4] For example, in (6) the verb *sodams* 'know' introduces a complement that is presupposed to be true: its truth

4. This situation is broadly similar to other languages where factive complements are more "object-like" than non-factives; see Kastner (2015) on the syntactic correlates of factivity in clausal complements.

is preserved under negation and in a question ('The teacher doesn't know that …' / 'Does the teacher know that … ?'). Therefore, this verb most often takes the SO pattern. By contrast, in (7) the verb 'promise' occurs with the SU pattern; the SO pattern is unacceptable. This is easily explained by the fact that the meaning of 'promise' presupposes the falsity of the dependent clause at the moment the sentence is uttered (something that is already done cannot be promised). Hence, the complement in (7) is a non-factive proposition, which is usually introduced by SU.

Serdobolskaya and Kozhemyakina (2014) consider 24 CTPs that take finite complements. Among them, there are CTPs that have a strong preference towards one of the agreement patterns or even only allow one of the agreement patterns. This group consists of factive verbs ('know', 'forget (that)'), showing preference towards SO, and the verbs that take a complement with an irrealis meaning ('fear', 'hope') or a false truth value ('promise'). With factive verbs, the SU pattern can be used in the presupposition-opaque context, i.e. if the presupposition does not project, see Karttunen (1973) and Beaver and Geurts (2012). With non-factives, the SO can be used in the case of the semantic shift implying the factivity reading of the complement. Consider the following examples:

(21) a. *mon* ***iz'-in'ə*** ***ars'-ə*** [***što*** *son* *t'aftamə*
I[NOM] NEG.PST-PST.3.O.1SG.S think-CN COMP s/he[NOM] so
s'ir'ə], *son* *pɛk* *octə* *n'ɛft'-i*
old s/he[NOM] very new.EL look-NPST.3SG

{Context: 'Why didn't you help Mariya Ivanovna with the heavy bags? She's already past 80! –} I didn't **think** (SO) she's that old, she looks young.'

b. ***t'a-t*** / **t'a-k* ***ars'-ə*** [***što*** *mon* *ton'*
PROH-IMP.SG PROH-IMP.3SG.O.SG.S think-CN COMP I[NOM] you.OBL
mel'-gə-t *šta-sajn'ə* *šava-n'ɛ-t'n'ə-n'*]
after-PROL-POSS.2SG wash-NPST.3PL.O.1SG.S dish-DIM-DEF.PL-GEN

'Don't **think** (SU) **that** I will wash the dishes after you.'

In (21a) the verb 'think', used in the meaning close to 'realize, become aware of', introduces a factive presuposition in terms of Kiparsky and Kiparsky (1970), and thus, the SO pattern is used. In its regular meaning ('believe, suppose') this verb usually takes the SU pattern, see (21b). The most frequent pattern with *ar's'əms* / *dumandams* 'think' is SU; the SO pattern is, however, possible in some special contexts where the meaning shift is observed.

Some CTPs allow both agreement patterns, e.g. 'wait', 'understand'. With these verbs, the SO pattern is chosen if the context implies the factivity of the complement, and the SU pattern is chosen otherwise.

Thus, factive complements occur with SO, while non-factive propositions trigger the SU pattern.

Apart from factive and non-factive propositions, many authors distinguish a separate class of event (state-of-affair) complements such as the complements of direct perception verbs:

(22) *pet'ɛ* *pəžaluj* *aš* *kucə.* *mon* ***iz'-in'ə*** /
Peter[NOM] probably NEG.EXST house.IN I[NOM] NEG.PST-PST.3.O.1SG.S
iz'-ən'* ***n'ɛj-ə* [***koda*** *son* *sa-s'*]
NEG.PST-PST.1SG see-CN how he come-PST.3SG

'Peter is probably not at home. I didn't **see** (SO) him return (so probably he didn't return).'

Events and propositions (both factive and non-factive) are delimited based on several criteria such as the possibility to have a truth value, contain negation, be located in space and time and have duration, see Asher (1993) and Peterson (1997). Similar distinctions are introduced in Ransom (1986) (in terms of *truth* vs. *occurrence*) and Dik (1997) (in terms of *facts* / *possible facts* vs. *states-of-affairs*).

In Moksha Mordvin event (state-of-affair) complements occur with a dedicated complementizer *koda* 'how' and obligatorily trigger the SO pattern, as seen in (22). This example also shows that this is the case even if the complement clause denotes a situation that did not happen.

Thus, events and facts require the SO pattern, while the SU pattern is used with non-factive propositions. We refer the reader to Serdobolskaya and Kozhemyakina (2014) for further information on the semantics of complementation in Moksha.

2.3.1 SO-complements as OBJ

The discussion of the status of complement clauses as objects in current literature (Dalrymple and Lødrup 2000; Moulton 2009; Kastner 2015) is mostly based around the following evidence. Many languages make a distinction between complements that can be promoted to subject in passive (23), and between complements that are or are not be referred to by the same anaphoric device as used for NPs (*I believe it* vs. *I believe so*).

(23) a. That the earth is round was not believed.
b. *That it would rain was hoped. (Dalrymple and Lødrup 2000, 5–6)

Coordination with a non-derived noun is also considered, see (24).

(24) a. * John claimed responsibility and that the building collapsed
b. ? John denied the allegations and that the building collapsed
(Kastner 2015, 173)

Two other related criteria introduced by Letuchiy (2012) are the possibility of pleonastic anaphora with extraposition of the complement (*I believe it that he has come*) and the possibility of quantification of several complements of the same syntactic type (*I believe everything: that he has come and that he has passed the exam*).

According to these criteria, Mordvin SO complements seem to belong to the nominal type. In addition to triggering object agreement, which is only allowed for DOs, they can become the subject if the matrix verb is passivized:

(25) *son'-d'ejə-nzə* ***soda-v-s'*** [***što*** *son'* *jora-saz'*
he.OBL-PRON.DAT-3SG.P know-PASS-PST.3SG COMP he.OBL want-NPST.3.O.3PL.S
vaļt-əm-s]
dismiss-INF-ILL

'It **was known** (SU) to him **that** they would dismiss him.'

Next, they allow pronominalization along the nominal pattern, namely, they can be replaced by the nominal pro-form *t'ɛn'* 'this':

(26) *mon* *kunarə* *soda-jn'ə* [*što* *vas'ɛ* *ašč-əl'*
I[NOM] for.a.long.time know-PST.3.O.1SG.S COMP Basil[NOM] be-PQP.3SG
t'ur'ma-sə]— *də* *mon-gə* ***t'ɛ-n'*** *soda-sa*
prison-IN yes I-ADD this-GEN know-NPST.3SG.O.1SG.S

'I have known (SO) for a long time that Basil had been in prison. – Yes, I know (SO) **it** too.'

They can also cooccur with a pleonastic pronoun of the same type:

(27) *mon* ***t'ɛ-n'*** *soda-sa* [*što* *vas'ɛ* *ingəl'ə*
I[NOM] this-GEN know-NPST.3SG.O.1SG.S COMP Basil[NOM] front.IN
ašč-əs' *t'ur'ma-sə*]
be.located-PST.3SG prison-IN

'I know (SO) **it** that Basil was in prison before.'

Next, they can be replaced by a quantifier:

(28) *učit'əl'-s'* *n'ɛj-əz'ə* ***s'embə-t'*** [***koda***
teacher-DEF.SG[NOM] see-PST.3SG.O.3SG.S all-DEF.SG.GEN how
kola-jt' *val'mə-t'*] *i* [***koda*** *r'isava-jt'*
break-PST.3.O.2SG.S window-DEF.SG.GEN and how draw-PST.3.O.2SG.S
s't'ena-t']
wall-DEF.SG.GEN

'The teacher saw (SO)**everything**: **how** you broke the window and **how** you painted on the wall.'

Finally, they can be coordinated with a non-derived noun:

(29) *mon* *pel'-an* *t'ɛ* *c'ora-t'* *ez-də* *son*
I[NOM] fear-NPST.1SG this boy-DEF.SG.GEN in-ABL s/he[NOM]
soda-si *mon'* ***kud-əz'ə-n'*** *i* [***što*** *pozdə*
know-NPST.3SG.O.3SG.S I.OBL house-1SG.POSS.SG-GEN and COMP late
sa-šənd-an *kud-u*]
come-IPFV-NPST.1SG house-LAT

'I'm afraid (SU) of this fellow. He **knows** (SO) where I live (lit. he knows my **house**) and **that** I come home late.'

All of this shows that the most parsimonious analysis would treat such complements as OBJ, without stipulating additional grammatical functions.

2.3.2 SU-complements as COMP

However, a minority of finite complement clauses are not easily classified as either direct objects or obliques. Non-factive finite complements do not control matrix verb object agreement and cannot be promoted to subject by passivization of the matrix verb (with the reservation on some special constructions with *ar's'əms* and *dumandams* 'think').

Non-factive complements cannot be replaced by the nominal proform *t'ɛn'* 'this'; the adverbial *t'aftə* 'thus' must be used instead:

(30) *nu* *mon* ***t'aftə***/ **t'ɛ-n'* *af* *dumand-an*
well I[NOM] thus this-GEN NEG think-NPST.1SG

{Context: 'Basil is so smart, he will surely pass the exams with excellent marks! —} Well, I do not think (SU) **so** / *that.'

They make use of the pleonastic pronoun of the same type:

(31) *vas'ɛ* {***t'aftə*** *iz'* *koɣta* / **t'ɛ-n'* *iz'-in'ə*
Basil[NOM] thus NEG.PST.3SG say.CN this-GEN NEG.PST-PST.3.O.1SG.S
koɣta } [***što*** *son* *pastupanda-s'* *institut-u*]
say.CN COMP he[NOM] enter-PST.3SG institute-LAT

'Basil didn't say (SU) it (lit. **so**) **that** he would enter the university.'

They cannot be replaced by a quantifier. If a quantifier is used, native speakers can in some cases switch to the SO pattern, but the meaning of the verb is shifted. For example, 'think' is interpreted as 'consider, ponder on'.

(32) *mon* ***ar's'-əsa*** ***s'embə-n'*** [***što*** *son*
I[NOM] think-NPST.3SG.O.1SG.S all-GEN COMP s/he[NOM]
pastupanda-j *institut-u*] *i* [***što*** *mu-j* *c'ebɛr'*
enter-NPST.3SG university-LAT and COMP find-NPST.3SG good
rabota]
job

'I **consider** (SO, *SU) **all** the situations, **that** he will enter the university and **that** he will find a good job.'

They mostly cannot be coordinated with a non-derived noun (unless the matrix verb uses the SO pattern, as in examples above):

(33) *mon* ***ar's'-əsan*** / **ar's'-an* *t'a-kə* ***mɛl'-t'***
I[NOM] think-NPST.3SG.O.1SG think-NPST.1SG this-ADD thought-DEF.SG[NOM]
kona-n' *i* *ton* *i* [***što*** *vas'ɛ* *ər'vɛjɛ-j*
which-GEN and you and COMP Vasya[NOM] marry-NPST.3SG
maša-n' *lank-s*]
Masha-GEN on-ILL

'I have (lit. **think**, SO, *SU) the same **thought** as you and also **that** Basil will marry Mary.'

This distinguishes these complements from both OBJ and OBL_θ complements, as the latter use various case forms of the pronoun *t'ɛn'* 'this'. All of this shows that such complements do not cluster with either SUBJ, OBJ or OBL_θ arguments.

2.3.3 Oblique arguments of intransitive verbs as OBL_θ

There are a number of intransitive matrix verbs that take finite complements. These complements take the same complementizers *što*, 'that', *štobə* 'in order to', *koda* 'how' and *məz'ardə* 'when' (34)–(35). Clearly, unlike with nominalized arguments, the oblique case feature cannot be expressed on a finite verb; therefore, it is not at all obvious that such complements are indeed obliques, and do not belong to the type discussed in the previous section.

(34) *mon* ***pel'-an*** *t'ɛ* *c'ora-t'* ***ez-də***
I[NOM] fear-NPST.1SG this boy-DEF.SG.GEN in-ABL

'I **am afraid** (SU) **of** this fellow.

(35) *mon* ***pel'-an*** [***što*** *vas'ɛ* *pozdə* *sa-j*
I[NOM] fear-NPST.1SG COMP Basil[NOM] late come-NPST.3SG
kud-u]
house-LAT

I **am afraid** (SU) **that** Basil will come home late.

The oblique status of this class of complements is shown through the use of diagnostics considered above: they can be pronominalized by the 'nominal' anaphoric pronoun *t'ɛn'* 'this', which takes the corresponding oblique case (36), and allow extraposition with the pleonastic use of the same pronoun (37):

(36) *mon* *dumand-an* [*što* *vas'ɛ* *af* *pastupanda-v-i*]
I[NOM] think-NPST.1SG COMP Basil[NOM] NEG enter-PASS-NPST.3SG
institut-u — *mon* *tožə* ***t'a-də*** *pel'-an*
institute-LAT I[NOM] also that-ABL fear-NPST.1SG

'I think (SU) that Basil will not enter the university. — I am afraid (SU) **of that** as well.'

(37) *mon* ***t'a-də*** *pel'-an* [***što*** *vas'ɛ* *pozdə* *sa-j*
I[NOM] that-ABL fear-NPST.1SG COMP Basil[NOM] late come-NPST.3SG
kud-u]
house-LAT

'I am afraid (SU) (lit. **of it**) **that** Basil will come home late.'

These complements allow replacement by quantifiers, just as SO-complements:

(38) *da* *mon* ***s'əmbə-də*** ***pel'-an*** [***što*** *af* *pastupand-at*
PTCL I[NOM] all-ABL fear-NPST.1SG COMP NEG enter-NPST.2SG
institut-u] *i* [*af* *muj-at* *rabota*]
institute-LAT and NEG find-NPST.2SG work

{Context: 'What are you afraid of, why worry? —} I **am afraid** (SU) **of everything**, both **that** you won't enter the institute and **that** you won't find a job.

Finally, they allow coordination with non-derived nouns:

(39) *mašə* *ken'ɛr'd'-i* ***p'at'orka-t'i*** *i* ***što*** *t'ad'a-c*
Mary rejoice-NPST.3SG five.mark-DEF.SG.DAT and COMPL mother-3SG.POSS.SG
son' *karma-j* *šna-mə*
s/he.OBL begin-NPST.3SG compliment-INF

'Mary rejoices **at the 'five'** (= A mark) and **that** mother is going to praise her.'

Thus, the pro-forms of complements that occupy the position of the oblique arguments of the verb show all the properties of oblique NPs. Hence, such complements can be classified as OBL.

3 Discussion

3.1 Generalization

A generalization that emerges from the above is that a minority of finite complement clauses introduced by *što*, *štobə* and *məz'ardə* and denoting non-factive propositions are not easily classified as either direct objects or obliques. They do not control matrix verb object agreement and cannot be replaced by the nominal proform *t'ɛn'* 'this'; the adverbial *t'aftə* 'thus' must be used instead. The same issue concerns pleonastic uses of the pronouns. They do not allow replacement by the quantifier 'all' and are not coordinated with non-derived nouns. This distinguishes these complements from SUBJ, OBJ and OBL_θ complements, as the latter use various case forms of the pronoun *t'ɛn'* 'this'. This is summarized in the following table:

Comp. type	**Factive**	**Nominal** morph.	**Internal** structure	**PP**	**SO agr.**	**Pass.**	**Pron.**
nmlz.	+/−	+	nominal	+	+/−	+	+
finite comp., obj. (SO-agr.)	+	−	clausal	−	+	+	+
finite comp., obj. (SU-agr.)	−	−	clausal	−	−	−	−
finite comp., obl.	+/−	−	clausal	−	−	−	+

3.2 Analysis

From the table above, we can see that all nominalizations can be uncontroversially treated as belonging to the standard grammatical functions. All finite clauses are different from nominalizations in that they lack any nominal morphology and have clausal internal structure and external distribution. In terms of LFG, this represents the difference between NP and CP status at c-structure: while nominalizations are NPs, finite complements are CPs.

At f-structure, most of the finite clauses can also be treated as OBJ or OBL_θ, like nominalizations. However, non-factive complements are an exception, as they have a number of unique features, such as the use of the adverbial proform *t'aftə* 'thus', the preference against coordination with non-derived nouns and the

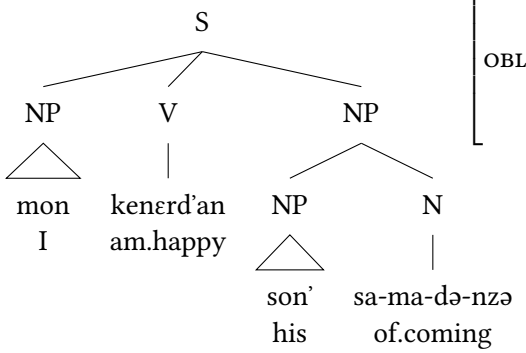
impossibility to be replaced by quantified NPs. Clearly, these features cannot be due to differences in c-structure categorial status, as all finite complements have clausal status and must be treated as CPs according to other criteria. In LFG terms, an adequate description of Moksha data requires stipulating an additional grammatical function: COMP.

This line of reasoning can be summarized in the following classification of Moksha complement clauses in LFG terms:

	NP	CP
SUBJ	*-ma*	*što, məz'ardə*
		('be wanted', 'be liked', 'be shameful' e.a.)
OBJ	*-ma-t'*	*što, štobə, koda, məz'ardə*
		('know', 'see', 'forget' e.a.)
OBL	*-ma* + OBL	*koda, məz'ardə, što, štobə*
		('rejoice', 'fear', 'be.surprised' e.a.)
COMP	–	*što, štobə, məz'ardə*
		('think', 'promise', e.a.)

By way of illustration, consider the proposed c- and f-structures for three examples. First, in (40), is the structure of (9): a nominalized clause with an oblique complement. Like nominal arguments, such a complement does not trigger verb agreement, but has both NP status at c-structure and OBL_{ABL} status at f-structure.[5]

(40)



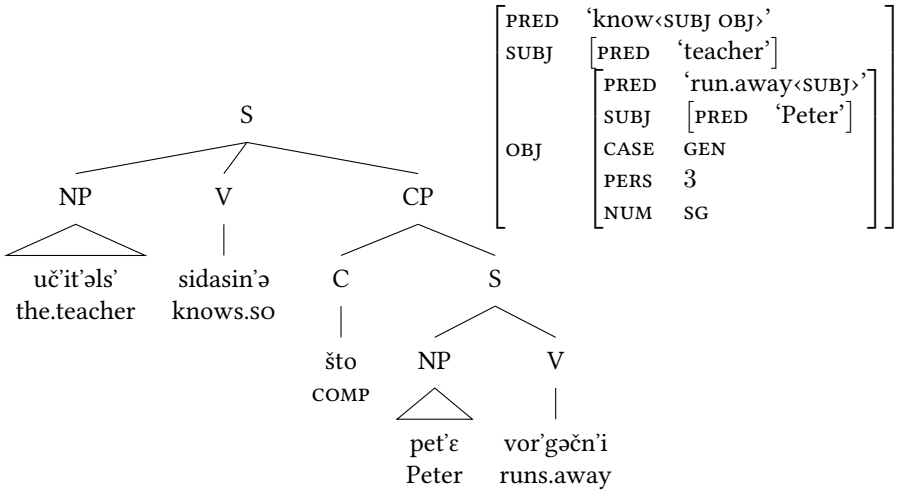
$$\begin{bmatrix} \text{PRED} & \text{'be.happy‹SUBJ OBL}_{\text{ABL}}\text{›'} \\ \text{SUBJ} & \left[\text{PRED} \quad \text{'I'}\right] \\ \text{OBL}_{\text{ABL}} & \begin{bmatrix} \text{PRED} & \text{'come‹POSS›'} \\ \text{POSS} & \left[\text{PRED} \quad \text{'PRO'}\right] \\ \text{CASE} & \text{ABL} \\ \text{PERS} & 3 \\ \text{NUM} & \text{SG} \end{bmatrix} \end{bmatrix}$$

Second, (41) illustrates the structure of (6), a sentence where the complement clause is finite and triggers object agreement (adjuncts are omitted as insignificant). The PERS and NUM features of the clause are reflected on the verb through agreement. The feature CASE is not morphologically expressed on the finite verb, but the complement clause receives it through a functional annotation on the

5. On the representation of genitive subjects as POSS arguments, see Laczkó (2000).

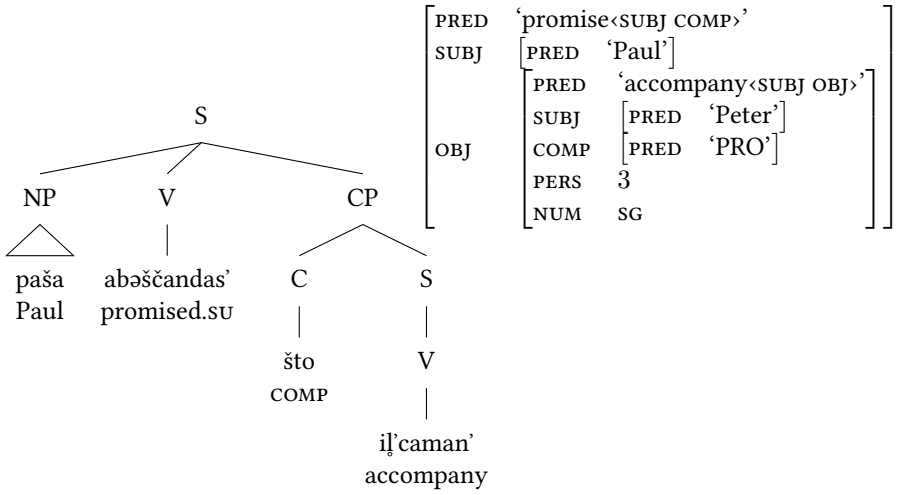
matrix verb like (↑ OBJ CASE) = GEN. This annotation licenses the correct morphological forms of case-marked elements such as pronouns (when they are used instead of the finite clause or pleonastically) and quantifiers.

(41)



Finally, the structures in (42) are for (7), where the finite complement does not trigger object agreement. This classifies the complement clause as COMP; it is not assigned a CASE feature, as there is no nominal or pronoun in Moksha that can occupy this grammatical function.

(42)



Thus, while our data do not support the early LFG view that *all* clausal complements belong to the grammatical function COMP, they demonstrate that it might be too early to abandon this notion altogether, as Alsina, Mohanan, and Mohanan (2005), Forst (2006) and Patejuk and Przepiórkowski (2016) seem to suggest. Rather, the more fine-grained approach of Dalrymple and Lødrup (2000) and Lø-

drup (2004, 2012) seems to be more appropriate both for Moksha and in the wider cross-linguistic perspective.

3.3 Alternative explanations

While the introduction of an additional grammatical function for a subset of complement clauses seems to be the most straightforward approach, other accounts of our data are in principle possible. First, given the high degree of correlation between object agreement and factivity, it might be tempting to consider a purely semantic explanation. However, this does not in principle preclude our syntactic approach. Similar differences between factive and non-factive clauses are well-known cross-linguistically (Kastner 2015), but it is not clear whether they all converge on the same syntactic representation. It might well be that the semantics only predicts a tendency to prefer certain kinds of structures. Given that phenomena such as agreement, case assignment, and pronominalization are all heavily conditioned by syntactic constraints, it seems that any account of Moksha complementation must involve a difference in syntactic status at some level of structure.

Another option is to treat the "exceptional" complements as being OBJ_θ. This idea is attractive in that one can draw a clear parallel with the treatment of Northern Khanty non-agreeing DOs in Dalrymple and Nikolaeva (2011), which they analyze as OBJ_θ. But the key difference is that in Northern Khanty, there are syntactic discrepancies between *nominal* agreeing and non-agreeing DOs; therefore, it makes sense to assign nominal non-agreeing DOs a special GF. This is not the case in Moksha, where both kinds of nominal arguments seem to be full-fledged direct objects (Kozlov in press). Major syntactic differences are only observed in the clausal domain. Hence, for a GF that is purely clausal, the label COMP seems to be more appropriate than OBJ_θ, although language-internally this is, of course, a purely terminological issue.

4 Conclusion

A topic of current debate in the LFG literature is the existence of a dedicated grammatical function COMP for clausal complements. While the standard LFG approach draws a clear distinction between "clausal" and "nominal" c-structure categories (NP vs. CP) on the one hand, and "clausal" vs. "nominal" grammatical functions on the other (SUBJ, $\text{OBJ}_{(\theta)}$, OBL_θ vs. (X)COMP), Alsina, Mohanan, and Mohanan (2005) have argued that there is no need for a separate grammatical function COMP, and all the differences between nominal and clausal complements are explicable in terms of their phrase structure categories. The data of Moksha Mordvin rather support the alternative point of view expressed in Dalrymple and Lødrup (2000), namely, that COMP is required to explain the data of languages that have several types of complement clauses, some of which do indeed cluster with nominal direct objects (namely, factive and eventive complements), but some of

which do not (non-factive propositions). Since Moksha draws a very sharp syntactic distinction between nominalized (NP) and finite (CP) subordinate clauses, it is not possible to interpret such a split among finite complement clauses in terms of c-structure categories, and a separate grammatical function COMP is necessary for a full account of the data.

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Dative Subjects and the Rise of Positional Licensing in Icelandic

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Abstract

We present the results of research on two areas of Icelandic historical syntax: dative subjects and V1 word order. These strands of syntax had previously been examined independently, but were found to be intimately connected as part of a broader collaboration between theoretical and computational linguistics involving the Icelandic Parsed Historical Corpus (IcePaHC). The interaction we found between V1 declaratives and dative subjects provides evidence for: a) changes over time with respect to the association of dative arguments with the subject role (contra Barðdal and Eythórsson 2009); b) the gradual development of left peripheral structure and the rise of positional licensing (in line with Kiparsky 1995, 1997). We provide an analysis of positional licensing in LFG terms and account for the newly observed complex interaction between datives, subjects and word order presented in this paper.

1 Introduction

Icelandic is standardly acknowledged to be the most conservative of the Germanic languages; Modern Icelandic has retained a complex morphological case system, three genders, as well as rich verbal morphology with distinctions for person, number, tense and mood. The language is also conservative in the sense that it has not undergone certain diachronic developments exhibited in other Germanic languages, such as the innovation of an indefinite article. Nevertheless, various morphosyntactic changes have been observed over the course of the ten centuries of attested written Icelandic. Among the most salient of these are a reduced freedom in word order (Rögnvaldsson, 1995), which we interpret as increased configurationality, a decrease in verb-first declaratives (Sigurðsson, 1990), an increase in dative subjects and the rise of overt expletive elements (Rögnvaldsson, 2002).

Overall, however, morphosyntactic change in Icelandic remains relatively understudied. In particular, the interaction between the various different changes has scarcely been explored. Moreover, most pre-existing studies typically compare data from the modern language with that from the earliest attested stage ('Old Icelandic', c. 1150-1350), thus leaving the diachronic detail of the intervening periods unclear. We present a corpus linguistic study using the Icelandic Parsed Historical Corpus ('IcePaHC', Wallenberg et al., 2011). In this study, we set out to investigate the interaction between word order, subjects and datives. The IcePaHC data allows us to conduct our investigation across all attested stages of the language (1150-2008), thereby capturing an unusually comprehensive level of diachronic detail. Our study reveals an interaction between the increasingly close association of certain types of

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dative arguments with subjects and a developing preference for subjects to occur clause-initially. Overall, we see our data as providing evidence for the gradual development of left peripheral structure and the rise of positional licensing in the history of Icelandic. Building on Kiparsky's (1995; 1997) proposals for positional licensing, we propose an LFG analysis that lays the groundwork for capturing the complex interrelation between case, word order, lexical semantics and information structure across the whole Icelandic diachrony.

2 Background

Modern and Old Icelandic both exhibit the verb-second (V2) constraint, which maximally allows one constituent in the clause-initial prefinite position (Rögnvaldsson and Thráinsson, 1990; Rögnvaldsson, 1995). Compare the subject-initial clause in (1-a) with (1-b) and (1-c), which each have a fronted non-subject constituent in initial position, the verb in second position and the subject in postfinite position:

(1) a. Ég **gleymdi** þeim fljótt. **S-V-O**
I.NOM forget.PST.1SG they.DAT quickly
'I quickly forgot them.'

b. Þeim **gleymdi** ég fljótt. **O-V-S**
they.DAT forget.PST.1SG I.NOM quickly
'Them, I quickly forgot.'

c. Fljótt **gleymdi** ég þeim. **X(P)-V-S**
quickly forget.PST.1SG I.NOM they.DAT
'Quickly I forgot them.'

Despite being a V2 language, modern Icelandic still allows for verb-first (V1) order in declarative sentences (Sigurðsson, 1990), as exhibited in (2):

(2) a. **Sá** ég þá á svipstundu villu míns
see.PST.1SG I.NOM then on moment.DAT error.ACC my.GEN
vegar.
way.GEN
'I then saw at once the error of my ways.' (IcePaHC: Margasaga, 1985)

b. **Hugði** ég mér gott til hans liðveislu.
think.PST.1SG I.NOM I.DAT good to he.GEN assistance.GEN
'I expect to benefit from his assistance.' (IcePaHC: Ofsi, 2008)

V1 declaratives are typical for older stages of Germanic (see e.g. Hinterhölzl and Petrova, 2010), but not generally for modern Germanic languages, where this order has either been lost or reduced to certain contexts, such as the context of the lead-in to jokes in German ('Came a woman through the door...'). Icelandic is exceptional in that such structures are still a general part of the modern language. Nevertheless, a decrease in V1 over time has been noted (Sigurðsson, 1990). This has previously been explained in connection with the rise of the expletive element

það occurring in clause-initial position (Franco, 2008; Sigurðsson, 1990), although the exact interaction between V1 and *það* has not been closely examined.

Another striking feature of Icelandic morphosyntax are non-nominative subjects, including dative subjects. The synchronic existence of dative subjects has been well established for modern Icelandic by showing that dative arguments as in the examples in (3) qualify as subjects on the grounds of various classic tests for subjecthood in Icelandic (e.g., Andrews, 1976; Zaenen et al., 1985):

(3) a. **Mér** fannst eins og **þeim** stæði
I.DAT seem.PST.3.SG as if they.DAT stand.PST.SBJV.3SG
stuggur af mér.
aversion.NOM of I.DAT
'It seemed to me as if they were frightened of me.'
(IcePaHC: Mamma, 2008)

b. ... **mér** leið illa.
I.DAT feel.PST.3SG badly
'I was feeling bad.' (IcePaHC: Ofsi, 2008)

The historical origin of dative subjects has attracted a good deal of research in recent years. A major point of debate concerns whether dative subjects are a common Proto Indo-European feature or are in fact a more recent innovation. The so-called 'Oblique Subject Hypothesis' (e.g., Barðdal and Eythórsson, 2003, 2009; Barðdal et al., 2012) argues for the Proto Indo-European inheritance of dative subjects, mainly drawing on the continuous existence of a monolithic dative subject construction throughout the Icelandic diachrony. This hypothesis challenges the more traditional 'Object-to-Subject Hypothesis' (cf. Cole et al., 1980; Haspelmath, 2001), which generally takes dative subjects to be the result of the gradual reanalysis of former objects. Evidence for the Object-to-Subject Hypothesis has been adduced from a related branch of Indo-European: the diachrony of Indo-Aryan case. While Old Indo-Aryan shows no evidence for dative subjects (Hock, 1990), dative objects were gradually reanalyzed as dative subjects during the New Indo-Aryan period, a process connected to lexical semantic shifts of individual verbs (cf. Deo, 2003; Butt and Deo, 2013), even after the original case system was lost in the course of Middle Indo-Aryan.

Interestingly, the Icelandic attestation only goes back to the 12th century, which is around the time that dative subjects begin to be possible in Indo-Aryan. Moreover, the Icelandic situation with respect to dative subjects is not as stable as it should be, assuming them to be an old part of the language. There is a change which has been dubbed 'Dative Substitution' or 'Dative Sickness', which can be traced back to the 19th century, but is currently still in progress (see e.g. Svavarsdóttir, 1982; Smith, 1996; Jónsson, 2003; Barðdal, 2011). This change describes a process whereby accusative experiencer subjects are systematically replaced by datives as given in (4). Dative substitution has been assumed to be connected to the increasing systematic association of dative case with experiencer semantics (Smith, 1996; Jónsson, 2003)

and presumably began in the latter part of the 19th century (Barðdal, 2011).

(4) a. **Mig** langar að fara.
I.ACC long.PRES to go.INF
'I long to go.'
b. **Mér** langar að fara.
I.DAT long.PRES to go.INF
'I long to go.'

(Smith, 1996, 22)

In addition, Schätzle et al. (2015) found that the distribution of dative subjects changes over the centuries. As with dative substitution, datives are increasingly associated with experiencers, and experiencer subjects in turn increase over time due to the lexicalization of former middle formations as psych predicates.

The examination of the distribution of dative subjects over time in conjunction with the Object-to-Subject hypothesis also necessitates a study of word order patterns. In conducting these studies, we discovered a previously unnoticed connection between the two exceptional features of Icelandic described above. We detail these empirical observations in the next section.

3 Corpus study: Findings and Conclusions

We investigated the interaction between subject position, verb placement, expletive *það* and subject case in matrix declarative clauses in several detailed corpus studies. This paper brings together two strands of research that were originally conducted independently: 1) the interaction between V1 and expletives (the Manchester team); 2) factors conditioning the distribution of dative subjects (the Konstanz team). In looking at these phenomena as part of a larger collaborative enterprise exploring Visual Analytics for Linguistics (LingVis), we discovered that the phenomena were more closely interlinked than previously noted.[1]

Our historical data is based on IcePaHC. IcePaHC is a valuable resource as it covers all attested stages of Icelandic, with 61 text extracts dating from the 12th to the 21st century CE. At the same time, however, we recognize some limitations of the corpus: the texts included represent a very small sample of the wealth of attested historical Icelandic, and there is a genre issue in that certain genres are over-represented and others under-represented in individual periods. The corpus is syntactically annotated in the Penn Treebank-format (Marcus et al., 1993) and provides information about clause types, grammatical relations, constituent order, noun types (proper nouns, empty/overt pronouns and expletives, etc.) and case, see e.g. the sample annotation in Figure 1, which shows a matrix IP with a clause-initial pronominal dative subject (*mér* 'me') followed by an inflected form (*finnst*), an old middle, of the verb *finna* 'seem, think, feel':

[1]We concentrate here on providing the relevant data and figures; for our most recent work on LingVis for historical linguistics with reference to Icelandic, see Schätzle et al. (2017).

```
(IP-MAT-SPE (NP-SBJ (PRO-D Mér-mér))
    (VBPI finnst-finna)
    (CP-ADV-SPE (WADVP-1 0)
      (C sem-sem)
      (IP-SUB-SPE (ADVP *T*-1)
                (NP-SBJ (PRO-N ég-ég))
                (BEPS sé-vera) (VBN sloppinn-sleppa)
                (PP (P úr-úr) (NP (NP-POS (ONE+Q-G einhvers-einhver)
                (N-G konar-konar)) (N-D fangelsi-fangelsi)))))
      (. .-.))
  (ID 1882.TORFHILDUR.NAR-FIC,.603))
```

Figure 1: Sample annotation from IcePaHC

We extracted the constructions relevant to our study and on which we base our diachronic claims using the CorpusSearch query language specific to Penn-style treebanks (Randall, 2000) and our own Perl scripts.[2] In total, we identified 65,394 declarative matrix clauses in the corpus in which the subject was distinctly annotated for case. These clauses form the foundation for the frequency calculations in our study. The obtained frequencies were divided into time periods as suggested by the existing literature on historical Scandinavian (Haugen, 1984), see e.g., the first column in Table 1.[3] We also conducted χ^2-tests to examine whether the observed distributions differed from what could be expected given the overall distributions of the constructions in the whole corpus ($p<0.05$*, $p<0.01$**, $p<0.001$***).

3.1 Subject positions, verb placement and expletives

At first, we looked at the distribution of subjects, i.e. whether they occur before or after the finite verb. The diachronic distributions of prefinite and postfinite subjects are displayed in Table 1, with the percentage of prefinite subjects given in the penultimate column. Texts in the first time period (1150–1349) have an almost equal share of pre- and postfinite subjects. Over time however, subjects are increasingly realized in the prefinite position, with a highly significant increase of prefinite subjects from 57.6% to 73.0% in the period post-1900. Given the striking increase in prefinite subjects as of 1900, we wondered if what we see in the data indicates the development of a designated subject position. In order to test this hypothesis, we investigated the options for verb placement in IcePaHC and their conditioning factors in more detail.

Butt et al. (2014) show in a corpus study of V1 matrix declaratives in IcePaHC that although V1 is attested throughout the history of Icelandic, V1 constructions undergo a marked decrease as of 1900. We confirmed their findings with our

[2]It is worth noting that the corpus query language does not always yield all the relevant constructions; we therefore rely mainly on our own Perl scripts.

[3]Note that the third time period in this classification, 1550–1749, is affected by a genre effect inherent in IcePaHC which causes deviating percentages from the overall developments throughout our study (cf. Butt et al. 2014; Schätzle et al. 2015). This time period is mainly represented by religious and legal texts, while narrative texts (i.e. sagas/modern fiction) dominate the other stages.

Period	prefinite	postfinite	Total	% prefinite	χ^2
1150-1349	7045	6672	13717	51.4%	***
1350-1549	10091	8258	18349	55.0%	***
1550-1749	6076	5134	11210	54.2%	***
1750-1899	6490	4767	11257	57.6%	
1900-2008	7924	2937	10861	73.0%	***

Table 1: Positions for all subjects across IcePaHC.

dataset and provide the respective frequencies in Table 2. The initial share of 20.6% V1 clauses decreases significantly over time, with a particularly striking drop in frequency between the last two time stages, from 18.4% to merely 2.7%.

Period	V1	non V1	Total	% V1	χ^2
1150-1349	2829	10888	13718	20.6%	***
1350-1549	3656	14693	18349	19.9%	***
1550-1749	1654	9556	11210	14.8%	***
1750-1899	2072	9185	11257	18.4%	***
1900-2008	292	10569	10861	2.7%	***

Table 2: Distribution of V1 matrix declaratives in IcePaHC.

As mentioned in section 2, the decrease in V1 has been previously connected to a simultaneous increase in the frequency of the expletive element *það* (Franco, 2008; Sigurðsson, 1990). In present-day Icelandic, expletive *það* appears in clause-initial position in a range of construction types, including presentationals, e.g. (5-a), but in older stages of the language it is typically absent, e.g (5-b):[4]

(5) a. **Það** var töluverður snjór yfir öllu.
EXPL be.PST.3SG considerable.NOM snow.NOM over everything.DAT
'There was a considerable amount of snow over everything.'
(IcePaHC: Ofsi, 2008)

b. _____ Var þá gleði mikil í kóngs höll.
ØEXPL be.PST.3SG then joy.NOM great.NOM in king.GEN hall.DAT
'There was then great joy in the king's hall.'
(IePaHC: Jarlmann, 1480)

A connection between a decrease in V1 and the rise of clause-initial expletives has previously been observed by Axel (2007) for historical German, though the connection has not been closely investigated for Icelandic. Our second corpus study therefore examined the proportion of instances in which expletive *það* is present in the clause-initial prefinite position rendering the sentence V2 (5-a), compared

[4] ØEXPL is used descriptively to mark the absence of *það* in a context where it would be expected in Modern Icelandic. This is not a theoretical statement on the possibility of 'null expletives'.

to those instances in which *það* is absent, resulting in a V1 structure (5-b). The proportions are compared across the five time periods in order to assess whether a rise in expletive *það* could explain the decrease in V1. The findings from IcePaHC are shown in Table 3:

Period	**prefinite expl (V2)**	**no expl (V1)**	**Total**	**% expl**	χ^2
1150-1349	16	153	169	9.5%	***
1350-1549	26	205	231	11.3%	***
1550-1749	13	87	100	13.0%	***
1750-1899	59	92	151	39.1%	
1900-2008	160	28	188	85.1%	***

Table 3: Distribution of prefinite expletives in IcePaHC.

The data in Table 3 indicates that there is a striking increase in expletive *það* as of 1900. This coincides with the decrease in V1 observed in Table 2 and thus it seems reasonable to conclude that an increase in expletive *það* in the clause-initial prefinite position rendering older V1 structures as V2 is a factor behind the decrease in V1.

There are, however, two issues which indicate that the expletive story cannot fully account for the decrease in V1. The first issue is that not all V1 clauses in IcePaHC are constructions which lack an expletive *það*. An example is (6), which has a prototypical referential subject in postfinite position (*drottinn*), and in which an overt expletive is therefore not expected to occur. Such examples indicate that the rise of expletive *það* can only be part of the explanation for the decrease in V1.

(6) Sýndi **drottinn** mikla miskunn vin
show.PST.3SG lord.NOM.DEF great.ACC mercy.ACC friend.DAT
sínum sankti Georgíum
his-own.DAT saint.DAT George.DAT
'The Lord showed great mercy to his friend St. George.'
(IcePaHC: Georgius, 1525)

Recall that our diachronic findings for subject positions outlined in Table 1 led us to ask whether we are observing the emergence of a new designated subject position (the prefinite position) as of 1900. This raises a second issue with the V1-expletive connection. It is well known that expletive *það* in Modern Icelandic is restricted to the clause-initial prefinite position in almost all construction types (for recent accounts see Sells, 2005; Sigurðsson, 2007; Thráinsson, 2007). Compare the impersonal passive construction in (7-a) which has a clause-initial *það*, with the identical construction with fronting of NEG in (7-b), in which *það* is absent:

(7) a. **Það** var ekki minnst á önnur dýr.
EXPL be.PST.3SG NEG mention.PTCP on other.ACC animals.ACC
'There was no mention of other animals.'

b. Ekki var _____ minnst á önnur
NEG be.PST.3SG ØEXPL mention.PASS.PTCP on other.ACC
dýr.
animals.ACC
'There was no mention of other animals.' (IcePaHC: Sagan, 1985)

In this respect, expletive *það* does not behave like a subject, as in Icelandic subjects typically invert with the verb and occur in postfinite position in non-subject fronting contexts like (6) or (7-b). Compare the examples in (7) with the Swedish impersonal passive in (8), in which expletive *det* behaves more like a subject, occurring in both pre- and postfinite position:

(8) a. **Det** dansades i går. (Swedish)
EXPL dance.PST.PASS yesterday
'There was dancing yesterday.'
b. I går dansades **det**. (Swedish)
yesterday dance.PST.PASS EXPL
'Yesterday there was dancing.'

Data like (7) and (8) are standardly cited to support the claim that Swedish expletive *det* qualifies as a syntactic subject, whereas Icelandic expletive *það* does not, e.g. Platzack (1983) and Maling (1988); cf. Faarlund (1990) 'expletive topic'.

The positional distribution contrast between Icelandic *það* and Swedish *det*, together with the grammaticality of so-called "Transitive Expletive Constructions" in Icelandic (9), which are not permitted in Swedish, lead us to conclude that expletive *það* is not fulfilling the role of a subject in Icelandic. In Transitive Expletive Constructions such as (9), the expletive co-occurs with an overt thematic subject (*margir jólasveinar* 'many Christmas trolls'):

(9) **Það** hafa [**margir jólasveinar**] borðað
EXPL have.PRES.3PL many.NOM Christmas-trolls.NOM eat.PST.PTCP
búðing.
pudding.ACC
'Many Christmas trolls have eaten pudding.'
(Bobaljik and Jonas, 1996, 209)

In contrast, Sells (2005), working within LFG, assumes that *það* is always a SUBJ in Icelandic. He treats Transitive Expletive Constructions as in (9) as cases where the thematic subject of the clause (*margir jólasveinar*) is unified with the information coming from the expletive *það*. Sells does not provide direct evidence for the subjecthood of *það*, but assumes it. In contrast, we see examples as in (9) as another indication that *það* is in fact not acting as a canonical SUBJ.

We conclude that the fact that expletive *það* – which does not straightforwardly qualify as a subject – is increasingly appearing in the clause-initial prefinite position in the historical data does not provide evidence for a newly designated prefinite

subject position. We must therefore revise our initial hypothesis and search for an alternative account.

3.2 V1 and Information Structure

The alternative account which we think likely has already been articulated in the existing literature (e.g. Hinterhölzl and Petrova, 2010) and has been picked up on and formalized within LFG by Sells (2005). We rely heavily on this part of his formal analysis in the account we develop in the next section. The core observation as to the function of the expletive that lies at the heart of this account was made by Rögnvaldsson and Thráinsson (1990). They observe that the function of the expletive is to license a clause in which there is no topic, not even the subject (which tends to be the default topic).[5]

We therefore propose an information structural motivation for the rise of clause-initial *það*, which in turn contributes to the decrease of V1. Our proposal follows Hinterhölzl & Petrova's (2010) information structural account for V1 in historical German, which assumes that the verb served as an information structural boundary, separating topic and comment. V1 clauses thus mark topicless sentences (e.g. presentationals) which place the whole clause into the scope of the assertion, i.e. the whole clause is focused (cf. Hinterhölzl and Petrova 2010). Contrary to Hinterhölzl and Petrova, who assume an articulated structure for Old High German, we assume a flat sentence structure for older Icelandic, but one in which verb placement was used for information structural purposes. In the course of the history of Icelandic, the prefinite position was eventually identified as the preferred topic position and became fixed as part of a more general growth of syntactic structure (cf. Kiparsky (1997) and references therein). Expletive *það*, meanwhile, emerges as a filler for this topic position in topicless sentences, rendering the original V1 structures as V2.[6] Subjects moreover are usually topics (Givón, 1990) and become more firmly associated with the clause-inital position accordingly.

3.3 Dative subjects and word order

Cross-linguistically, there is a well-known trade-off between word order, case and/or agreement to mark grammatical relations (e.g., see Kiparsky 1987, 1988, 1997). Having concluded that structural changes led to the emergence of a clause-initial topic position which frequently houses subjects (subjects often being topical), we examined the diachrony of subject case in IcePaHC, in order to see whether any other changes coincide with the observed structural changes. We based ourselves on the initial findings of Schätzle et al. (2015) on the diachrony of dative subjects, but took those investigations further with respect to overall subject case distributions

[5] See also Zaenen (1983).

[6] Maling (1980) argues that Stylistic Fronting is another way to fill subject/topicless clauses, converting a V1 structure into a V2 clause.

and the interaction of dative subjects and voice. Our results are shown in Tables 4 and 5, respectively:[7]

Period	Nom	Dat	Acc	Gen	Total	% Dat	χ^2
1150-1349	13028	535	128	26	13718	3.9%	
1350-1549	17596	591	142	20	18349	3.2%	***
1550-1749	10676	417	106	11	11210	3.7%	
1750-1899	10733	428	80	16	11257	3.8%	
1900-2008	10113	626	115	7	10861	5.8%	***

Table 4: Diachronic distribution of subject case in IcePaHC.

Period	active	middle	passive	Total	% middle	χ^2
1150-1349	397	66	72	535	12.3%	***
1350-1549	417	80	94	591	13.5%	***
1550-1749	239	69	109	417	16.6%	***
1750-1899	273	88	67	428	20.6%	
1900-2008	315	239	72	626	38.2%	***

Table 5: Diachronic distribution of voice across dative subjects in IcePaHC.

The share of dative subjects is stable until the very last time period, in which dative subjects undergo a marked and significant increase from 3.8 to 5.8% as of 1900. Schätzle et al. (2015) have shown that the observed increase of dative subjects is driven by lexical semantic factors, as dative subjects occur more often with so-called psych or experiencer predicates over time. Further evidence for the increasing correlation between lexical semantic factors and dative subjects comes from the growing use of verbs carrying middle morphology (marked via the suffix *-st*) together with dative subjects, which furthermore increases significantly as of the last time period, see Table 5. These formerly middle verbs are mainly lexicalized experiencer predicates (cf. Schätzle et al. 2015). These findings tally well with the establishment of a systematic association of dative case with lexical semantic conditions, i.e. experiencer/goal semantics, over the history of Icelandic, as middle constructions are generally characterized by the structural absence of an agent argument (Kaufmann, 2007; Wood, 2015; Schätzle et al., 2015).

Subsequently, we analyzed the interaction of dative case with subjects and structural position (pre- versus postfinite position) in IcePaHC. Table 6 shows the positions in which dative subjects occur throughout IcePaHC. The last column in

[7]The original dative subject sentences as annotated in IcePaHC have undergone an additional process of manual correction, as we encountered several annotation mistakes during our studies. Mainly dative objects had been erroneously annotated as subjects and some nominative proper nouns had been wrongly tagged as datives. The annotation of the pronoun *þér* is furthermore problematic in IcePaHC, because it can be either the 3SG.DAT of the personal pronoun *þú* 'you' or an honorific form of address in nominative case in the older Icelandic texts.

Table 6 moreover displays the original relative frequencies of all prefinite subjects as given in Table 1 for a better comparison.

In contrast to the equal distribution between pre- and postfinite position that we have shown for all subjects, dative subjects are preferably realized in the postfinite position in older stages of Icelandic, with a share of only 24.5% of prefinite subjects in the first time stage. Nevertheless, dative subjects also conform to the overall development of the prefinite position as a fixed topic/subject position, becoming increasingly realized in the prefinite position over time. Again, the most striking increase takes place as of 1900. However, dative subjects lag behind all subjects overall in the increasing preference for the prefinite position, with the prefinite position only becoming dominant for dative subjects as of 1900 with a share of 56.4% (compare 55.0% in Table 1 for all subjects for 1350–1549 already).

Period	**prefin (Dat)**	**postfin (Dat)**	**Total**	**% prefin (Dat)**	χ^2	**% prefin (all)**
1150-1349	131	404	535	24.5%	***	51.4%
1350-1549	126	465	591	21.3%	***	55.0%
1550-1749	119	298	417	28.5%	*	54.2%
1750-1899	151	277	428	35.3%		57.6%
1900-2008	353	273	626	56.4%	***	73.0%

Table 6: Subject positions for dative subjects across IcePaHC.

A closer examination of V1 sentences containing dative subjects offered further insights. We found that dative subjects have a stronger overall tendency to occur in V1 constructions than all subjects, see Table 7. Despite the fluctuations that we see in the V1 distribution for dative subjects over time, V1 sentences with dative subjects are decreasing overall. Once more, we observe a very striking drop in V1 sentences in our data set as of 1900 (from 29.4% to only 3.2%).

Period	**V1 (Dat)**	**non V1 (Dat)**	**Total**	**% V1 (Dat)**	χ^2	**% V1 (all)**
1150-1349	173	362	535	32.3%	**	20.6%
1350-1549	254	337	591	43.0%	***	19.9%
1550-1749	106	311	417	25.4%		14.8%
1750-1899	126	302	428	29.4%		18.4%
1900-2008	20	606	626	3.2%	***	2.7%

Table 7: Dative subjects in V1 declaratives across IcePaHC.

In sum, the positioning of dative subjects deviates from the overall development of structure, in that their preference to occur clause-initially is considerably weaker than for all subjects. We explain this deviation in terms of the dual linking possibilities associated with experiencer/goal arguments, which are compatible

with both subject and object realization. We claim that the dative experiencers must first become more firmly linked to subjects than objects, before they are able to conform to the overall structural licensing configuration. Our hypotheses and analyses regarding the interaction of positional licensing and subject case in the history of Icelandic on the basis of our corpus evidence are detailed in section 4.

4 Formal Analysis

In this section, we build on the existing formal proposals by Sells (2005) on the syntax of Icelandic with respect to the expletive *það*. Unlike Sells (2005), we do not assume that *það* fulfils the role of a SUBJ (see section 3.1). However, in line with Sells (and previous literature), we see *það* as playing an information structural role in that it licenses topicless clauses. We integrate the patterns found for dative subjects into the analysis by also drawing on Kiparsky's (1997) ideas with respect to the rise of positional licensing and the concomitant "growth" of syntactic structure. Kiparsky argues that the rise of positional licensing correlates with the loss of morphology in the history of English. These factors led to the firm establishment of the functional category I, which is seen as having been only optional in Old English. Icelandic differs sharply from English in that it has not seen a radical loss of morphological marking. However, Modern Icelandic exhibits a fairly fixed word order and it is clear that its word order has become more fixed over time. Our findings confirm this overall take on Icelandic, showing that subjects become more firmly associated with the prefinite position over time (cf. Table 1). Kiparsky argues that while morphological marking has not been lost in Icelandic, it is recessive in determing grammatical relations; *positional licensing* of grammatical relations on the other hand is dominant, thus accounting for the increase in word order rigidity. Kiparsky also provides an analysis of experiencer subjects in Old English, which show variable linking to SUBJ vs. OBJ. Again, we build on these insights in the development of our analysis.

4.1 Rise of Positional Licensing — LFG

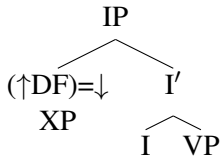
Kiparsky (1995) argues that the Germanic languages developed structure and associated functional categories which were not present in its Indo-European ancestor. In particular, he adduces data primarily from Hulk and van Kemenade (1995) and van Gelderen (1993) to show that Old English lacked a clause-level functional projection C and that this developed at a later stage. He takes parallel data from Old Icelandic and Old High German to indicate that C was present in these languages. The idea that a flat structure lacking functional categories develops into a more articulated structure making use of functional categories has been applied to Icelandic noun phrases by Börjars et al. (2016). We develop an analysis that brings together the factor of positioning for information structural reasons with the increasing use of position for the licensing of grammatical relations, as proposed by Kiparsky. We

assume the restrictive approach to functional categories within LFG, where a functional category is assumed when a functional feature is associated with a structural position (see Kroeger (1993, 6–7) and Börjars et al. (1999)).

For the earliest data, we assume a flat tree in which grammatical relations are indicated by case, along the lines of the analysis developed for Urdu by Butt and King (2004). As is still currently the case in Urdu/Hindi (Gambhir, 1981), word order in Icelandic was used to signal information structural content. In particular, we follow Hinterhölzl & Petrova's (2010) information structural account for V1 in historical German which assumes that the finite verb served as an information structural boundary, separating topic and comment. V1 clauses thus mark topicless sentences (e.g. presentationals).

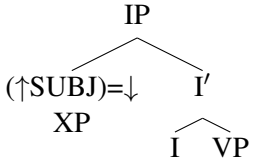
A number of factors contributed to the growth of structure from this point. The information-structural role of the finite verb leads to the initial position becoming increasingly associated with a specific discourse function capturing given or topical information. We follow Kiparsky (1997), who provides evidence for a scenario in which I was optional in Old English, but became a necessary part of the clause over the history of English. This analysis is extended to Icelandic, yielding the clausal structure in (10) (where DF=Discourse Function).

(10)



The subject is often also the topical constituent of a clause. This is because subjects tend to encode the more agentive, sentient clausal participant. Agentive and sentient entities tend to make better topics than inanimate patients. Given this crosslinguistic tendency, it has been argued that subjects are in fact grammaticalized topics (Givón, 1990). This would then lead to the initial position becoming associated with the subject function over time as shown in (11).

(11)



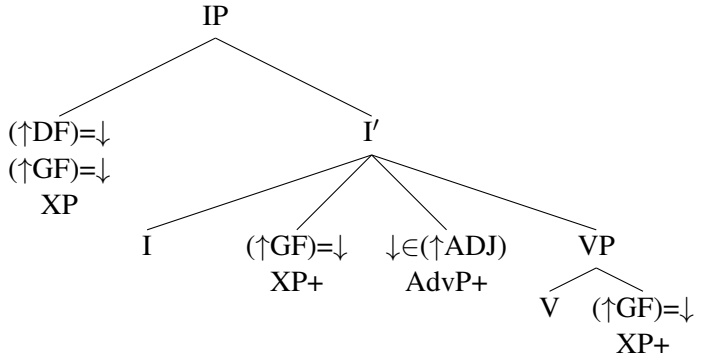
However, this is not quite the case in Icelandic, as we have clauses like the Transitive Expletive Construction, repeated in (12) where the thematic subject *margir jólasveinar* is not in prefinite position. Or V1 constructions as in (13), where the subject is again in the postfinite position.

(12) **Það** hafa [**margir jólasveinar**] borðað
EXPL have.PRES.3PL many.NOM Christmas-trolls.NOM eat.PST.PTCP
búðing.
pudding.ACC
'Many Christmas trolls have eaten pudding.'
(Bobaljik and Jonas, 1996, 209)

(13) **Hafði** hann ekki sextíu menn með sér.
have.PST.3SG he.NOM NEG sixty men.ACC with REFL.DAT
'He didn't have sixty men with him.' (IcePaHC: Fossar, 1902)

Sells (2001, 2005) proposes (14) as the blueprint for clausal structure in Icelandic. The idea is that the prefinite position in SpecIP is associated with a discourse function. Subjects can appear here, but are not restricted to this position. In particular, a subject can appear in the immediately postfinite position when the prefinite position is occupied by the expletive *það* or in V1 sentences. He argues for a set of linear constraints governing the clause structure of Icelandic.

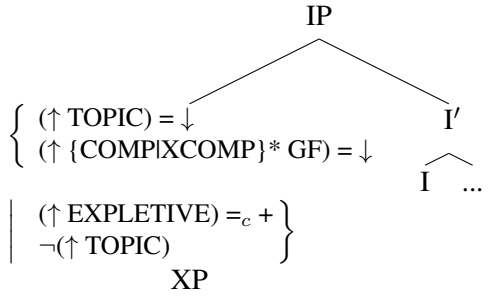
(14)



Unlike Sells, we do not see expletive *það* as a subject. Instead, we posit the possibilities shown in (15) for the SpecIP position in Icelandic. For one, it can be a topical position that can host subject topics, but also other topical grammatical functions, though subjects are preferred for the reasons stated above.

Alternatively, this position can be filled by the expletive *það*. In this case, we explicitly state that the sentence has no topic. The position may also remain unfilled, leading to V1 structures, which also do not contain a topic.

(15)



However, an overall reorganization of the information structural packaging in Icelandic is leading to a decrease in V1 constructions in favor of an obligatory prefinite position that hosts topics and, with increasing preference, subjects (cf. Table 6). When clauses do not contain a topic, this position is filled with the expletive.

In sum, our corpus data supports Kiparsky's analysis of the rise of positional licensing in Icelandic.[8] In the next section, we turn to understanding the role of dative subjects with respect to positional licensing.

4.2 Dative Subjects and Positional Licensing

Recall that dative subjects have undergone some change over time. For one, dative case has become more firmly associated with experiencers over the history of Icelandic. For another, dative experiencer arguments become increasingly associated with the prefinite position, which in turn is a topical position that is increasingly becoming associated with subjects.

Experiencer predicates involve an experiencer and a stimulus. Neither experiencers nor stimuli are prototypical agents or patients in the sense of Dowty (1991) or Van Valin and La Polla (1997), and are in principle open to variable linking. There are several sources for experiencer predicates, among them former middles in Icelandic, see Schätzle et al. (2015). The relationship between an experiencer and a stimulus is essentially a stative one and is often historically derived from locative predication where the experiencer is encoded as a location at which the stimulus is placed (cf. Butt and Deo (2013) for Sanskrit), as shown in (16).

(16) ...og þó er mér grunur
and still be.PRES.3.SG I.DAT suspicion.NOM
'...and I am still suspicious' (Lit. suspicion is to me) (IcePaHC: Morkin, 1275)

The variable linking possibilities are easily demonstrated with respect to the former locative predications. (17) shows the linking for a locative predication, where a stimulus (theme) is associated with a location. Notice, however, that as per the classic analysis of locative inversion (Bresnan and Kanerva, 1989), this configuration also allows for an alternative linking by which the location is linked to a subject and the theme to an object.

[8] A related topic is the issue of null pronouns/arguments. Icelandic has allowed for various types of argument drop throughout its history, see e.g. Sigurðsson (1993). In an IcePaHC study, Kinn et al. (2016) show that the frequency of referential null subjects has decreased over the history of Icelandic, again with the period as of 1900 showing the most significant changes. This finding also supports the overall rise of positional licensing.

(17) Experiencer Verb < theme location >

	[−r]	[−o]
	|	|
	SUBJ	OBL
OR	OBJ	SUBJ
	NOM	DAT/GEN

A hallmark of experiencers is that they tend to be sentient, which is in turn a property more commonly associated with Proto-Agents rather than Proto-Patients (see Dowty, 1991). Assuming the argument hierarchy in (18), the location can therefore over time be reinterpreted as a sentient goal/experiencer, resulting in the alternative linking in (17) being preferred for experiencer predicates, as in (19).

(18) $agent > goal/experiencer > instrument > theme/patient > location$

(19) Experiencer Verb < experiencer theme/stimulus >

[−o]	[−r]
|	|
SUBJ	OBJ
DAT/GEN	NOM

With respect to Icelandic, we postulate that topical dative arguments were placed prefinitely in what was established as a topical SpecIP position. In turn, this position becomes more firmly associated with subjects as of 1900, but recall that our data showed that dative subjects consistently lag behind other subjects in appearing in the prefinite position. We explain this as follows: dative experiencers are not prototypical subjects and may retain some object properties. Over time, dative experiencers become more firmly established as subjects, with the linking possibility in (19) becoming established as dominant linking for experiencer predicates. This is in line with what Allen (1995) has shown for oblique experiencers in English. Allen demonstrates that oblique experiencers already have some subject properties in Old English, and that when nominative subjects become obligatory in the 14th century, the experiencer subjects also conform and are realized as nominatives.

Once the prefinite position becomes more firmly established as a subject position in Icelandic (with over 70% of subjects appearing there in the data as of 1900), dative subjects also increasingly occur there, in order to conform to the overall structural change in the language. However, as they are not prototypical subjects, they follow suit, rather than lead the change; as non-canonical subjects, they eventually follow the language's overall positional licensing.

5 Summary and Conclusions

Kiparsky (1997) explicitly discusses experiencer subjects. These present an interesting difficulty for his linking system, which is based on binary features, like LFG's standard Mapping Theory. These features are associated with position, thematic role,

case and agreement morphology (for a summary of Kiparsky's theory of linking, see Butt (2006)). In Kiparsky's analysis, the Icelandic experiencer argument is assigned features that are in principle not compatible with a subject analysis, because the features associated with the dative preclude a linking to subject. However, he sees the linking to subject as being "rescued" by the features associated with SpecIP. Positional nominative case can be assigned in this position and the features associated with positional nominative case "override" the inherent features of the dative argument. In Kiparsky's analysis, morphology is thus "recessive", as it does not determine the grammatical relation status of an argument. Rather, position is dominant due to the rise of positional licensing in Germanic.

Our corpus study provides further evidence for the rise of positional licensing in Icelandic, but we also suggest that the prefinite SpecIP position is not yet exclusively a subject position, as V1 has not been lost (as yet) and the expletive *það* co-occurs with postfinite thematic subjects. We have further shown evidence for changes in the status of dative arguments. These become more firmly associated with experiencer semantics, which in turn become more firmly associated with a linking to subjects. As the prefinite position is becoming more established as a dedicated subject position, dative subjects are also increasingly found in this position.

Our analysis posits a complex interaction between case, word order, lexical semantics and information structure, but separates out lexical semantics from positional licensing. That is, unlike in Kiparsky's system, where position and case interact directly, LFG's linking theory does not factor in position. Rather, position and grammatical functions interact, so that grammatical functions act as a mediator between position and lexical semantics. Information structure in turn interacts with word order. With respect to this interaction, much more needs to be done to understand how information structure was expressed in Old Icelandic vs. the newer developments in the language.

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Polar *kya* and the Prosody-Syntax-Pragmatics Interface

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Abstract

This paper reports on part of a larger investigation of polar questions in Urdu/Hindi. Our overall study is concerned with how the interfaces between prosody, syntax, and semantics/pragmatics interact with respect to forming non-canonical readings for questions. In this paper, we focus on the prosody-syntax interface in particular and show how this is crucial for disambiguating between the polar and the wh-constituent uses of Urdu/Hindi *kya* 'what'. We work with the architecture of the prosody-syntax interface developed by Bögel (2015) and show how prosodic information guides syntactic disambiguation, which in turn results in the activation of the appropriate semantic information (polar vs. wh-constituent readings).

1 Introduction

This paper reports on part of a larger investigation of polar questions in Urdu/-Hindi. Our overall study is concerned with how the interfaces between prosody, syntax, and semantics/pragmatics interact with respect to forming non-canonical readings for questions. In this paper, we focus on the prosody-syntax interface in particular and show how this is crucial for disambiguating between the polar and the wh-constituent uses of Urdu/Hindi *kya* 'what'. We work with the architecture of the prosody-syntax interface developed by Bögel (2015) and show how prosodic information guides syntactic disambiguation, which in turn results in the activation of the appropriate semantic information (polar vs. wh-constituent readings).

As illustrated in (1)–(3), the wh-element *kya* 'what' is highly polyfunctional in Urdu/Hindi. We have so far identified uses in: a) constitutent questions as in (1); b) polar questions as in (2); and c) the so-called scope marking construction.

(1) ɑnu=ne uma=ko **kya** di-ya?
Anu.F=Erg Uma.F=Dat what give-Perf.M.Sg
'What did Anu give to Uma?' (Wh-Constituent Question)

(2) **kya** ɑnu=ne uma=ko kıtab d-i?
what Anu.F=Erg Uma.F=Dat book.F.Sg.Nom give-Perf.F.Sg
'Did Anu give a/the book to Uma?' (Polar Question)

Example (3) illustrates the scope marking construction (Dayal, 1996, 2000). In the declarative version, illustrated in (3-a), a pleonastic element *ye* 'this' is coindexed with an embedded that-clause. In the wh-counterpart, the *ye* 'this' is re-

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placed by the *kya* 'what' and the embedded that-clause contains a wh-constituent. It is called the scope marking construction because the *kya* 'what' licenses matrix scope of the wh-in-situ, as shown in (3-b).

(3) a. sita **ye** soc-ti hai [ki ram
Sita.F.Nom this think-Impf.F.Sg be.Pres.3.Sg that Ram
ja-ye-ga]
go-3.Sg-Fut-M.Sg
'Sita thinks that Ram will go.' (Scope Marking)
(lit.: Sita thinks this, that Ram will go.)

b. sita **kya** soc-ti hai [ki kon
Sita.F.Nom what think-Impf.F.Sg be.Pres.3.Sg that who
ja-ye-ga?]
go-3.Sg-Fut-M.Sg
'Who does Sita think will go?' (Wh Scope Marking)
(lit.: What does Sita think, that who will go?)

In this paper, we leave aside the scope-marking construction and concentrate on the ambiguities that arise with respect to polar *kya* vs. wh-constituent *kya*.

(4) a. ʃahina=ne naz=ko **kya** [tofa] di-ya?
Shahina.F=Erg Naz.F=Dat what present.M.Sg.Nom give-Perf.M.Sg
'Did Shahina give a gift to Naz?'

b. ʃahina=ne naz=ko [**kya** tofa] di-ya?
Shahina.F=Erg Naz.F=Dat what present.M.Sg.Nom give-Perf.M.Sg
'What gift did Shahina give to Naz?'

While the examples in (4) are string identical, they can be interpreted either as a polar question (4-b) or as a wh-constituent question (4-b) where the *kya* 'what' is embedded within an NP.

The paper is structured as follows. Sections 2 and 3 provide necessary background on wh-constituent and polar questions, respectively. This includes information about syntactic, prosodic, and pragmatic properties of the question types. The information is then used in section 4 to show how examples as in (4) can be disambiguated via the prosody-syntax architecture developed by Bögel (2015). The analysis is complex in the sense that information coming from the various modules of grammar, namely prosody, syntax, and pragmatics must be integrated. However, the analysis is also simple in that the architecture allows a seamless integration of the information, laying the foundation for work on more complex aspects of question formation in Urdu/Hindi. Section 5 concludes the paper.

2 Wh-Constituent Questions

Urdu/Hindi has traditionally been characterized as a wh-in-situ language (Bayer, 2006). The default word order in Urdu/Hindi is SOV so the idea is that the in-situ

position is the most natural position for the wh-word, as shown in (5).

(5) a. sita=ne d^{h}yan=se **ram=ko** dek^{h}-a t^{h}-a
Sita.F=Erg carefully Ram.M=Acc see-Perf.M.Sg be.Past-M.Sg
'Sita had looked at Ram carefully'

b. sita=ne d^{h}yan=se **kɪs=ko** dek^{h}-a t^{h}-a?
Sita.F=Erg carefully who.Obl=Acc see-Perf.M.Sg be.Past-M.Sg
'Who had Sita looked at carefully?'

However, a closer investigation reveals that the default position for wh-words in constituent questions is actually the immediately preverbal position, as in (6).

(6) a. sita=ne ram=ko dek^{h}-a t^{h}-a
Sita.F=Erg Ram.M=Acc see-Perf.M.Sg be.Past-M.Sg
'Sita had seen Ram.'

b. ram=ko **kɪs=ne** dek^{h}-a t^{h}-a?
Ram.M=Acc who.Obl=Erg see-Perf.M.Sg be.Past-M.Sg
'Who saw Ram?'

This immediately preverbal position has been identified independently as a syntactic focus position (Gambhir, 1981; Butt & King, 1996, 1997; Kidwai, 2000). Given that wh-words inherently designate focus because they open up a set of alternatives among which the answer should be selected as per Rooth's Alternative Semantics (Rooth, 2016), it follows that the default position for constituent question wh-words should indeed be the immediately preverbal focus position.

Further evidence for this analysis comes from a comparative study of Hindi and Indian English conducted by Féry et al. (2016). In the context of investigating information structure, they asked informants to produce sentences in response to a given context. They asked questions which targeted a specific grammatical relation, as in (7) and recorded the word order of the answer to the question.

(7) a. *In front of the well, who is pushing the car?* (Questioning the Subject)
b. *In front of the well, what is the man pushing?* (Questioning the Object)

The results for Hindi are shown in (8). When the object is questioned, the word order is always SOV. This is the wh-in-situ order, but it is also the order predicted by an analysis in which the object appears in an immediately preverbal focus position becuase this is what has been questioned and is thus placed in focus.

(8)

	SOV	OSV
Subject Questioned (n=28)	6	22
Object Questioned (n=26)	26	–

When the subject was targeted for questioning, the results were less clear, but an overwhelming number of responses place the subject in the immediately prever-

bal position, rather than using the default SOV word order. These results are again in line with an immediately preverbal focus position, which is where the response to the questioned item is being placed.

A web-based acceptability judgement test with speakers of Urdu conducted by Jabeen (2017) corroborates the results of Féry et al. (2016). We thus conclude that the default position for focused items is the immediately preverbal position. As the default position for focus, this is also the preferred position for wh-words in constituent questions.[1]

However, the immediately preverbal position is only the preferred position for wh-words in constituent questions. Manetta (2012) demonstrates that wh-phrases have the same kind of scrambling possibilities as normal NPs. So, wh-words can in principle appear anywhere in the clause, as shown in (9).

(9) a. ɑnu=ne uma=ko **kya** di-ya?
Anu.F=Erg Uma.F=Dat what give-Perf.M.Sg
'What did Anu give to Uma?'
b. %**kya** ɑnu=ne uma=ko di-ya?
c. ɑnu=ne **kya** uma=ko di-ya?
d. ɑnu=ne uma=ko di-ya **kya**?

However, there are several things to notice about the distribution of the wh-words. For one, the different word orders go hand in hand with differences in interpretation. These differences are subtle as they fall within the realm of pragmatics. For example, Butt et al. (2016) investigate examples as in (10) where the wh-word appears immediately postverbally within the verbal complex (Bhatt & Dayal, 2007; Manetta, 2012) between the main verb and attendant auxiliaries. They argue that this immediately postverbal position within the verbal complex reflects a secondary focus position. The pragmatic effect of the other word orders remains to be fully investigated and understood.

(10) sita=ne dʰyan=se [dekʰ-a **kɪs=ko** tʰ-a]?
Sita.F=Erg carefully see-Perf.M.Sg who.Obl=Acc be.Past-M.Sg
'Who had Sita looked at carefully?'

Also note that *kya* 'what' is dispreferred in the clause initial position. This holds for *kya* 'what', but not for other wh-words, as the contrast between (9) and (11) shows with respect to **kis** 'who/whom'.

(11) a. **kɪs=ne** uma=ko tofa di-ya?
who=Erg Uma.F=Dat present.M.Sg.Nom give-Perf.M.Sg
'Who gave Uma a present?'
b. uma=ko **kɪs=ne** tofa di-ya?
c. uma=ko tofa **kɪs=ne** di-ya?
d. uma=ko tofa di-ya **kɪs=ne**?

[1] We leave aside the issue of questions with multiple wh-words for now.

We put forward an explanation for this asymmetry in this paper by attributing the dispreference for the clause initial position due to interference by the distribution of polar *kya*.

3 Polar Questions

Polar questions in Urdu/Hindi are string identical to the corresponding declarative, as shown in (12) and (13). The difference between question vs. declarative status is signaled via intonation. Declaratives have an L-L% intonational phrase boundary, while a polar question is signaled by an L/H-H% intonational phrase boundary.

(12) (ʃahina=ne norina=ko mara)$_{\text{L-L\%}}$
Shahina.F=Erg Norina.F=Acc hit-Perf.M.Sg
'Shahina hit Norina.' (Declarative)

(13) (ʃahina=ne norina=ko mara)$_{\text{L/H-H\%}}$
Shahina.F=Erg Norina.F=Acc hit-Perf.M.Sg
'Did Shahina hit Norina?' (Polar Question)

3.1 Distribution of Polar *kya*

Polar questions can optionally be expressed with *kya* 'what', as shown in (14). This use of *kya* has been dubbed "polar *kya*" by Bhatt & Dayal (2015).

(14) **kya** ʃahina=ne norina=ko ma-ra?
what Shahina.F=Erg Norina.F=Acc hit-Perf.M.Sg
'Did Shahina hit Norina?'

Grammars and previous literature report polar *kya* as appearing only clause initially in Urdu/Hindi (Glassman, 1977; Platts, 1884; Masica, 1991; Montaut, 2004). Given established crosslinguistic patterns and the fact that Urdu declaratives and polar questions are string identical, a likely hypothesis is that polar *kya* is a question marker that serves to differentiate polar questions from declaratives.

However, Bhatt & Dayal (2015) convincingly establish that polar *kya* is not a question marker. They note that it is optional in matrix clauses, something that one would not expect from a clause typing marker. They also show that polar *kya* is generally disallowed in embedded clauses, whereby complements of so-called "rogative" predicates like *wonder, investigate, ask, examine* (Lahiri, 2002, 287) as in (15-b) are an exception.

(15) a. *ɑnu jan-ti hai [ki kya tum cai
Anu know-Impf.F.Sg be.Pres.3.Sg that what you tea
pi-yo-ge?]
drink-2.Pl-Fut.M.Pl
Intended: 'Anu knows whether you will drink tea.' (Non-rogative)

b. ɑnu jan-na cah-ti hai [ki kya tum cai
Anu know-Inf.M.Sg want-Impf.F.Sg be.Pres.3.Sg that what you tea
pi-yo-ge?]
drink-2.Pl-Fut.M.Pl
'Anu wants to know whether you will drink tea?' (Rogative)

Bhatt & Dayal (2015) further point out that polar *kya* can actually appear anywhere in the clause, as shown in (16). This is also not a property generally associated with question markers, which tend to have a fixed position; in South Asian langauges, this tends to be either clause initial or clause final (Masica, 1991).

(16) (kya) ɑnu=ne (kya) uma=ko (kya) kɪtab (%kya)
what Anu.F=Erg what Uma.F=Dat what book.F.Sg.Nom what
d-i (kya)?
give-Perf.F.Sg what
'Did Anu give a/the book to Uma?

They also note that the *kya* is strongly dispreferred in the immediately preverbal position. We hypothesize that this is because the immediately preverbal position is the default focus position, which is an unnatural position for the polar *kya*. Conversely, it is the most natural position for wh-words in constituent questions and given that *kya* can appear in both constituent and polar questions, we posit that the most salient reading of *kya* in this position is the constituent one. The polar reading is therefore dispreferred.

This hypothesis is borne out by examples such as (17), which in principle should preferentially give rise to a polar reading since both of the core arguments of *mara* 'hit' are present in the clause. However, when we asked informants to pronounce the string in (17), they overwhelmingly chose to pronounce it as a constituent question and had severe trouble pronouncing it as a polar question.

(17) ʃahina=ne norina=ko **kya** ma-ra?
Shahina.F=Erg Norina.F=Acc what hit-Perf.M.Sg
Polar Reading: 'Did Shahina hit Norina?'
Preferred Wh-Constituent Reading: 'What did Shahina hit Norina with?'

3.2 Function of Polar *kya*

If we follow Bhatt & Dayal's arguments that polar *kya* is not a question marker, then we need to determine what its function is. Bhatt & Dayal suggest that it is used to partition a clause roughly into given vs. new (cf. the "watershed" idea of Krivonosov 1977; Grosz 2016). Material to the left of polar *kya* is thus taken as given and not available for being questioned (Bhatt & Dayal, 2015).

(18) A. **ɑnu=ne** **kya** uma=ko tofa di-ya?
Anu.F=Erg what Uma.F=Dat present.M.Sg.Nom give-Perf.M.Sg
'Did Anu give a/the present to Uma?'

B. #nɑhĩ, **asɪm=ne** di-ya
no Asim.M=Erg give-Perf.M.Sg
'No, Asim did.'

However, our own investigations showed that when a constituent to the left of polar *kya* is prosodically prominent, it can indeed be questioned.

(19) A. **ɑnu=ne**$_{Prominent}$ **kya** uma=ko tofa
Anu.F=Erg what Uma.F=Dat present.M.Sg.Nom
di-ya?
give-Perf.M.Sg
'Did ANU give a/the present to Uma?'

B. nɑhĩ, **asɪm=ne** di-ya
no Asim.M=Erg give-Perf.M.Sg
'No, Asim did.'

We are therefore assume the hypothesis articulated by Biezma et al. (2017) that polar *kya* is a focus sensitive operator which associates with focused material. It will either associate with a stressed item in the clause or, per default, with the item to its right. The function of polar *kya* as a focus sensitive operator is to constrain the set of possible answers viable in the context of an utterance. It imposes restrictions on what the question is about and conveys assumptions regarding the possible answers that plain information-seeking questions do not convey. These extra assumptions lie at the heart of the fact that polar *kya* questions tend to be used for non-canonical meanings, such as rhetorical questions of the type in (20). That is, the use of polar *kya* adds an extra pragmatic dimension and differentiates polar *kya* questions from plain polar questions as in (20).

(20) tu pagɑl hai kya?
you crazy be.Pres.3.Sg what
'Are you crazy?' Script of *Socha Na Tha*

We do not go into the details of Biezma et al.'s proposal here, nor do we reproduce their argumentation. The focus of this paper lies on the disambiguation of polar vs. constituent *kya*.

4 Ambiguity Resolution via the Interface Architecture

Recall that some strings are ambiguous between polar *kya* and wh-constituent questions. This is illustrated below via examples taken from movie scripts.

(21) mɛ̃ **kya** bol-ũ?
I.Nom what speak-1.Sg
Constituent Question: 'What should I say?'
Polar Question: 'Should I say (something)?' Script, *Ankhon Dekhi*

(22) **kya** tɑklif ho rɑh-i hai [. . .]?
what bother.Nom be Prog-F.Sg be.Pres.3.Sg
Constituent Question: 'What's bothering (you)?'
Polar Question: 'Is something bothering (you)?' Script, *Ankhon Dekhi*

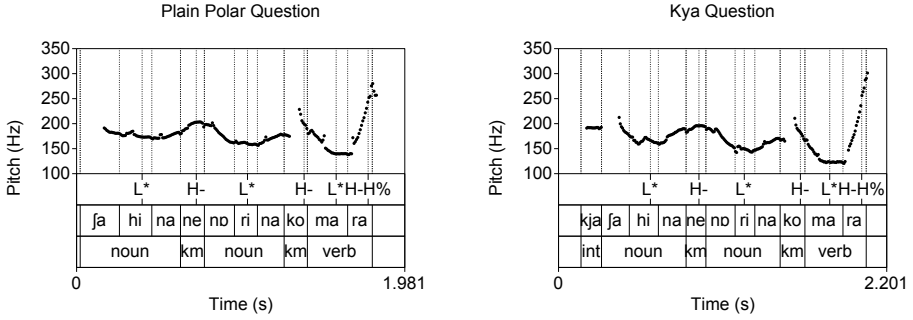
(23) ɑb **kya** mafi mãg-ẽ tʊm=se?
now what forgiveness.M.Sg.Nom ask-Pl you.Fam=Inst
Constituent Question: 'It's no use apologizing now.'
(Lit.: 'What forgiveness can I ask of you?)
Polar Question: 'Am I supposed to ask for your forgiveness now?'
Script, *Ankhon Dekhi*

While the examples are in principle ambiguous, they can be disambiguated via the context they occur in. They can also be reliably disambiguated via their attendant prosody as each of the readings are prosodically distinct.

4.1 Prosodic Information

Our investigations have shown that the polar *kya* always has a flat or falling intonation while the constituent question *kya* has a high tone H*. Urdu/Hindi generally exhibits a L* H- pattern on all prosodic phrases (Genzel & Kügler, 2010), with a larger pitch excursion on focused phrases. Given this, the flat intonation of polar *kya* is interesting. The contrast between the plain polar question and the polar *kya* question in (24) is shown in the figure below.

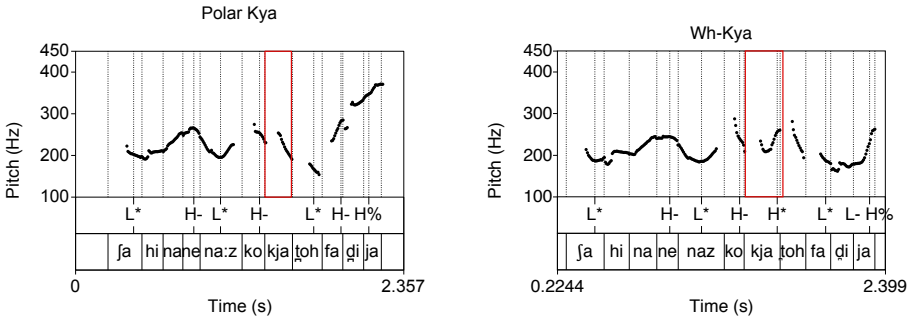
(24) (**kya**) ʃahina=ne norina=ko ma-ra?
what Shahina.F=Erg Norina.F=Acc hit-Perf.M.Sg
'Did Shahina hit Norina?'



The difference between the H* of the constituent question *kya* and the flat/falling intonation of the polar *kya* is further illustrated by the pitch tracks following and illustrating (25), which repeats examples (4-b) and (4-b).

In addition to the prosodic differences between polar *kya* and constituent question *kya*, polar questions can be distinguished from constituent questions via the boundary tones: constituent questions pattern like declaratives and have L-L% as a boundary tone (with some variation as in the example below) while polar questions end on a high tone (L/H-H%), as also illustrated in the pitch tracks.

(25) ʃahina=ne naz=ko **kya** tofa di-ya?
Shahina.F=Erg Naz.F=Dat what present.M.Sg.Nom give-Perf.M.Sg
'Did Shahina give a gift to Naz?' (Left Pitch Track)
'What gift did Shahina give to Naz?' (Right Pitch Track)



4.2 Syntax

In what follows we work with the example in (26) and show how we integrate prosodic information via the prosody-syntax interface proposed by Bögel (2015) in order to disambiguate polar vs. constituent *kya* readings.

(26) alina=ne zain=ko **kya** tofa di-ya tʰ-a?
Alina=Erg Zain=Acc what present.M.Sg give-Perf.M.Sg be.Past-M.Sg
Constituent Question: 'What gift did Alina give to Zain?'
Polar Question: 'Did Alina (actually) give a gift to Zain?'

In terms of syntactic analysis, we base ourselves on the approach to Urdu syntax established as part of the Urdu ParGram grammar (Butt & King, 2007). The Urdu ParGram grammar uses a flat structure in which all major constituents are allowed to scramble. One of these major constituents is the verbal complex, labeled VC in the c-structure analyses.

Following Slade (2011), we analyze *kya* as a Q node within the c-structure. We furthermore assume only one underspecified *kya* 'what' for the polar and the *wh*-readings.[2] Figure 1 shows the c-structures for both interpretations of *kya*: While

[2]We could assume two separate lexical and syntactic entities and treat polar and constituent question *kya* as an accidental homophony. However, crosslinguistic evidence shows that there is a general

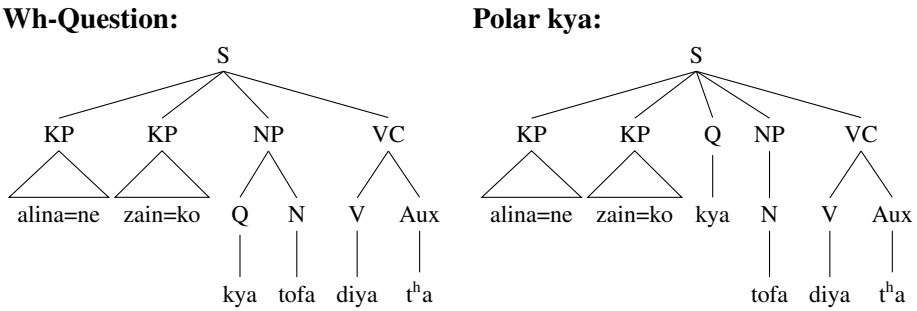


Figure 1: C-structures for the *wh*-reading and for *polar kya*.

kya forms an NP together with the associated N in the *wh*-reading, it remains an independent daughter of S in the *polar kya* interpretation.

4.3 The Syntax-Prosody Interface

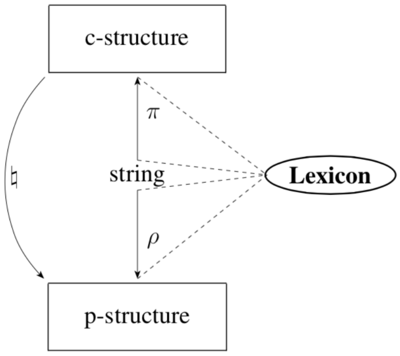
Initial LFG proposals for the p(rosodic)-structure were "syntactocentric" (cf. Jackendoff 2002, see, e.g., Butt & King (1998)), but newer proposals have moved towards seeing prosody as a more independent level of representation (Mycock, 2013; Dalrymple & Mycock, 2011; Dalrymple & Nikolaeva, 2011; Bögel, 2015). Prosody is taken to interact with morphosyntax, but is not derived from it.

For the analysis of *kya*, we follow the version of the syntax-prosody interface proposed by Bögel (2015). Based on the assumption that *listening* and *speaking* are inherently different processes at the interface between prosody and syntax (and grammar in general), the proposal makes a crucial distinction between *production* and *comprehension* and the grammar-internal position of the single modules between the two terminal points of *meaning* and *form*:

- *Production/generation/speaking*:
  from meaning to form (syntax $\rightarrow$ prosody)
- *Comprehension/perception/listening*:
  from form to meaning (prosody $\rightarrow$ syntax)

Two information transfer processes are assumed at the interface between syntax and prosody: The *Transfer of structure* ($\natural$) relates syntactic and prosodic constituency. The *Transfer of vocabulary* (ρ) associates morphosyntactic and phonological information within the lexicon and projects these onto the respective structures. The figure below shows how these new projections are integrated into the LFG architecture.

trend for 'what' to be used for other question types and we believe that this is not an accident. We are working on a unified semantic approach to polar and constituent question *what* and we here anticipate that approach by positing just one underlying and underspecified entry for *kya*.



♮: The *Transfer of structure* → Information on syntactic and prosodic grouping, and on intonation is exchanged.

ρ: The *Transfer of vocabulary* → Associates morphosyntactic and phonological information on lexical elements and projects them to their respective structures.

We illustrate how the system works with a concrete example involving the *comprehension* of the utterance in (26). In a very first step the acoustic signal corresponding to (26) is received and processed by a hearer. As the speech signal is processed, the phonetic information is identified and used to analyze the speech signal in terms of phonological categories. The speech signal is divided into syllables that are associated with further information, e.g., pitch and duration (as shown in the upper part of Figure 2). These 'raw' acoustic cues are then parsed into categorical information, e.g., about intonational cues such as H* or L-L%, as shown in the lower part of Figure 2.[3]

- The 'raw' speech signal information:

DUR.	0,07	0,17	0,16	0,15	0,28	0,13	0,25	0,23	0,13	0,13	0,11	0,14	SIGNAL
F^0	177	183	204	216	181	177	205	188	166	164	140	136	↓
VALUE	[ə]	[li]	[na]	[ne]	[zæn]	[ko]	[kja]	[t̪o]	[fa]	[d̪i]	[ja]	[tʰa]	
INDEX	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	...

- Categorical interpretation on the basis of 'raw' information:

PHRAS.	...	...	...	...	...	...	...	...	...	...	...	$)_\iota$	INTERPRETATION
TOBI	...	...	...	...	...	...	H*	...	...	...	...	L-L%	↓
DUR.	0,07	0,17	0,16	0,15	0,28	0,13	0,25	0,23	0,13	0,13	0,11	0,14	SIGNAL
F^0	177	183	204	216	181	177	205	188	166	164	140	136	↓
VALUE	[ə]	[li]	[na]	[ne]	[zæn]	[ko]	[kja]	[t̪oh]	[fa]	[d̪i]	[ja]	[tʰa]	
INDEX	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	...

Figure 2: Processing of Speech Signal

The (segmental) information coming from the speech signal is matched against the p-form of a multidimensional lexicon which includes information about syntactic category, segmental structure, morphological class, functional information, and meaning. Sample lexical entries for the noun *tofa* 'gift' and the question word *kya* 'what' are provided in Table 1. In the table "s-form" is short for "syntactic form" and "p-form" is short for "phonological form".

concept	s-form		p-form	
'GIFT'	N	(↑ PRED) = 'tofa' (↑ NUM) = sg (↑ GEND) = masc	SEGMENTS	/t̪ o f a/
	Q	(↑ INT-FORM) = kya	SEGMENTS	/k j a/

Table 1: Lexical entries for *kya* and *tofa*.

Once a p-form is identified in the multidimensional lexicon, the s-form information associated with it also becomes available and can be used as input to c-structure terminal nodes via the π projection (Kaplan, 1987; Asudeh & Toivonen, 2009). This is the *Transfer of Vocabulary*.

While all of the information associated with a given lexical entry becomes available for processing (or production), once one of the dimensions (e.g., c-structural or p-structural information) is accessed, we maintain LFG's principles of modularity. We do this by only allowing each of the dimensions within the lexicon to be accessed by the module whose information it encodes. That is, f-structure works with the f-structural annotations, c-structure works with the syntactic category, semantic structure with the semantic forms and p-structure with the phonological information. This is already part of standard LFG and we continue to leverage the multidimensionality of an LFG lexicon.

We now turn to the *Transfer of Structure* which relates c-structure to associated infomation in p-structure. This is the crucial part of the prosody-syntax interface with respect to information that goes beyond the lexicon. The projection $\natural$ is defined as the inverse projection of π composed with ρ, as shown in (27).[4]

(27) **Transfer of Structure — Definitions**

- where $\natural(\equiv \rho(\pi^{-1}))$
- where S_{min} refers to the *first* syllable within the scope of a node
- where S_{max} refers to the *last* syllable within the scope of a node,
  for example: $(\natural(T(*))S_{max}$ PHRASING) = $)_\iota$

We define S_{min} as the first syllable within a node and S_{max} as the last syllable within a node. We need to be able to access parts of the speech signal in order to check for intonational information and do this on the basis of syllables, into which the speech signal has been segmented.

[4]In the LFG architecture relations between components of grammar are governed by projection functions that map between different structures. For example, the ϕ-projection relates c-structure to f-structure. These functions can be inverted so that the inverse ϕ-projection relates f-structure to c-structure. These inverse functions allow for the inclusion of information from other modules. For example, information about surface syntactic scope can be accessed via an inverse function from f-structure to c-structure.

4.4 Analysis

With the prosody-syntax interface in place, we are now in a position to show how the utterance in (28) (repeated from (26)) can be disambiguated.

(28) alina=ne zain=ko **kya** tofa di-ya t^{h}-a?
Alina=Erg Zain=Acc what present.M.Sg give-Perf.M.Sg be.Past-M.Sg
Constituent Question: 'What gift did Alina give to Zain?'
Polar Question: 'Did Alina (actually) give a gift to Zain?'

4.4.1 Constituent Question *kya*

We begin with the constituent question reading of *kya*. In this case, *kya* carries a H*, which can be accessed via the Transfer of Structure as in (29).

(29) *kya*: ($\natural(T(*))S$ ToBI) = H*

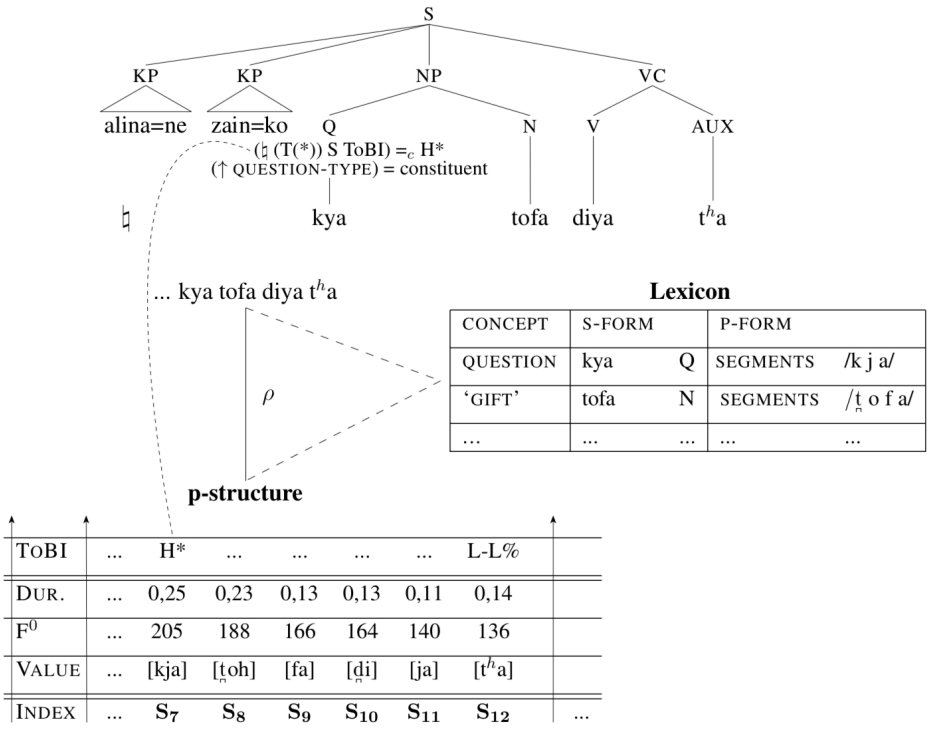


Figure 3: *kya* as a constituent question

The c-structure analysis and the lexicon are repeated in Figure 3, as is the relevant part of the speech signal processed into a vector of syllables. The speech signal contains a H* on S7, which is the word 'kya'. This *kya* is accessed in the Lexicon via the Transfer of Vocabulary. The Lexicon relates the p-form / k j a / to the syntactic form, which specifies that it is a Q at c-structure. The lexicon otherwise

has nothing to say about *kya*. It is completely unspecified whether this *kya* signals a constituent or a polar question.

The rules of our grammar allow for two c-structure analyses of the utterance in (29) as shown in Figure 3 and 4. However, the c-structure in Figure 3 is only licensed if *kya* can be interpreted as a constituent question. In order to be interpreted this way, it needs to be associated with an H*. This is part of the grammatical knowledge of the language and is encoded in our analysis as part of the c-structure annotation on *kya* in Figure 4, as shown in (30).

(30) NP $\longrightarrow$ Q N
($\natural(T(*))S$ ToBI) $=_c$ H*
($\uparrow$QUESTION-TYPE) = constituent

The c-structure annotation on Q features a constraining equation which ensures that *kya* can only be inserted as a terminal Q node if there is a H* on the corresponding p-form. This is ensured via the Transfer of Structure, which relates c-structural and p-structural information via the $\natural$ projection.

If *kya* is indeed associated with a H* in the speech signal, then this can be identified as a constituent question and this information is passed along to the f-structure via the second annotation under Q in (30): an equation assigning the value "constituent" to the feature QUESTION-TYPE.

4.4.2 Polar *kya*

The analysis for polar *kya* is shown in Figure 4. Here *kya* is analyzed as an immediate daughter of S. There is no syntactic or prosodic evidence to indicate that *kya* forms a constituent with any other item in the clause. Additionally, given that all immediate daughters of S can scramble as part of the word order variation exhibited by Urdu/Hindi, the ability of *kya* to scramble can be dealt with via the shuffle operator on a par with the other major constituents of S.

The c-structure analysis in Figure 4 is only possible if *kya* does not carry a H*. Again, the lexical entry for *kya* has nothing in particular to say about *kya* with respect to the syntax other than that it is a Q. It is the same underspecified entry seen with respect to Figure 3. And again, the major work is done by the f-structure annotations on Q and by the $\natural$ projection invoked by these annotations.

(31) S $\longrightarrow$ ... Q ...
($\natural(T(*))S$ ToBI) $\neq$ H*
($\uparrow$QUESTION-TYPE) = polar

The f-structure annotations on Q in (31) say two things: 1) this is a polar question; 2) but only if there is no H* on *kya*. The information as to whether the negative constraint on Q in (31) is satisfied or not is again determined via the Transfer of Structure, which relates prosodic with syntactic information via the $\natural$ projection.

We have not made use of the boundary tone information (H-H% for polar vs. L-

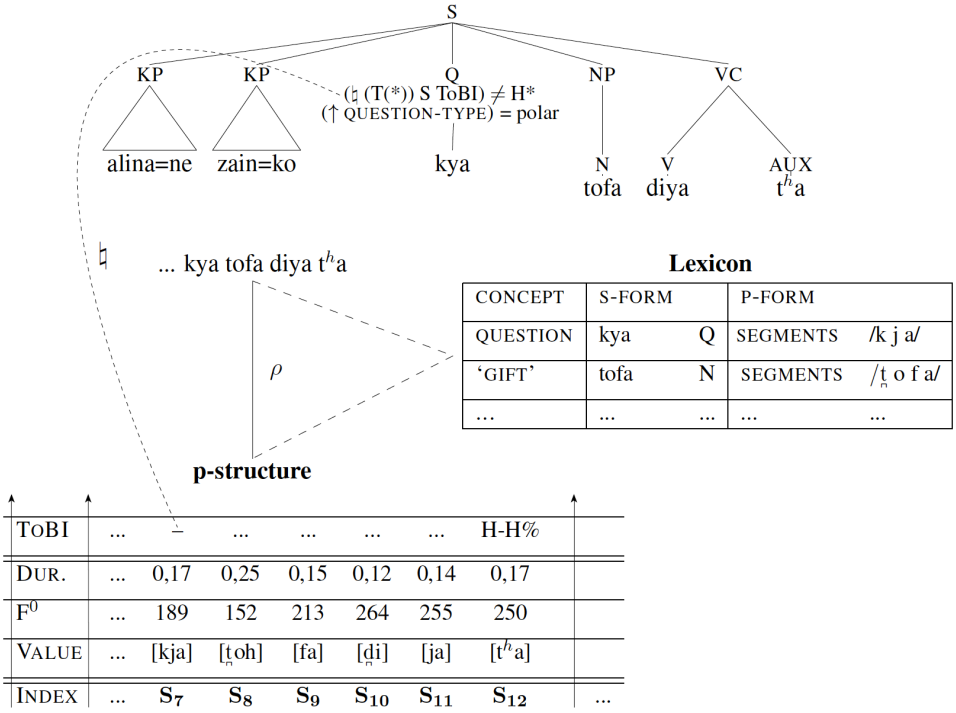


Figure 4: *kya* as a polar question

L% for wh-constituent questions) in our analysis. In our prosodic work on Urdu, we have found that the boundary tones tend to vary (cf. also Puri 2013). The variation is mainly due to phonetically governed factors and is in line with crosslinguistic observations on variable realizations of boundary tones. For purposes of presentation we have abstracted away from the variation in this paper and have not included boundary tone information as part of our proposal for disambiguating between polar and wh-constituent *kya*. Instead, we have relied on the phonological information associated with *kya* as this information appears to be very reliable.

4.5 Preferences and Interfacing with Semantics/Pragmatics

In this final analysis section we address several issues that remain open. One is the issue of preferences found with regard to the distribution of polar vs. wh-constituent *kya*. Another is the focus sensitive nature of polar *kya* and the determination of its scope.

4.5.1 Preferences in Distribution

Recall that polar *kya* and wh-constituent *kya* in principle have the distribution of other major constituents in the clause. However, polar *kya* is dispreferred in the immediately preverbal position while wh-constituent *kya* is dispreferred in the clause

initial position.

(32) (kya) ɑnu=ne (kya) uma=ko (kya) kıtab (%kya)
what Anu.F=Erg what Uma.F=Dat what book.F.Sg.Nom what
d-i (kya)?
give-Perf.F.Sg what
'Did Anu give a/the book to Uma?

(33) (%kya) ɑnu=ne (kya) uma=ko (kya) d-i (kya)?
what Anu.F=Erg what Uma.F=Dat what give-Perf.F.Sg what
'What did Anu give to Uma?

We propose that polar *kya* is dispreferred in the immediately preverbal position because this is the default position for focus, hence the most natural position for wh-constituent *kya* and hence also an unnatural position for polar *kya* as a focus sensitive operator.

The reason for the dispreference for the clause initial position by wh-constituent *kya* is not as clear. We believe the most likely explanation is a historical one. Given that the older descriptions of polar *kya* only allow for a clause initial use, it is likely that the freer distribution is due to historical change. If this is true, then it is likely that the clause initial position is still more firmly associated with polar *kya*. Another possible explanation could be that the clause initial position is the one in which polar *kya* appears most frequently. However, a small study of the script of the Bollywood movie *Socha Na Tha* suggests that this explanation is not on the right track. Of a total of 24 polar questions found with *kya*, the distribution of the polar *kya* was: 7 initial, 5 medial and 12 final.[5]

Whichever historical or synchronic reason there is for the difference in distribution, the positional dispreferences can be modeled most conveniently via the OT-style constraints implemented as part of the XLE grammar development platform (Frank et al., 1998; Crouch et al., 2017). These constraints serve to disprefer an analysis in which wh-constituent *kya* is placed clause initially and in which polar *kya* is placed in the immediately preverbal position. The OT-style constraints implemented within XLE can be used in both directions: parsing and generation. Given that Bögel's prosody-syntax architecture takes the needs of comprehension vs. production very seriously, these OT-style constraints are exactly right for our analysis.

4.5.2 Semantics/Pragmatic Interpretation

The polar vs. wh-constituent *kya* are associated with very different meanings. We have not gone into the semantic interpretation of either construction in any detail in this paper. We did note that our current research sees polar *kya* as a focus sensitive operator that adds extra restrictions on the question and conveys assumptions

[5]We found a total of 649 questions, of which 204 were polar questions.

regarding what the possible answers could or should be. Plain information-seeking polar questions do not trigger such extra pragmatic inferencing.

We do not discuss the precise details and formulation of this pragmatic account here (but cf. Biezma et al. 2017). We do, however, ensure that syntax provides all of the necessary information needed for semantic/pragmatic interpretation. We assume a syntax-semantics/pragmatics interface that does "description by analysis" (Halvorsen & Kaplan, 1988), whereby a semantic analysis is arrived at on the basis of information provided by another level of representation. For semantics, this is generally taken to be the f-structure.

In our analysis the following information is made available at f-structure. The feature-value `QUESTION-TYPE polar` vs. `QUESTION-TYPE constituent` signals the type of question, triggering the relevant semantic interpretation. With respect to polar questions, it is also necessary to know whether it is a plain polar question or whether the question contained a polar *kya*. This information can be provided by associating an extra feature with *kya* in Figure 4: `INT-FORM kya`. This registers the fact that there was a *kya* in the polar question at f-structure and thereby makes this information easily retrievable for semantic interpretation at s-structure.

Further information that is needed is the scope of the focus sensitive polar *kya*. Recall that the polar *kya* can be associated with either: 1) a constituent to its right; 2) a constituent that is prosodically prominent. The first option applies in the absence of a prosodically prominent constituent. We propose a Metarulemacro (Crouch et al., 2017) that is triggered as part of the rule containing a polar *kya*. A metarulemacro is a macro rule that applies to all other rules of the grammar. Within the LFG ParGram grammars, for example, metarulemacros are standardly used to capture constituent coordination. That is, rather than writing individual rules for each constituent in the grammar to allow for the coordination of that constituent, the metarulemacro applies to all rules of the grammar and adds in the possibility of constituent coordination where appropriate.

In our case, for each constituent in the clause (daughters of S), a metarulemacro checks whether this constituent is prosodically prominent. The checking happens via the Transfer of Structure at the prosody-syntax interface, whereby the information of whether a constituent is prosodically prominent or not is tested via the $\natural$ projection. If there is no prosodically prominent constituent, then the scope of polar *kya* is determined via f-precedence so that the right sister of polar *kya* is picked out as the entity that the focus sensitive operator *kya* applies to.

5 Conclusion

In this paper, we have investigated various uses of *kya* 'what' in Urdu/Hindi. We focused particularly on polar *kya* vs. wh-constituent *kya* and showed that ambiguities arise because of their distributional possibilities in the clause. Prosodic information is crucial for the resolution of these ambiguities. We demonstrated how the

relevant prosodic information can be accessed via the syntax given the architecture proposed by Bögel (2015).

Our analysis sees *kya* 'what' as a lexically underspecified item. *kya* is specified as polar *kya* vs. a constituent wh-word as part of the syntactic analysis due to annotations at c-structure. The c-structure analysis in turn depends on prosodic information encoded in the speech signal.

Polar *kya* is optional in polar questions. We briefly discussed its function and pointed to the conclusion in Biezma et al. (2017) that polar *kya* is a focus sensitive operator which conveys restrictions on the expected answer. The details of this analysis are the subject of future work. In this paper, we focused on laying the foundations for that future work by sorting through the uses of *kya*, proposing syntactic analyses for polar vs. wh-constituent *kya* and showing how to integrate vital prosodic information via the prosody-syntax interface.

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Negative Sensitive Indefinites in Maltese

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Abstract

This paper looks at sentential negation in Maltese and the syntactic behaviour of a group of negative sensitive indefinite items in Maltese, for which existing literature offers only a partial (and indeed partially incorrect) characterisation. We focus on syntactic aspects of the interplay between sentential negation and negative sensitive items (NSIs), both negative concord items (NCIs) and negative polarity items (NPIs). Our primary aim is to provide a solid description of the somewhat complex facts and some formalisation of the syntactic aspects in LFG, building on previous work on syntactic aspects of negation in this framework.

1 Sentential Negation in Maltese

In broad terms, Maltese uses a bi-partite strategy, realized as *ma ...-x/m' ...-x*, in the negation of finite verbal predicates, as described in several sources, including Borg & Azzopardi-Alexander (1997) and Lucas (2009). It thus shares a number of aspects of the morphosyntax of negation with closely related varieties of vernacular Arabic. The examples in (1) illustrate this with a finite, perfective verb. Imperfective forms also use this circumfixal strategy. As Spagnol (2009, 29) notes, imperfective forms also permit a second strategy, which is the one otherwise used to express non-finite forms. These two different strategies are associated with distinct aspectual interpretations. This second strategy circumfixes *ma- ...-x/m' ...-x* to a form identical to a nominative pronominal. The example in (2b) illustrates this and table 1 provides the inventory of forms constituting the 'pronominal' NEG strategy in Maltese. Either a default or an agreeing form may be used in the pronominal NEG strategy.

(1) a. Qraj-t il-ktieb.
read.PFV-1SG DEF-book
I read the book.

b. **Ma** qraj-t-**x** il-ktieb.
NEG read.PFV-1SG-NEG DEF-book
I didn't read the book.

(2) a. **Ma** n-iekol-**x** ħafna.
NEG 1-eat.IMPV.SG-NEG a.lot
I don't eat a lot. HABITUAL

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b. **Mhux** ∼ **minix** n-iekol ħafna.
NEG.3SGM.NEG ∼ NEG.1SG.NEG 1-eat.IMPV.SG a.lot
I am not eating a lot. PROGRESSIVE | RESTRICTED HABIT

Morphosyntactic features	**Pronominal** NEG **inflection**
1SG	*mnix* ∼ *minix* ∼ *mjienx*
2SG	*mintx* ∼ *mintix*
3SGM	*mhux* ∼ *mhuwiex* ∼ (dialectal) *mihux*
1PL	*maħniex*
2PL	*mintomx*
3PL	*mhumiex*

Table 1: The paradigm of the pronominal NEG strategy in Maltese [1]

The pronominal NEG strategy illustrated in (2b) is also used with non-finite verbal morphological forms such as participles, as in (3), and with non-verbal predicates. Throughout the rest of this paper we will focus our analysis on the bipartite strategy illustrated in (1) and (2a). Our observations concerning the interaction with negative sensitive items carry over to the pronominal NEG strategy.

(3) **Mhux** ∼ **mhumiex** sejr-in.
NEG.3SGM.NEG ∼ NEG.3PL.NEG go.ACT.PTCP-PL
They are not going. ACTIVE PARTICIPLE

We conclude our brief overview of the realization of sentential negation with the negation of imperative forms.[2] The PROHIBITIVE form involves *la* (which is optional) in combination with *-x* affixed to the SG and 2PL imperfective forms, while the (positive) imperative is realized by a distinct imperative form.

(4) a. Ikteb!
write.IMP.2SG
Write!

b. **(La)** t-i-ktib-**x**! *__(La)__ iktib**x**!
NEG 2-FRM.VWL-write.IMPV.SG-NEG
Don't write!

Similar to other Arabic dialects, the bi-partite negation of Maltese represents stage II of the Jespersen cycle (Jespersen, 1917) of NEG-formation (Lucas, 2007).

[1] As we will see below, when *-x* is not part of the form, the orthographical form changes slightly, e.g. *m'aħna*, as opposed to *maħniex*. In contexts where *-x* is not part of the form, the only form that becomes available in the 1SG cell is: *m'jien*.

[2] Note that other sentential NEG strategies are also employed in Maltese, including *lanqas* (> *ʔal-ʔanqas* 'the least' in Arabic (Barbera, 1940)) and *mank* (> *mancare* 'lack; miss' in Italian), which additionally function as scalar focus markers and minimisers.

The affix *-x* part has grammaticalised out of an earlier form corresponding to *šay?* 'thing' in Classical Arabic, with *ma* as the sole exponent of negation in stage I of the cycle. Synchronically, the question arises as to whether one part (and if so, which part) or both parts (via distributed exponence) realizes sentential NEG. We will show that it is *ma* which realizes sentential NEG in Maltese.

2 Indefinite Proforms

This section introduces a range of negative sensitive items and discusses their interaction with sentential negation. Previous literature has discussed these elements as negative concord (NC) items, that is, as inherently negative and giving rise to single negation (concordial) interpretations in combination with markers of sentential NEG (Lucas, 2009, 2013, 2014). Extending the observations in Camilleri & Sadler (2016) we will show that the picture is considerably more complicated.

2.1 N-series Proforms as *n*-words

Table 2 shows the relevant inventory of proform items in Maltese.[3] While the *xi ħaġa*-series are generally taken to be positive polarity items (PPIs), the *xejn*-series are taken to be n-words, that is, as NC items in combination with sentential NEG (see (5)); in fact Lucas takes Maltese to be 'the only Arabic variety that may accurately and straightforwardly be described as a negative-concord language' (Lucas, 2009, 2013, 2014). Following previous literature, we will sometimes refer to these forms as negative indefinites (without commitment to their semantic treatment as indefinites, existentials or universals) or as n-words, at this stage, but we also introduce the terms N-series and P-series to avoid confusion.

	***xejn* or N-series**	***xi ħaġa* or P-series**
determiner	*ebda* 'no(ne)'	*xi* 'some'
thing	*xejn* 'nothing'	*xi ħaġa* 'something'
person	*ħadd* 'no one'	*xi ħadd* 'someone'
time	*qatt* '(n)ever'	*xi darba* 'once/sometimes'
place	*imkien* 'nowhere'	*x'imkien* 'somewhere'

Table 2: Inventory of indefinite items (Haspelmath & Caruana, 1996, 215)

(5) and (6) show that only P-series proforms occur in affirmative declaratives, and only N-series proforms in negative clauses (N-series in boldface).

(5) a. Mor-t x'imkien.
go.PFV-1SG somewhere
I went somewhere.

b. *Mor-t **imkien**.
go.PFV-1SG nowhere
Intended: I went nowhere.

(6) a. **Ma** mor-t **imkien**.
NEG go.PFV-1SG nowhere

b. ***Ma** mor-t-(x) x'imkien.
NEG go.PFV-1SG-X somewhere.

[3]For completeness we note that *xejn* also occurs as a determiner meaning 'any' and as an adverb/adjunct meaning 'at all', as identified in Camilleri & Sadler (2016).

I went nowhere. Intended: I went nowhere.

The phenomenon of negative concord (NC) involves multiple negative elements associated with a single semantic negation (Labov, 1972). It (typically) involves the co-occurrence of sentential NEG with one or more additional *n*-words, or inherently negative items (Mugarza, 1990). NCIs or n-words are distinguished from negative polarity items (NPIs) which co-occur with sentential NEG (and often in a wider set of environments) but are not themselves inherently negative, and the superordinate term negative sensitive item (NSI) covers both NPIs and NCIs. An *n*-word or NCI is understood to be an expression α that can be used in structures containing sentential negation or another α-expression to yield a reading equivalent to one logical negation, and which can provide a negative fragment answer (Giannakidou, 2006, 328). The Spanish NEG indefinite *nada* is an *n*-word: it co-occurs with sentential NEG in (7) giving rise to a single logical negation and provides a negative fragment answer in (8).

(7) **No** funciona **nada**.
NEG functions nothing
Nothing works. Spanish: (de Swart & Sag, 2002, 405)

(8) Q Qué viste? A **Nada**
What did you see? Nothing! Spanish: (de Swart, 2004, 203)

There are different types of NC languages. Spanish is both a non-strict and a spreading NC language. It is non-strict because sentential NEG ceases to be necessary when NEG indefinites such as *nada* precede the verbal predicate (9). Sentential NEG is also absent when two NCIs or n-words co-occur: (10) is an instance of spreading, where sentential NEG *no* is not available as *nada* co-occurs with *nadie*.

(9) **Nada** *funciona*.
nothing functions
Nothing works. Spanish: (de Swart & Sag, 2002, 405-406)

(10) **Nadie** habla de **nada**.
no.one speak.PRES.3SG of nothing
No one speaks about anything. Spanish

By constrast, Maltese is a strict NC language, and one where spreading is not available. Irrespective of the linear order of *ħadd* 'no one' vis-à-vis the predicate or the presence of a co-occurring N-series element, sentential NEG expressed by *ma* is obligatory in these sentences. Note that all of these examples give rise to a single negation reading.

(11) a. Ilbieraħ **ħadd** *(**ma**) ġie.
yesterday no.one NEG come.PFV.3SGM
No one came yesterday.

b. Ilbieraħ *(**ma**) ġie **ħadd**.
yesterday NEG come.PFV.3SGM no.one
No one came yesterday.

(12) a. **ħadd** *(**m**'hu) **xejn**.
no.one NEG.3SGM nothing
No one is anything.

b. **Ebda** tifel *(**ma**) mar **imkien**.
none boy NEG go.PFV.3SGM nowhere
No boy went anywhere.

The N-series proforms provide negative fragment answers, as expected for *n*-words/NCIs.

(13) Q X'ra-t? A **Xejn**
what.see.PFV-3SGF nothing
What did she see? Nothing! (Lucas 2009, 223-224)

(14) Q Fejn mor-t? A **Imkien**
where go.PFV-2SG nowhere
where did you go? Nowhere.

2.2 Incompatibility with *-x*

Although Maltese uses the bi-partite (*ma....-x*) strategy for negation, *-x* is in complementary distribution with any N-series n-word item in the same clause, as shown in (15b). The *xejn* in (16) is not an n-word but an adverbial minimiser (a weak NPI), but the complementarity in fact extends to the more general class of NSIs, including the class of weak NPIs (a matter to which we return below). Given this incompatibility, and the fact that *ma* is required to express sentential negation in (15a), it is clearly *ma* that expresses sentential NEG, and not *-x*.[4]

(15) a. It-tifla *(**ma**) *ra-t* **xejn**.
DEF-girl NEG see.PFV-3SGF nothing
The girl saw nothing.

b. *It-tifla **ma** ra-t-**x** **xejn**.
DEF-girl NEG see.PFV-3SGF-X nothing
Intended: The girl saw nothing.

(16) Dan **m'***hu* / ***mhux** ħelu **xejn**!
DEM.SGM NEG.3SGM / NEG.3SGM.X sweet.SGM at.all
This is not sweet at all!

[4]Having established that the suffix *-x* does not itself express NEG, from now on we will gloss *-x* merely as X. This is consistent with the view of *-š* in other Arabic varieties postulated in sources including Jones & Al-Rashdan (2017) and Mughazy (2003, 1158)

2.3 Locality

A crosslinguistically characteristic property of *n*-words/NCIs is that they are locally licensed, although this tendency is by no means absolute. In some languages long-distance licensing is possible through transparent domains (such as those created by restructuring, or subjunctive or infinitival clauses), and Aranovich (1994) shows long distance licensing into argument functions of complement clauses in Spanish.

(17) No quiero que visites a ninguno de sus
NEG want.1SG.PRES.INDIC COMP visit.2SG.SUBJ ACC no.one of their
amigos.
friend.PLM

I do not want you to visit any of their friends. (Aranovich, 1994, 204)

The behaviour of n-words and their licensing has not been considered in the literature on Maltese, beyond reference to the obligatory presence of sentential negation. For Palestinian, Hoyt (2014, 54-56) (also Hoyt (2006, 50)), demonstrates that while the *n*-word *wela* 'even' is 'generally subject to strict locality constraints ...[and] must be contained within the smallest inflected clause containing its licensor', long-distance licensing of *wela*-phrases is found in the complement of verbs such as *bidd-* 'want'; *ḥalla* 'let; make; do'; *ħāwil* 'try'; *fakkar* 'think; believe'; *ṣār* 'become' and other modal auxiliaries such as *mumkin* 'can; might; be possible' and *lāzim* 'must; have to; necessary' (Hoyt, 2006, 50); (Hoyt, 2014, 54-56)). Hoyt (2006, 50) suggests that this non-local licensing of the *n*-word indicates that the predicates permitting long-distance licensing are restructuring predicates, and hence give rise to a single 'clausal' domain, and the limitation to imperfective forms for the embedded verbal predicates is consistent with the view that this type of embedding is non-finite (Benmamoun, 1999; Hallman, 2015). Turning to Maltese, the examples in (18) are perfectly felicitous (with clear finite subordinate clauses containing perfective verb forms and modal auxiliaries) involving deeply embedded N-series proforms. It does not seem plausible, therefore, that the relevant factor relates to clause-type distinctions such as those between restructuring and non-restructuring predicates.[5]

(18) a. **Ma** sab-et [li donn-u [kien-u
NEG find.PFV-3SGF COMP appear-3SGM.GEN be.PFV.3-PL
ltaqgħ-u **qatt imkien**.]]
meet.RECIP.PFV.3-PL never nowhere

She didn't find that they seemed to have ever met anywhere.

[5]Note that strong NPIs are said to only be licensed long-distance in the context of NEG raising predicates, while other predicates also license weak NPIs (such as *any* in English) in subordinate clauses. The class of predicates permitting long-distance n-word licensing in Maltese does not correspond to the class of NEG-raising predicates.

b. **Ma** j-i-dhr-u [li kien-u ppruva-w
NEG 3-FRM.VWL-appear.IMPV-PL COMP be.PFV.3-PL try.IMPV.3-PL
[j-weġġgħ-u 'l **ħadd** bi kliem-hom.]]
3-hurt.IMPV-PL ACC no.one with word.PL-3PL.GEN
They don't seem that they had tried to hurt anyone with their words.

2.4 Nonlocality and the Incompatibility with *-x*

Examples with 'long-distance' n-words, such as (18) and (19) below display the same incompatibility with the suffix *-x* in the negative clause itself; adding that suffix would make the sentences ungrammatical.

(19) **Ma** smaj-t [li qal-u [li
NEG hear.PFV-1SG COMP say.PFV.3-PL COMP
qal-t-i-l-hom [li għand-hom
say.PFV-3SGF-EPENT.VWL-DAT-3PL COMP have-3PL.GEN
j-i-xtr-u **xejn**.]]]
3-FRM.VWL-buy.IMPV-PL nothing
I didn't hear that they said she told them they have to buy anything.

Long distance NC is optional, however, and instead of (19) it is possible to combine matrix *ma.....-x* with the corresponding P-series proform (here *xi ħaġa*), with equivalent meaning, and in the presence of matrix *-x*, an N-series proform would be ungrammatical. Similar pairs can be given with other of the putative NC indefinite items such as *ebda N* 'no N' and *xi N* 'some/any N'.

(20) **Ma** smaj-t-**x** [li qal-u [li
NEG hear.PFV-1SG-X COMP say.PFV.3-PL COMP
qal-t-i-l-hom [li għand-hom
say.PFV-3SGF-EPENT.VWL-DAT-3PL COMP have-3PL.GEN
j-i-xtr-u **xi ħaġa**.]]]
3-FRM.VWL-buy.IMPV-PL some thing
I didn't hear that they said she told them they have to buy anything.

To summarise, *ma* is obligatorily paired with affixal *-x* on the verbal predicate unless it co-occurs with a NC (N-series) item in the relevant (local or nonlocal) domain, in which case *-x* is impossible. Intuitively, it seems as if the presence of *-x* closes down the NEG licensing domain in some manner. P-series proforms are excluded from negative clauses (on semantic grounds, as positive polarity items). A NC item can be licensed long distance (by an 'unpaired' or active *ma*), which is crosslinguistically rather unusual, and in fact consistent with the possibility that concordial N-series proforms in Maltese are in fact weak NPIs. In the following section we will show that in fact the N-series of indefinites in Maltese (with the exception of the determiner *ebda* 'none') occur in a wider set of environments as weak NPIs (or *affective polarity items* (APIs) in the terminology of Giannakidou (2000)).

2.5 NEG indefinites as weak NPIs

Negative Polarity Items (NPIs) are expressions which need to be licensed by suitable contexts which include but are not limited to that created by sentential negation. Such elements are not inherently negative, and may be of a wide range of different syntactic categories. Although named for their sensitivity to negative contexts, some NPIs (the weak NPIs, also called *affected polarity items*) are licensed in a much wider set of contexts, including interrogatives, comparatives, modal and conditional contexts. Others (often referred to as strong NPIs) are more severely constrained in their distribution, being (locally) licensed by sentential negation and in *without* clauses, i.e. anti-veridical contexts. A variety of different semantic characterisations have been offered for the contexts licensing NPIs, including those in terms of downward entailment (Ladusaw, 1979), Strawson downward entailment (von Fintel, 1999), and non-veridicality (Giannakidou, 1998, 2011).

Taking the N-series to be NC items, as suggested by Lucas, leads us to expect that they occur only in the context of sentential negation (the set of contexts which license strong NPIs), and in negative fragment utterances, as reviewed in the sections above. In fact this does not entirely capture their distribution. In general, the N-series proforms may occur in the set of non-veridical contexts (and hence are not limited to strictly negative, or anti-veridical, contexts). The examples in (21) illustrate nominal, determiner and adverbial *xejn* respectively in polar interrogatives.

(21) a. Sib-t/raj-t **xejn** tajjeb j-għodd
find.PFV-2SG/see.PFV-2SG nothing good 3M-count.IMPV.SG
għal-i-k?
for-EPENT.VWL-2SG.GEN
Did you find/see anything good that's useful for you? NOMINAL NPI

b. Kil-t **xejn** ċikkulata?
eat.PFV-2SG nothing chocolate
Did you eat any chocolate? DETERMINER NPI

c. Irqad-t **xejn**?
sleep.PFV-2SG nothing
Did you sleep at all? ADVERBIAL NPI

Other indefinites in the N-series also function as weak NPIs, including *qatt* (as in (22)) and *imkien* (23).

(22) **Qatt** t-kellim-t ma' xi ħadd dwar l-affari?
never RECIP-talk.PFV-2SG with some one about DEF-matter
Have you ever talked to anyone about the matter?

(23) T-i-nfed għal **imkien** dit-triq?
3F-FRM.VWL-link.IMPV.SG for nowhere DEM.SGF.DEF-street.SGF
Does this road lead/take you anywhere?

In fact, non-nominal *xejn* (from the N-series) can never express a negative fragment answer, and so should not be characterised as a NC item at all, but is (simply) an NPI. In (24) the minimiser *lanqas* is required to express a negative response.

(24) Q Ilbieraħ ħad-t-u gost? A *(Lanqas) xejn.
yesterday take.PFV-2-PL fun not even nothing
Did you have fun yesterday? Not at all! ADVERBIAL NPI

(25) Q T-rid ħafna logħob? A ***Xejn*** logħob.
3SGF-want.IMPV a.lot games nothing games
Does it need a lot of playing with/fiddling? DETERMINER NPI

The determiner *ebda is* seemingly *limited* to negative (anti-veridical) environments and so should be classified as a strong NPI (or *n*-word/NC item). This N-series determiner cannot be used in a polar interrogative and either (the P-series item) *xi* 'some' or (N-series determiner) *xejn* must be used instead ((26)-(27)).

(26) Qraj-t **xi/*ebda** kotba ġodda?
read.PFV-2SG some/none book.PL new.PL
Did you read any new books?

(27) Qraj-t **xejn** kotba?
read.PFV-2SG nothing book.PL
Did you read any/many books?

It is often observed that the licensing conditions for polarity sensitive items are much more nuanced than a simple division might suggest and Maltese certainly bears this out: the N-series proform *ħadd* 'no one' occurs in anti-veridical environments (like a NC item), and in some non-veridical contexts (with 'barely' and in the antecedent of a conditional) but it can occur in polar interrogatives only if it co-occurs with the N-series element *qatt* '(n)ever' (but not any other), as in (31).[6]

(28) Bilkemm ra 'l ħadd
with.DEF.how.much see.PFV.3SGM ACC no.one
He barely saw anyone.

(29) Jekk ħadd i-kellm-ek, għid-l-i
if no.one 3M-talk.IMPV.SG-2SGM.ACC tell.IMP.2SG-DAT-1SG
If anyone talks to you, tell me.

(30) *Kellm-ek ħadd?
talk.PFV.3SGM-2SG.ACC no.one
Intended: Did anyone talk to you?

(31) **Qatt** kellm-ek (**ħadd**)?
never talk.PFV.3SGM-2SG.ACC no.one
Did anyone ever talk to you?

[6] *qatt* is the only N-series element that can itself take the *-x* suffix – we leave a full investigation of this item for future work.

2.6 Summary

We have shown that the distribution of Maltese N-series items is not consistent with the assumption that they are simply NC items. When they do occur in the context of sentential negation, they are in complementary distribution with the *-x* suffix on the verb or the negative pronominal inflection, and nominal elements in the series can provide negative fragment answers. However, in general the N-series items are not limited to anti-veridical environments but occur also in non-veridical environments, a behaviour consistent with weak-NPI status (that is, they are subject to semantic licensing conditions which are more permissive, extending beyond the environment created by sentential negation). The N-series determiner *ebda* on the other hand *does* appear to be limited to strictly negative (anti-veridical) environments, and *ħadd* also shows a degree of restriction in the range of non-veridical environments it tolerates.

With this background in place we are now in a position to outline an analysis of the relevant syntactic aspects of NEG concord and the interaction with bi-partite negation in Maltese, that is, the complementary distribution between N-series items and *-x* in the context of both local and non-local sentential NEG licensing. Prior to our analysis, we first consider how certain issues have been tackled in other Arabic dialects within other frameworks, and then we consider parallel data from Polish and its treatment in LFG.

3 An analysis

3.1 Bipartite Negation in Arabic dialects

Bipartite negation is found in many Arabic dialects, primarily in the region running westward from the Levant to Morocco. Syntactic accounts are often articulated in terms of interpretable/uninterpretable features and feature checking. For instance, in this vein Jones & Al-Rashdan (2017, 24-25) propose a Minimalist analysis of the morphosyntax of negation in (North-West) Jordanian Arabic, but do not discuss any interaction with NSIs. Jordanian Arabic displays optional stage I/II behaviour in terms of the Jespersen NEG cycle, with constrained stage III behaviour in which the suffix -š on its own can express NEG. (32) illustrates.

(32) a. mā ʔakal-t-(iš)
NEG eat.PFV-1SG-NEG
I didn't eat. (Jones and Alrashdan 2017, 3)

b. b-i-rūħ-iš
INDIC-3SGM-go.IMPV-NEG
He doesn't go. Jordanian: (Jones and Alrashdan 2017, 9)

Jones & Al-Rashdan (2017) assume a [U-NEG] (uninterpretable NEG) feature associated with *-š* which needs to be checked by the corresponding interpretable NEG feature on *mā*/*lā*. This accounts for the optional co-occurence of the bipartite morphological expression of NEG. When -š occurs on its own, they assume that the

same checking takes place, and that once this requirement is satisfied, the *mā/lā* bearing the interpretable NEG feature is subsequently deleted.

Libyan Arabic also has bipartite negation, and in fact *n*-words have an essentially similar distribution to their Maltese counterparts, displaying the same complementarity with respect to the *-š* suffix.

(33) a. la-wlād **ma**-mšū-**š** li-l-madrsa
DEF-boy.PL NEG-go.PFV.3-NEG to-DEF-school
The boys didn't go to the school.

b. **ma**-šuf-t-***š** ħad/šay
NEG-see.PFV-1SG-NEG nobody/nothing
I saw nobody/nothing. Libyan: (Borsely & Krer 2012, 1-2)

Borsley & Krer (2012) propose an HPSG analysis in which both *mā* and -š are treated as affixes. They assume a HEAD feature POL with subtypes *weak-neg* and *strong-neg*. This means that their ontology basically individuates *positive* from *weak-neg* from *strong-neg* verbs. Verbs with bipartite negation marking are [POL *strong-neg*] while those with *ma-* alone are [POL *weak-neg*].

(34) $\begin{bmatrix} \text{MORPH} \begin{bmatrix} \text{FORM } \textit{ma-šuft} \\ \text{I-FORM } \textit{šuft} \text{ ('see')} \end{bmatrix} \\ \text{SYNSEM|LOC|CAT} \begin{bmatrix} \text{HEAD} \begin{bmatrix} \textit{verb} \\ \text{POL } \textit{weak-neg} \end{bmatrix} \end{bmatrix} \end{bmatrix}$

It is assumed that constituents containing NSIs will be marked with the feature [AFF] (though it is not specified where in the feature structure this feature is located, and how it is shared/percolated within structures, or which elements it is lexically associated with). Given this assumption, a constraint is formulated whereby a *neg-clause* has a DTR with a [POL *weak-neg*] feature iff it has an [AFF +] daughter.

3.2 Negative Concord in LFG

Syntactic aspects of NC in LFG are discussed in Sells (2000) and Przepiórkowski & Patejuk (2015) and to a lesser extent in Laczkó (2014) and Laczkó (2015). Sells (2000) does not adopt the standard LFG model within which f-structure is fully defined by f-descriptions associated with lexical items and c-structure rules, but rather a realizational correspondence architecture in which correspondences are stated between f-structure attributes and morphosyntactic features determining morphological realization. It also relies on a number of extrinsically stated principles and generalizations (such as the notion that there will be only one realization of a given f-structure attribute value pair). Nonetheless, it is relevant to note that Sells (2000, 17) treats Italian *non* as introducing a feature [NEG +] into the clausal f-structure while NC quantifiers in the language (see (35)), are treated as checking for the presence of this clausal NEG feature. In this model c-structure categories are complex

categories (sets of attribute-value pairs) and the capitalized lowercase features in (36) and (37) denote categorial a:v pairs. For Sells (2000) both constituent negation and sentential negation are expressed as [NEG +], but associated with different f-structures.

(35) Non ha telefonato nessuno.
NEG has phoned no.one
No one has phoned. Italian: (Sells 2000,17)

(36) non*:* (↑NEG) = +
[Negform: +]

(37) nessuno*:* ((GF ↑) NEG) $=_c$ +
[Negform: +]

Przepiórkowski & Patejuk (2015) discuss NC in Polish, a language exhibiting strict NC with no spreading like Maltese, within the standard architectural assumptions of LFG, and also adopting a feature (rather than ADJunct) analysis of negation. They deal primarily with the licensing of these NC items by sentential NEG. In (38) *nie* is the NEG marker and *nikt* and *nikogo* function as concord items. As a marker of sentential negation, *nie* triggers the genitive of negation. As a marker of constituent negation, in (39). it does not, and does not license NC items either.

(38) **Nikt** **nie** lubi **nikogo**.
nobody.NOM NEG likes nobody.GEN
Nobody likes anybody. (PP 2015, 330)

(39) Nie Janek lubi Marię /*Marii /*nikogo (lecz
NEG Janek.NOM likes Maria.ACC Maria.GEN nobody.NW.ACC/GEN but
Tomek).
Tomek.NOM
It's not Janek who likes Maria (but Tomek). (PP 2015, 326)

Given this difference in syntactic behaviour, and arguing that constituent and sentential negation can co-occur *in the same f-structure*, Przepiórkowski & Patejuk (2015)'s featural treatment of negation uses the features ENEG (*eventuality negation*) and CNEG (*constituent negation*), and treats *nie* as corresponding to both ENEG and CNEG categories (with different syntactic distributions and behaviours). Their account of NC words assumes lexical entries such (42). The functional uncertainty path in (42) accounts for the observation that Polish NC items can be licensed non-locally, as shown in (44), where an infinitival embedding is involved. Przepiórkowski & Patejuk (2015) do not discuss how the positive counterparts of NC-items are prevented from occurring in the NC-triggering environments.

(40) nie ENEG*:* (↑ ENEG) = +

(41) nie CNEG*:* (↑ CNEG) = +

(42) nikt N*:* (↑ CASE) = NOM
((XCOMP* GF^+ ↑) ENEG) $=_c$ +

(43) GF ≡ {SUBJ | OBJ | OBL | ADJ ∈}

(44) Karpowicz **nie** chciał pisać **żadnych** wierszy.
Karpowicz NEG wanted write.INF none poems.GEN
Karpowicz didn't want to write any poems. (PP 2015, 331)

3.3 Maltese sentential negation

We have shown that there is both a dependency and an essential asymmetry in the distribution of *ma* and *-x*: *ma* realizes sentential negation but requires the presence of either *-x* or an NCI item, which may be a dependent in the local f-structure or more distantly embedded in the structure. Furthermore, *ma* licenses an NC item provided that it does not itself (locally) license *-x*. NCIs are limited in their distribution in that they require (in Borsley and Krer's terminology) a *weak neg* verb.

Following Przepiórkowski & Patejuk (2015) we assume that *ma* marks eventuality negation (ENEG). It also introduces a syntactic requirement for a further element, which we call a non-veridical marker (NVM). The *-x* suffix satisifies this requirement, as do the NC items in the N-series, within a certain domain. (45) requires some element in the clausal domain to have the feature [NVM +] while (47) prevents *-x* co-occurring with NVM on any dependents *in its own clause*.[7]

(45) ma*:* ENEG (↑ ENEG) = +_ (i.e. the value of this feature is instantiated)
(↑ GF* NVM) =c +

(46) xejn*:* N (↑ NVM) = +

(47) -x*:* (↑ NVM) = +
¬(↑GF+ NVM) = +

(48) GF ≡ {SUBJ | OBJ | OBJθ | OBL | POSS | ADJ ∈}
¬ (→ TNS)

We will start by considering the local clausal domain. The examples in (49) give rise to the f-structures in (50), given these lexical descriptions, and the path definition shown in (48) (to be revised).

(49) a. **Ma** qraj-t-**x** il-ktieb.
NEG read.PFV-1SG-X DEF-book
I didn't read the book.

b. **Ma** qraj-t **xejn**.
NEG read.PFV-1SG nothing
I read nothing.

[7]The value of the ENEG feature is marked as instantiated, meaning that it is required to be uniquely contributed, so expressed only once in the f-structure.

(50)
$$\begin{bmatrix} \text{ENEG} & + \\ \text{PRED} & \text{`READ}\!<\text{SUBJ OBJ}>\text{'} \\ \text{NVM} & + \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`BOOK'} \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \end{bmatrix} \end{bmatrix} \qquad \begin{bmatrix} \text{ENEG} & + \\ \text{PRED} & \text{`READ}\!<\text{SUBJ OBJ}>\text{'} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`NOTHING'} \\ \text{NVM} & + \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \end{bmatrix} \end{bmatrix}$$

The entries in (45)-(46) permit two (or more) NC items as in (51b) and capture the complementary distribution of *-x* and an NC dependent, because (47) disallows [NVM +] on any (local) dependent, **ruling out** the first f-structure in (52).[8]

(51) a. *It-tifla **ma** ra-t-**x** **xejn**.
DEF-girl NEG see.PFV-3SGF-X nothing
intended: The girl saw nothing.

b. **Ebda** tifel **ma** ra **xejn**.
none boy NEG see.PFV.3SGM nothing
lit: no boy didn't see nothing
No boy saw anything.

(52) *
$$\begin{bmatrix} \text{ENEG} & + \\ \text{NVM} & + \\ \text{PRED} & \text{`SEE}\!<\text{SUBJ OBJ}>\text{'} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`NOTHING'} \\ \text{NVM} & + \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`GIRL'} \end{bmatrix} \end{bmatrix} \qquad \begin{bmatrix} \text{ENEG} & + \\ \text{PRED} & \text{`SEE}\!<\text{SUBJ OBJ}>\text{'} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`NOTHING'} \\ \text{NVM} & + \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{NVM} & + \end{bmatrix} \end{bmatrix}$$

Recall however that a non-local NVM dependent may satisfy the constraint placed by *ma* (as shown by (18) and (19) above), but that *-x* is required to be strictly local. In order to capture this, we replace the entries for *ma* and *-x* above with (53) and (54) respectively, altering the functional uncertainty paths to take account of these wider domains.[9]

(53) ma: ENEG (↑ ENEG) = +
$\{$ (↑ $\{$XCOMP|COMP|ADJ$\}$* GF^{+} NVM) | (↑ NVM) $\}$ =$_{c}$ +
¬(→ ENEG)

(54) -x: (↑ NVM) = +
¬(↑ $\{$ XCOMP|COMP|ADJ$\}$* GF^{+} NVM) = +
¬(→ ENEG)

An example such as (19) will have the f-structure shown schematically in (55).

[8]Note that our entry for *ma* does not require all dependents for which there is an NCI option to occur in that form — that is, positive polarity items are not excluded on syntactic grounds.

[9]Note that the constraints in (54) do not exclude *-x* occurring on *qatt* (see footnote 6).

(55)
$$\begin{bmatrix} \text{ENEG} & + \\ \text{PRED} & \text{`HEAR}< \text{SUBJ, COMP} > \text{'} \\ \text{COMP} & \begin{bmatrix} \ldots & \begin{bmatrix} \text{COMP} & \begin{bmatrix} \text{PRED} & \text{`BUY}< \text{SUBJ, OBJ} > \text{'} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`NOTHING'} \\ \text{NVM} & + \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(54) states that *-x* is incompatible with [NVM +] on any dependents within a wider domain which excludes embedded clauses themselves marked for sentential negation. That is, *-x* is not just incompatible with NVM on dependents of its own clause, it is incompatible with NVM on dependents in the wider domain within which *ma* is able to license a NVM dependent. This accounts for the contrast between (56) (where *-x* does not place any restriction on NVM in the COMP) and (57), in which it does (and hence rules out the occurrence of the N-series *ebda* 'paired with' *ma* in the matrix clause).[10]

(56) **Ma** semmie-**x** [li **ma** ra [li darb-u
NEG say.PFV.3SGM-X COMP NEG see.PFV.3SGM COMP injure.PFV.3-PL
lil **ebda** raġel.]]
ACC some man
He didn't say that he didn't see that they injured any man.

(57) *__Ma__ semma [li **ma** ra-**x** [li darb-u
NEG say.PFV.3SGM COMP NEG see.PFV.3SGM-X COMP injure.PFV.3-PL
lil **ebda** raġel.]]
ACC some man
He didn't say that he didn't see that they injured any man.

3.4 Further remarks on the distribution of *-x*

The proposal that *-x* is some sort of non-veridical marker, rather than purely a marker of negation is consistent with the fact that it is not limited to negative clauses.[11] Above we have seen that most N-series proforms can occur in interrogatives (and other non-veridical contexts) and the same is true of *-x*. These contexts include conditionals, interrogatives (58); rhetorical interrogatives (59); embedded interrogatives (60) and counterfactuals (61).

[10] As an alternative to the functional uncertainty paths with off-path constraints formulated here, we could consider a 'threading style' approach to the long-distance NVM dependencies, marking all clauses as transparent or not to the NVM requirement 'launched' by *ma*. It may well be that this would give a more transparent account of the syntactic dependency, at the expensive of some featural clutter. We leave exploration of this option to future work.

[11] The diachronic source of this *-x* is distinct from that of the *-x* of sentential NEG (Lucas, forthcoming). However it seems that these two distinct grammaticalisation paths have fused synchronically into a single marker of non-veridical environments.

(58) Ra-t-**x** xi ħaġa tal-biżgħa?
see.PFV-3SGF-X some thing of.DEF-fear
Did she see something scary?[12]

(59) Int-**x** t-għid li jien giddieb, ukoll?!
you.SG-X 2-say.IMPV.SG COMP I lier.SGM, as well
Are you also saying that I am a liar?!

(60) a. **Ma** n-af-**x** (jekk) j-emmin-ni-**x** (jew le).
NEG 1-know.IMPV.SG-X (if) 3M-believe.IMPV.SG-1SG.ACC-X or no
I don't know whether he'll believe me or not.

b. Ir-rid n-ara (jekk) t-rid-**x** t-i-ġi magħ-na.
1-want.IMPV.SG 1-see.IMPV.SG whether/if 3F-want.IMPV.SG-X 3F-FRM.VWL-come.IMPV.SG with-1PL.GEN
I want to see whether she wants to come with us.

(61) T-i-ċċajta kon-t-**x** n-i-xtri-ha (kieku rbaħ-t)!
2-FRM.VWL-joke.IMPV.SG be.PFV-1SG-X 1-FRM.VWL-buy.IMPV.SG-3SGF.ACC if win.PFV-1SG
You bet I would have bought it, had I won!

Although we do not develop an account here, we leave open the possibility that the *-x* of sentential negation and the *-x* of this wider set of non-veridical context share a single lexical entry, requiring non-occurrence with any other NVM within the relevant domain.

4 Further functions of *xejn*

Our original starting point was the observation in previous literature that the N-series forms are NC items. We have shown that, contrary to this claim, these forms in general have the (wider) distribution of weak NPIs. The N-series form *xejn* 'nothing' is the precursor of *-x*, and in Maltese has lost the meaning 'thing', except in a few specific lexical uses (including *qabelxejn* lit. 'before thing', meaning 'first of all' Lucas (2009, 228)). As evidence for the inherently negative status of this particular N-series form, Lucas points to the existence of a derivationally related IInd *binyan* verb-form *xejjen* 'CAUSE to bring to nothing', as in (62), and states

[12]Observe that here we have *xi ħaġa*, suggesting that it is not simply a PPI, as claimed in previous literature.

that '*xejn* can appear in non-verbal-argument positions in affirmative sentences, including comparatives (63b), where it retains its negative meaning' (Lucas 2009, 225).

(62) Iżda ***xejjen*** lilu nnifs-u.
but CAUSE.bring.to.nothing.PFV.3SGM 3SGM.ACC self-3SGM.GEN
But he made himself nothing. Philippians 2: 7

(63) a. Issa n-offr-u KMiles b'**xejn**!
now 1-offer.IMPV-PL KMiles with-nothing
Now we're offering KMiles for free.

b. ... dejjem huwa aħjar minn **xejn**.
... always COP.3SGM better.COMPAR from nothing
[It is] always better than nothing. (Lucas, 2009: 225-226)

Lucas' (63a) is not really relevant, because *b'xejn* has lexicalised in Maltese and means 'free; for free' in any case. When we consider a wider range of data, however, the pattern which emerges seems to be that *xejn* functions as a negative quantifier (NQ) in PP adjuncts but not in subcategorised PP oblique arguments, where (in our view) it is an NPI. Thus the examples in (64) and (65), where *ma* is required to obtain the negative meaning and *xejn* is within an OBL, contrast with (66), where it is a NQ in adjunct function.

(64) a. **Ma** nqas-t-hom minn/f'**xejn**.
NEG reduce.PFV-1SG-3PL.ACC from/in.nothing
I didn't fail them in anything.

b. *Nqas-t-hom minn/f'**xejn**.

(65) a. **Ma** qegħd-t-hom fuq **xejn**.
NEG place/put.PFV-1SG-3PL.ACC on nothing
I didn't place them on anything.

b. *Qegħdthom fuq **xejn**.

(66) a. Mar għal **xejn**.
go.PFV.3SGM for nothing
He went for nothing.

b. Bne-w relazzjoni fuq **ix-xejn**.
build.PFV3-PL relationship on DEF-nothing
They built a relationship on no foundation.

Evidence that examples such as those in (66) involve a NQ also comes from the fact that a double negation reading occurs when we add the sentential negation *ma*.

(67) a. **Ma** mar-**x** għal **xejn**.
NEG go.PFV.3SGM-X for nothing
He didn't go for nothing ... i.e. He went for a purpose.

b. **Ma** benie-**x** relazzjoni fuq **ix-xejn**.
NEG build.PFV.3SGM-X relationship on DEF-nothing
He didn't build a relationship on nothing ... i.e. there was a basis on which the relationship was built.

This suggests that *xejn* as an OBJ (nominal) complement of a P is either an NPI or a NEG quantifier, depending on whether the P heads an OBL or an ADJ. We might postulate a distinct lexical entry along the lines of (68) to capture the latter. The f-structure for (67a) is shown in (69).

(68) xejn*:* N (↑ CNEG) = +
(ADJ ∈ OBJ↑)
PP ∈ CAT((OBJ↑))

(69)
$$\begin{bmatrix} \text{ENEG} & + \\ \text{PRED} & \text{`GO}< \text{SUBJ} > \text{'} \\ \text{NVM} & + \\ \text{ADJ} & \left\{ \begin{bmatrix} \text{PRED} & \text{`FOR}< \text{OBJ} > \text{'} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{CNEG} & + \end{bmatrix} \end{bmatrix} \right\} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \end{bmatrix} \end{bmatrix}$$

5 Conclusion

We have offered an account of the N-series proforms in Maltese, rectifying previous claims in the literature that these items are strict NCIs. We have shown that some of these items appear both in contexts where ENEG is present and in a wider set of non-veridical contexts, and thus correspond more closely to weak NPIs. Building on Przepiórkowski & Patejuk (2015)'s account of syntactic aspects of NC in Polish, we have proposed an approach to the interaction between N-series items and bipartite sentential negation in Maltese. We have also demonstrated that the N-series item *xejn* can function as a NEG quantifier, but only when it is associated with an ADJ function. We account for this use of *xejn* by proposing that it corresponds to CNEG in this function. Finally, we have also suggested that the classification of the P-series (*xi ħaġa*) indefinites as PPIs is probably incorrect, or at least represents a significant oversimplification, but we leave this matter for further research.

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Posture Verbs and Aspect: A View from Vernacular Arabic

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Abstract

This paper discusses a construction found in contemporary Arabic vernaculars (but not in Modern Standard Arabic (henceforth MSA)) which constitutes an instance of a common grammaticalisation path in which a posture verb with a core lexical meaning of 'sitting' has grammaticalised into an ASPECTual marker. We bring together data from a range of dialects and provide substantial evidence of grammaticalisation, in which the active participle (ACT.PTCP) of the 'sit' verb has developed a range of ASPECTual senses. Here we concentrate on the PROGRESSIVE interpretation, which exists in all of the vernaculars. We argue that there is also evidence for a further grammaticalisation of the posture verb form into a copula. Our aim is to present a comprehensive cross-dialectal picture of the data and consider synchronic and diachronic aspects from an LFG perspective.

1 Introduction

This paper discusses a particular construction found in contemporary Arabic vernaculars (but not in Modern Standard Arabic) which constitutes an instance of a common grammaticalisation path (Bybee & Dahl (1989); Heine (1993); Lord (1993); Bybee et al. (1994); Kuteva (2001); Heine & Kuteva (2002)). The construction involves posture verbs, in particular the ACT.PTCP forms of verbs with a core lexical meaning of 'sitting/lying' (often extended to 'stay/remain') that have grammaticalised into ASPECTual markers. Since these forms also maintain their lexical usage, sometimes resulting in ambiguity, they exhibit a 'functional split' (Hopper & Traugott, 2003) or 'divergence' (Heine & Reh, 1984). In what follows we focus specifically on cases of posture ACT.PTCP forms which have grammaticalised into PROGRESSIVE auxiliaries, but note that in some dialects both the ACT.PTCP and the corresponding verb forms can take on a wider range of progressive, durative, habitual and continuative senses (Eksell, 1995), crosslinguistically typical of such lexical verbs (Kuteva, 1999).

The existence of these grammaticalised forms is noted and partially described in the literature on the Arabic vernaculars (Johnstone (1967); Cuvalay (1991); Aguadé (1996); Brustad (2000); Mion (2004); Persson (2013)). We provide fuller description and discussion of these grammaticalised forms. Additionally we argue that there is evidence for a further grammaticalisation of the posture verb form into a copula, which can be understood as an off-shoot of the posture verb $>$ ASPECT grammaticalisation. This contradicts a recent claim in the literature on Arabic that this development is not attested in the core dialects (Akkuş, 2016). Because it

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exhibits this further process, we focus specifically on the ACT.PTCPs *gāʕid/qāʕid* and *ǧālis/yālis* (lex: 'sitting') rather than posture verbs such as *gām* 'stand up' which have also grammaticalised into aspectual auxiliaries, but whose copula status may not be as clear or not as geographically widespread. Our aims are to present the first comprehensive cross-dialectal picture of the data and to contribute to the LFG-oriented literature on grammaticalisation and change (see Vincent (2001) and Schwarze (2001) *inter alia*).

2 The grammaticalisation of a Progressive construction

The ACT.PTCP forms *gāʕid/qāʕid* > *gaʕad/qaʕad* and *ǧālis/yālis* > *ǧalas* both meaning 'sit; lie', give a PROGRESSIVE meaning when combined with a lexical verb in the imperfective form.[1] As shown in (1)-(2) the lexical meaning of 'sit' is still be associated with the ACT.PTCP which may lead to ambiguity out of context.[2]

(1) weħid **qāʕid** ye-kol
one.SGM sit.ACT.PTCP.SGM 3SGM-eat.IMPV
Lexical: 'Somebody is sitting and eating/sitting while eating.'
Grammatical: 'Somebody is eating.' Tunisian: Saddour (2009, 273)

(2) bas hāði **gāʕid-ə** t-mūt
but DEM.SGF sit.ACT.PTCP-SGF 3SGF-die.IMPV
Lexical: 'But this is sitting dying.'
Grammatical: 'But this is dying.' Emirati: Persson (2013, 15)

The grammaticalisation of this structure to express PROG may seem somewhat redundant as it has emerged and integrated into a system where imperfective morphological forms (vs. perfective ones) already give the three readings which imperfectives display crosslinguistically, i.e:

(3) (i) the progressive or *event-in-progress* reading;
(ii) the habitual or *generic characterizing* reading;
(iii) the *continuous* reading with lexically stative predicates Deo (2015, 4)

The data in (4) are representative of the three interpretations associated with the imperfective form (examples from Qasīmi).[3]

[1] This is not the only way to express a PROGRESSIVE aspect. The ACT.PTCP of the lexical verb itself can express a progressive, though not in all dialects (see Henkin (1992); Woidich (1995); Boneh (2010) Mughazy (2005); Procházka & Batan (2015)), and some dialects use of the prepositional marker *fi* before the transitive object (Mion (2004); Pallottino (2016); Börjars et al. (2016)).

[2] *Lexical* refers to the use of the ACT.PTCP form with a lexical meaning, while *grammatical* refers to the ASPECTual function of the ACT.PTCP.

[3] The finite morphological forms in Arabic are the imperfective and the perfective. It is well established that the imperfective also serves as a non-finite form (Benmamoun (1999); Hallman (2015)), at the syntactic level notably in embedded structures. The perfective form in Arabic provides interpretations associated with both past tense forms and perfect forms in English (Fassi Fehri, 2003).

(4) a. ʔana ʔa-dris (al-ħin)
I 1SG-study.IMPV DEF-time
'I am studying now.' *event-in-progress*

b. ʔana ʔa-dris (bil-ǧamiʕa)
I 1SG-study.IMPV in.DEF-university
'I study at university.' *characterising*

c. ʔana ʔa-ʕiš fi london
I 1SG-live.IMPV in London
'I live in London.' *continuous*

In her study of grammaticalisation paths in this domain, Deo (2015, 5) observes: 'In languages where both progressive and imperfective aspects are realised with distinct morphology, the event-in-progress reading is often blocked for the imperfective form'. While this is indeed the state of affairs in Maltese, it is not the case in other Arabic dialects.[4]

Our main focus here is on the synchronic specifics of the progressive construction and the grammaticalised status of the posture verb form as an auxiliary in that construction, together with its subsequent grammaticalisation into a copula. We believe that the structure combining the *sit* ACT.PTCP and the imperfective of the lexical verb grammaticalised out of a construction which involved the lexical verb functioning as the PRED of a circumstantial adjunct clause to the (intransitive) posture verb itself. This adjunct eventually got reanalysed into a clausal argument of *gāʕid/ǧālis* (in LFG terms, we would take this to be an XCOMP) out of which the grammaticalisation of the progressive construction developed, in line with plenty of instances of this trajectory of change crosslinguistically (Heine (1993); Lord (1993); Aikhenvald (2006); Dixon (2006); Versteegh (2009)). In what follows we will consider what evidence supports the sort of grammaticalisation path which is summarised in (5).

(5) *gāʕid/ǧālis* + Circumstantial ADJ clause > *gāʕid/ǧālis* + XCOMP > PROG + lexical main verb

[4]We consider Maltese as an Arabic dialect on the basis of a number of grammatical (i.e. morphology and syntax) considerations. The grammar of Maltese, however, is somewhat more advanced on the grammaticalisation cline, as displayed in Camilleri et al. (2014) for instance, and one repercussion of this is that the imperfective in Maltese has completely lost the ability to express PROGRESSIVE. This is recent – in the early 20th century it seems that Maltese displayed a behaviour similar to the one we observe synchronically in the other Arabic vernaculars. Sutcliffe (1936, 70) appears to have captured a shift in interpretation taking place in Maltese at the time when he was writing his grammar. When discussing the PAST TENSE auxiliary *kien* + imperfective combination he claims that: 'The form *kien joqtol* in addition to 'he used to kill' can also mean 'he was killing', but continuous action is more clearly and emphatically expressed by the addition of *qiegħed* ('sit.ACT.PTCP') as in *kien qiegħed joqtol*'. The only instance where an *event-in-progress* reading is associated with an imperfective form in the matrix clause is in the context of pronominal negation, as opposed to circumfixal negation (see Spagnol (2009)). PROGRESSIVE readings are however (still) associated with the imperfective form in non-matrix contexts (Camilleri, 2016).

3 Evidence for Grammaticalisation

Evidence for desemanticisation comes from the fact that in some dialects, the semantics of the ACT.PTCP form of this root has widened from *spatially located* to something that is *temporally located*, that is, from 'sit' > 'stay/remain'.

In Maltese the ACT.PTCP form has completely lost the lexical meaning of 'sitting' as a main verb, while other forms such as the imperfective *joqgħod* in (6) retain theire lexical meaning (as 'sit'). In fact, the only place where a 'sitting' meaning is associated with the ACT.PTCP is in the highly fixed structure shown in (7), where it is the nominal use of the (invariant, non-inflecting SGF) ACT.PTCP in the PP ('with the sitting") and *not* the verbal ACT.PTCP form in the sentence which provides the sense of sitting. More generally, the ACT.PTCP *qiegħed* (and its inflectional variants) has come to mean 'stagnant; not working', which can be seen as part of the semantic spatial bleaching of the meaning of 'sitting'.

(6) Il-ħin kollu j-qum u
DEF-time.SGM all.SGM 3M-stand.up.IMPV.SG CONJ
j-o-qgħod.
3M-FRM.VWL-sit.IMPV.SG
'He's all the time getting up and sitting down.'

(7) It-tfal qegħd-in bil-qiegħd-a
DEF-children sit.ACT.PTCP-PL with.DEF-sit.ACT.PTCP-SGF
'The children are sitting down.'

A second piece of evidence comes from the combination of the ACT.PTCP with lexical verbs that involve incompatible physical disposition with the original (lexical) meaning of the 'sit' ACT.PTCP. Data bearing on this point is found across a wide range of dialects.

(8) gāʕd-a t-nit
sit.ACT.PTCP-SGF 3SGF-jump.IMPV
'She is jumping.' Kuwaiti: Duha Alaskar (PC)

(9) yālis yi-bni ʕmāra
sit.ACT.PTCP.SGM 3SGM-build.IMPV building
'He is building a building.' Emirati: Jarad (2015,102)

(10) ğālis yi-sbaħ
sit.ACT.PTCP.SGM 3SGM-swim.IMPV
'He is swimming.' Hijazi: Al Zahrani (2015, 58)

(11) al-weled gāʕed tōl al-waget y-nōt
DEF-boy sit.ACT.PTCP.SGM long DEF-time 3SGM-jump.IMPV
'The boy is jumping all the time.' Libyan: Enas Sigurti (PC)

(12) monǧiyya qāʕd-a to-ḥrok fil-kuzina
M sit.ACT.PTCP-SGF 3SGF-bustle.IMPV in.DEF-kitchen
'Monjiyya is bustling around in the kitchen.' Sfaxi: Cohen (1984, 279)

Third, just as the physical meaning of the posture is lost (evidenced above) the requirement for an animate SUBJ is lost. This loss of SUBJ selectional restrictions is expected for an element which has become an auxiliary. Kuteva (1999, 207) takes the ability to have the meaning of 'sit' verbs extended to express the spatial position of inanimate physical objects to be the prerequisite for the trigger of auxiliation.

(13) il-bass gāʕid y-ōṣal is-sāʕa xams min
DEF-bus.SGM sit.ACT.PTCP.SGM 3SGM-arrive.IMPV DEF-hour five from
isnīn
year.PL
'The bus has been arriving at five o'clock for years.'
Kuwaiti: Al-Najjar (1991)

(14) il-giṭar ǰālis y-wagif
DEF-train.SGM sit.ACT.PTCP.SGM 3SGM-stop.IMPV
'The train is stopping/The train is slowing down to stop.'
Hassāwi: Al-Abdullah (2016, 84)

(15) al-malābes gāʕad-a ta-nšif
DEF-clothes sit.ACT.PTCP-SGF 3SGF-dry.IMPV
'The clothes are drying.' Libyan: Sigutri (PC)

(16) Qiegħd-a t-a-għmel ħafna sħana
sit.ACT.PTCP-SGF 3F-FRM.VWL-do.IMPV.SG a.lot heat.SGF
Lit: 'It is doing a lot of heat.'
'It is being very hot (at the moment).' Maltese

Despite this array of data from across the area, Jarad (2015, 93) states (for Emirati Arabic) that inanimates cannot be SUBJs. However his examples do not involve the combination of the 'sit' verb ACT.PTCP with a lexical verb but rather (potentially) relate to further grammaticalisation as a locative copula.[5]

(17) a. *fi ktab yālis/minsidiḥ ʕaṭ-ṭāwli
EXIST book sit.ACT.PTCP.SGM/lying-SGF on.DEF-table
Intended: 'There's a book (sitting/lying) on the table.'

[5]We will discuss this type of data further below, as it is in contrast with what we find in other dialects, and this in turn sheds more light on the further developments of the PROGRESSIVE auxiliary.

b. *l-lamba yāls-a/minsidḥ-a ʕaṭ-ṭāwli
DEF-lamp.SGF sit.ACT.PTCP-SGF/lying-SGF on.DEF-table
Intended: 'The lamp is (sitting/lying) on the table.'

Fourth, it is often the case that as a lexical word changes into a grammatical word, it also undergoes phonological weakening and morphological erosion, sometimes developing into a clitic and later into an affix (and further, into null) (Hopper & Traugott (2003, 7); Harris & Campbell (1995, 337); Fischer (2007, 182). One way in which morphology is eroded is through the loss of paradigmatic contrasts/inflection. Synchronically, the use of agreeing forms of the grammaticalised ACT.PTCP is optional in Kuwaiti and the SGM form is an optional default, initiating a loss of paradigmatic contrasts.

(18) huma **gāʕid** / gāʕd-in y-ħaqqaq-ūn
they sit.ACT.PTCP.SGM / sit.ACT.PTCP-PL 3-achieve.IMPV-PL
ħadaf-hum muʔaḥḥar
goal-3PL.GEN lately
'They are achieving their goal lately.' Kuwaiti: Alaskar (PC)

There are a number of cases in which the morphological form of the ACT.PTCP has eroded, e.g. the retention of the last syllable in the case of *da* > from *gāʕda*, and the first syllable (along with shortening) in the case of *gaʕ* > from *gāʕad* (we gloss these simply as PROG).

(19) **da**-tu-mṭur ihwāha has-sana
PROG-3SGF-rain.IMPV a.lot DEM.SGF.DEM-year.SGF
'It is raining a lot this year.' Iraqi (Baghdadi): Cohen (1984, 288)

(20) maryam **gaʕ** ta-ktib maktūb
Maryam PROG 3SGF-write.IMPV letter
'Maryam is writing a letter.' Kuwaiti: Al-Najjar (1991)

(21) It-tifla **qed** t-i-kteb
DEF-girl PROG 3F-FRM.VWL-write.IMPV.SG
'The girl is writing.' Maltese: Camilleri (2016, 73)

(22) a. winti ʔiš **qat**-t-qūl?
CONJ.you what PROG-2SG-say.IMPV
'And you, what were you saying?'

b. ūwa **qā** i-fədlək
he PROG 3SGM-joke.IMPV
'He is joking.' Tunisian: Cohen (1984, 280)

The interaction with negation provides an insight into small differences between the status of the grammaticalised 'sit' ACT.PTCP in different vernaculars. Negation of non-finite predicates such as ACT.PTCPs, nominal and adjectival predicates differs in its realisation from negation of finite verbs. In some varieties, we observe **persistence** of the form of negation appropriate to non-finite predicates, despite the participle's apparent synchronic and morphological reanalysis into an auxiliary. This is illustrated by the use of the so-called pronominal NEG marking (which is the form used for non-finite predicates) in (24) and (25), in parallel with the negation of *gāʕid* as a *lexical* ACT.PTCP, shown in (23).

(23) **mū** gāʕid, gāyim
NEG sit.ACT.PTCP.SGM stand.ACT.PTCP.SGM
'He is not sitting, but standing.' Kuwaiti: Alaskar (PC)

(24) al-ħarēm **mū/mūš / ma-hum** gāʕd-in/ǧāls-in iy-sulf-ūn ʕan
DEF-women NEG / NEG-3PL sit.ACT.PTCP-PL 3-talk.IMPV-PL about
al-ʕirs al-ħin
DEF-wedding DEF-time
'The women are not talking about the wedding now.'
Hassāwi Al-Abdullah (2016, 61-62)

(25) Pawlu **mhux** qiegħed/qed i-kellim-hom
Paul NEG sit.ACT.PTCP.SGM/PROG 3M-talk.IMPV.SG-3PL.ACC
'Paul is not talking to them.' Standard Maltese

In other varieties, however, syntactic reanalysis along with morphological erosion results in the auxiliary undergoing negation in the manner of finite verbs, as shown in (26) and (27), where negation is through the *ma ...(-š)* strategy, as opposed to the pronominal strategy seen in (23)-(25).

(26) ʔiskut **ma**-da-š-šūf iǧ-ǧāhil
be.quiet.IMP.2SG NEG-PROG-2SG-see.IMPV DEF-child
nāyim
sleep.ACT.PTCP.SGM
'Quiet! Aren't you seeing that the child is sleeping!'
Baghdadi: Cohen (1984, 288)

(27) **M'**qid-**x** n-għid-l-ik hekk biex
NEG.PROG-NEG 1-say.IMPV.SG-DAT-2SG like.this in.order.to
n-beżżgħ-ek
1-frighten.CAUSE.IMPV.SG-2SG.ACC
'I am not telling you this to frighten you.'
Dialectal Maltese: Camilleri (2016, 79)

3.1 Further Degrees of Grammaticalisation

In recent work Deo (2015, 20) discusses the Imperfective Cycle and in particular the final stage in which a previously established niche PROG marker can develop into a more general marker of imperfectivity, thus bringing the cycle full circle, as illustrated in (28), where X and Y denote forms.

(28) (I) *X*IMPV - The initial state with just a general IMPV marker, in principle ambiguous in its interpretation
(II) (*Y*PROG), *X*IMPV — emergent (optional)-PROG
(III) *Y*PROG, *X*IMPV — categorical-PROG
(IV) *Y*IMPV — generalized-PROG

Our working hypothesis is that essentially all the Arabic vernaculars have reached or are moving towards stage III of this cycle. The other stages have been shown through the use of the imperfective form with the appropriate interpretations shown in §2, e.g. (4). At the end of the cycle we have a state of affairs where the syntactic construction is generalised and has taken over (aspectual) functions otherwise fulfilled by the morphological imperfective.[6] According to the cycle, in time 'progressive marking realizes a more specific meaning than the imperfective and gradually generalizes over time' Deo (2015, 8). This gradual generalization from the more specific meaning is an *extension* effect in which the construction or structure continues developing its grammaticalised meaning further. Several examples from the literature suggest to us that this process is underway in at least some varieties of Arabic.

First, we see that in at least some dialects the PROG marker (i.e. the ACT.PTCP of the 'sit' verb) is felicitous with stative lexical verbs and gets a *continuous* type interpretation in this context (as would a simple imperfective form). This appears to be possible in Hassāwi and Kuwaiti but not in (the more conservative) Emirati.

(29) gāʕid yi-šbah ubū-h
sit.ACT.PTCP.SGM 3SGM-resemble.IMPV father-3SGM.GEN
'He resembles his father.' Kuwaiti: Alaskar (PC)

(30) hū gāʕid/ǰālis ya-ħbba-hā
he sit.ACT.PTCP.SGM 3SGM-love.IMPV-3SGF.ACC
'He loves her.' Hassāwi: Al-Abdullah, (2016, 85)

Further evidence for the extension of this grammatical construction may perhaps also be seen in Al-Abdullah (2016, 38)'s observation that in Hassāwi the PROG marker *gāʕid/ǧālis* co-occurs with (some) achievement lexical verbs which

[6] We cannot discuss tests for stativity in Arabic here but see Hallman (2016) on the presence of an epistemic reading as opposed to a deontic reading when such verbs are placed under modals which could in principle allow for both interpretations, e.g. *lāzim* 'must' .

(normally) describe a punctual event with a result state. In some cases, the interpretation is habitual, or *characterising* as in (31). However in others, as shown by the free translation in (32) (reflecting the discussion in Al-Abdullah (2016)), the interpretation appears to be processual.

(31) il-ħilal gāʕid/ǧālis ya-fūz bil-kass kil sanah
DEF-hilal sit.ACT.PTCP.SGM 3SGM-win.IMPV with.DEF-cup every year
(illa has-sanah)
except DEM.SGF.DEF-year.SGF
'Il-Hilal wins the cup every year (except this year).' = (habitually wins)
Hassāwi: Al-Abdullah (2016, 38)

(32) hū gāʕid/ǧālis yu-ṣal l-il-qima
he sit.ACT.PTCP.SGM 3SGM-arrive.IMPV to-DEF-top
'He is on his way to the top.'

The construction also occurs with punctual, change of state (achievement) verbs in Kuwaiti (Al-Najjar (1991), Alaskar (PC)).[7]

(33) il-bass gāʕid y-ōṣal is-sāʕa xams min
DEF-bus sit.ACT.PTCP.SGM 3SGM-arrive.IMPV DEF-hour five from
isnın
year.PL
'The bus has been arriving at five o'clock for years.' Al-Najjar, 1991

(34) huma gāʕid / gāʕd-in y-ħaqqaq-ūn
they sit.ACT.PTCP.SGM / sit.ACT.PTCP-PL 3-achieve.IMPV-PL
ħadaf-hum muʔaḥḥar
goal-3PL.GEN lately
'They are achieving their goal lately.' Alaskar (PC)

It is quite straightforward to demonstrate extension as the 'endpoint' of the Imperfective Cycle in Maltese. In this vernacular, only a small handful of ACT.PTCP forms still exist in the paradigm of *lexical/content* verbs. Where they exist, these morphological forms always express progressive aspect in Maltese (Borg, 1988): E.g. *miexi* 'walk.ACT.PTCP and *nieżel* descend.ACT.PTCP mean 'walking' and 'going down' respectively. In contrast, the *syntactic* construction built of the PROGRESSIVE auxiliary *qed/qiegħed* 'sit.ACT.PTCP' + (imperfective) lexical verb is quite widespread. This construction involving the auxiliary *qed/qiegħed* + lexical imperfective can occur with those (few) verbs which themselves have ACT.PTCP forms in their verbal paradigm, giving rise to pairs such as (35).

[7] In examples such as (34) we seem to have a particular type of *characterising* habitual, namely one which has taken root relatively recently. This 'restricted habit' reading is also found in Maltese. We see it as an instance of the sort of 'more specific' interpretation which Deo discusses.

(35) a. Miex-ja
walk.ACT.PTCP-SGF
'She is walking (now)/(generally).' PROG

b. Qiegħd-a ∼ qed t-i-mxi
sit.ACT.PTCP-SGF ∼ PROG 3F-FRM.VWL-walk.IMPV.SG
(dal-aħħar)
DEM.SGM.DEF-late.ELAT
'She walks (lately) (≠ now).' RESTRICTED HABIT

In (35a) it is precisely the choice of morphological form of the lexical verb, (the ACT.PTCP) that gives rise to the PROG interpretation (use of the imperfective would give a purely *characterising* reading 'she walks'). On the other hand, the (periphrastic) PROGRESSIVE construction with *this particular* lexical verb in (35b) does not in fact give rise to a reading denoting that the eventuality is in progress (a progressive). Rather, what we get is a HABITUAL which is in some way restricted, and hence the name RESTRICTED HABIT provided. It is restricted in the sense that it is not understood to have always been the case. This reading, which we argue is more 'specific' than the interpretation otherwise yielded by the imperfective, to use Deo's (2015) terminology, is we believe, compatible with the temporality which the PROGRESSIVE auxiliary itself denotes. (See Fabri (1995), Spagnol (2009) and especially Camilleri (2016, pp. 80-81) for discussion how these morphological vs. syntactic constructions give rise to complementarily distributed readings). For verbs such as *lagħab* 'play' which no longer have an ACT.PTCP form **liegħeb* in the *verbal* paradigm, we have only the periphrastic PROGRESSIVE construction. This gives rise to both PROGRESSIVE and restricted HABIT readings.

The final piece of evidence we present in favour of the grammaticalisation of a posture verb into a PROGRESSIVE-expressing auxiliary comes from the seemingly additional grammaticalisation that has been undergone by *gāʕid* 'sit.ACT.PTCP', where it functions as a copula in the context of stage-level predication where the pronominal copula is not allowed. The grammaticalisation literature (Kuteva, 1999) discusses the relationship between the development of a PROG auxiliary and that of a stage-level copula, and this issue has also recently received some attention for Arabic in Akkuş (2016), which (erroneously, in our view) takes it to be non-existent in the core (non-peripheral) dialects. We will not discuss this in any detail, but observe that the grammaticalisation of a copula is at various stages across the different core Arabic dialects, even when geographically quite close. Thus in Emirati, examples such as (17) above are ungrammatical but counterparts such as (36) are grammatical in Kuwaiti though restricted to temporary locations, themselves a subset of stage-level predication types. A wider range of stage-level copula functions for *gāʕid* appears to be attested in Libyan.

(36) a. is-sħūn gāʕid gaddām-ik
DEF-plate.SGM sit.ACT.PTCP.SGM in.front-2SG.GEN

‘The plate is in front of you.’

b. il-akil gāʕid bil-sħūn
DEF-food.SGM sit.ACT.PTCP.SGM in.DEF-plate
‘The food is on the plate.’

c. kahu il-akil gāʕid
there DEF-food.SGM sit.ACT.PTCP.SGM
‘There is the food.’

d. il-ktāb gāʕid fug iṭ-ṭāwla
DEF-book sit.ACT.PTCP.SGM on DEF-table
‘The book is on the table.’ Kuwaiti: Duha Alaskar (PC)

(37) a. gāʕd-in f-əl-ħoš əl-yōm?
sit.ACT.PTCP-PL in-DEF-house DEF-day
‘Are you in the house today?’ Libyan: Pereira (2008, 408)

b. gāʕəd šekl-a zēy əz-zebb
sit.ACT.PTCP.SGM form.SGM-3SGM.GEN like DEF-dick
‘Its appearance is (at the time being) shitty.’ Libyan: Pereira (2008, 417)

Once again, Maltese shows a further level of grammaticalisation because the *qiegħed* copula can turn up in a wider set of circumstances, with the choice between this copula and the pronominal copula having some interpretive significance.

(38) a. Kemm hu ħelu/tajjeb!
how COP.3SGM sweet.SGM/good.SGM
‘How sweet/good it/he is!’

b. Kemm qed/qiegħed ħelu/tajjeb!
how QED sweet.SGM/good.SGM
‘How sweet/good it/he is (in this current state, e.g. in a photo; in a current acting role).’ Maltese

Only the pronominal copula in (38a) gives a permanent or individual-level reading while *qed/qiegħed* can only be used in stage-level contexts where equational or identificational interpretations can never arise (Borg 1988, 299). This split parallels copula distinctions between the use of *ser* and *estar* in Spanish, where *qed/qiegħed* parallels the contingent state *estar* ‘be’.

From the above data concerning the distribution of the PROGRESSIVE auxiliary and its grammaticalisation as a copula, one could in principle hypothesise one of the two alternative trajectories which Kuteva (1999) posits: (i) lexical posture verb > stage-level copula > PROG auxiliary as in the case of Spanish *estar* and (ii) a

cycle that gradually involves a change from a lexical posture verb to an ASPECT-realizing auxiliary via the loss of human/animate SUBJ requirements along with added cohesion between the posture verb and the verbal complement (for the Bulgarian posture verb pseudo-coordinate construction). We will not consider these alternatives further here, although we take the view that the latter trajectory might be the most correct characterisation for the data we have discussed, with the emergence of an (additional) copula across the Arabic vernaculars being a natural process, once a feature-type auxiliary combines with a wider range of predicate types, including non-verbal predicates.

4 Towards an LFG analysis

To summarise, the data above illustrate that across the range of (core) contemporary Arabic vernaculars, the ACT.PTCP of the 'sit' posture verb has grammaticalised at least into a PROG marker, with some evidence of development into a more generalised imperfective marker. In several dialects we also see the development of a stage-level copula from the same form (which we hypothesise is a further stage of grammaticalisation). Stative posture verbs, which are by definition inherently unbounded, first undergo spatial extension, allowing inanimate SUBJs (incapable of the physical posture). Once grammaticalisation and desemanticisation proceeds further, what is left (of 'sit') is the eventuality's unboundedness which in turn gives rise to the ASPECTual interpretation as a PROG marker (and inexhorably generalises further).

Synchronically, we might consider two alternative analyses for the aspectual use of 'sit.ACT.PTCP' (which we have called PROG above, but which we have noted has broadened in at least some dialects to serve as a general imperfective marker) — as an auxiliary or as forming a complex predicate in which the posture verb has the status of a light verb. Within the LFG context, the term complex predicate broadly refers to cases where multiple predicational elements jointly determine a monoclausal f-structure. Most canonical are instances of argument merger, where each predicate makes some independent contribution (of arguments) to a merged a-structure (which then maps to a single f-structure), as shown for the Urdu permissive in (39) - (40) (Butt, 1996). [8]

(39) yassIn=nE nAdyA=kO gHar banA-n-E dI-yA
Yassin=ERG Nadya=DAT house.NOM make-INF-OBL give-PERF.MSG
'Yassin let Nadya make a house.' Urdu: Butt & King (2006,239)

(40) a-structure: give$<$ ag go$_i$ make $<$ ag$_i$ th $>>$
f-structure: PRED = 'give-make$<$ SUBJ, OBJ$_\theta$, OBJ$>$'

[8]The approach to complex predicate formation using restriction offers the slight different PRED value: PRED = 'GIVE $<$ SUBJ, 'MAKE $<$ OBJ$_{go}$, OBJ $>$' $>$' (Butt & King 2006, 240-242). Nothing hinges on this difference here.

In cases of aspectual V V complex predicates, by contrast, the 'aspectual' light verb is argued to contribute only to event modification at the sub-event structure, and hence there is no argument fusion (Butt, 1996; Butt & Geuder, 2003). However while it is claimed (Butt & Lahiri, 2013) that the lexical (main) and its aspectual light verb counterpart may be derived from the same lexical entry, such sources are somewhat elusive concerning the concrete details about the f-description associated with the aspectual light verb (or the clausal PRED value itself). Nonetheless, we can conclude on other grounds that the grammaticalised 'sit.ACT.PTCP' we are concerned with is not a light verb.

Studies of light verbs (Butt & Lahiri, 2002; Butt & Geuder, 2003; Butt & Lahiri, 2013) identify a number of distinguishing properties (see also Seiss (2009)). If these observations are correct, light verbs maintain some vestiges of lexical meaning (so may be subtly restricted in their combinatorial possibilities); are form-identical to the corresponding lexical verb; and are paradigmatically regular both in their form and distribution. As we have shown at some length in the preceding sections, these properties do not accuractely characterise the grammaticalised use of the 'sit' ACT.PTCP. Furthermore, if Butt & Lahiri (2002) and Butt & Lahiri (2013) are correct that light verbs constitute a 'dead end' on the grammaticalisation cline, and cannot grammaticalise further, then the very fact that the PROG marker has also grammaticalised into a copula form in some vernaculars additionally militates against a light verb/complex predicate analysis. We therefore rule out a complex predicate analysis, leaving us with an auxiliary analysis.

The synchronic analysis of an example such as (41) as a grammaticalised auxiliary form could in principle involve raising in an AUX-PRED approach, as in (42), or a fully functional AUX-FEAT approach as in (43) (Falk, 2008). Note that the eroded form *gaʕ* **cannot** express the lexical predicate 'sit' here, although of course the verb *taktib* 'she writes' is in principle compatible with the lexical meaning of the posture ACT.PTCP. Consequently, the utterance in (41) is not ambiguous, and only a PROGRESSIVE reading is available.

(41) maryam gaʕ ta-ktib maktūb
Maryam PROG 3SGF-write.IMPV letter
'Maryam is writing a letter.' Kuwaiti: Al-Najjar (1991)

(42)
$$\begin{bmatrix} \text{TENSE} & \text{PRES} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'MARYAM'} \end{bmatrix} \\ \text{PRED} & \text{'PROG}\langle\ \text{XCOMP}\ \rangle\ \text{SUBJ'} \\ \text{XCOMP} & \begin{bmatrix} \text{PRED} & \text{'WRITE}\langle\ \text{SUBJ, OBJ}\ \rangle\text{'} \\ \text{SUBJ} & \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{'LETTER'} \\ \text{DEF} & \text{INDEF} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

(43)
$$\begin{bmatrix} \text{TENSE} & \text{PRES} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`MARYAM'} \end{bmatrix} \\ \text{ASP} & \text{PROG} \\ \text{PRED} & \text{`WRITE}< \text{SUBJ, OBJ} >\text{'} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`LETTER'} \\ \text{DEF} & \text{INDEF} \end{bmatrix} \end{bmatrix}$$

Finding grounds to choose between these two alternative analyses is quite tricky, as Falk (2008) observes in his discussion of English auxiliaries. For English, Falk (2008) points to some evidence of a distributional type involving co-occurence requirements of specific lexical items which weigh in favour of the AUX-FEAT analysis for *do* and *have* - for example, the English auxiliary form *use to* occurs only in the context of past tense, but this can be expressed periphrastically (*did he use to...*) or synthetically (*he used to...*). Under an AUX-PRED analysis the TENSE would not be in the same clause, and so the dependency would at best be clumsy to state.[9] A further consideration is whether or not the features are compositionally distributed across the periphrasis: for English, Falk shows that (unlike the past participle) the progressive participle is associated with its own aspectual feature (leading to a XCOMP analysis).

Our current understanding of the tense/aspect verbal periphrasis system of the Arabic vernaculars is not well enough advanced to allow us to make a absolutely firm choice between these closely related AUX-FEAT and the AUX-PRED analyses. However we favour the AUX-FEAT approach shown in (43) for several reasons. [10] First, it is more attractive on the grounds of simplicity, in the absence of independent evidence in *favour* of the AUX-PRED analysis. Second, and crucially, it is not clear what the PRED's function name would be on the AUX-PRED analysis, for it evidently cannot be 'sit'. We have represented this as PROG in (42). Given that there is no vestige of the lexical meaning of 'sit' in this example or in with the aspectual uses of the 'sit.ACT.PTCP' in general, it would not be appropriate to use the function name SIT alongside this 'raising type' argument structure given (recall that *gaʕ* is not even part of the paradigm of the lexical verb). In the absence of evidence for (42), given these considerations, we opt for (43).

We now briefly consider a possible diachronic trajectory in which the PROG auxiliary element has grammaticalised from the lexical use of the 'sit' predicate, and what stages it might have passed through in the course of developing towards an aspectual auxiliary, and in some varieties, beyond, into a stage-level copula. Observe that if Butt & Lahiri (2002), Butt & Geuder (2003) and Butt & Lahiri (2013) are correct, the previous stages of grammaticalisation *also* cannot involve a light verb/complex predicate. There is a substantial literature on the path through degrees of increasing integration into fully grammaticalised aspectual constructions

[9] Similar arguments are made concerning the dependencies between *have* and *got* in the *have got* dialects of English, and between *had* and *better* in *had better*.

[10] Börjars et al. (2016) treat the Arabic auxiliary *kāna* 'be' as a raising verb.

(Lord (1993); Heine (1993); Dixon (2006, 343); Aikhenvald (2006, 30-31)), and some of it makes reference to serialisation, although this notion is far from being understood in a uniform manner across sources. A possibility is that it has instead grammaticalised in various stages from a circumstantial adjunct construction (these are very common structures in Arabic, in which the verb in the adjunct clause is often an imperfective form), through what Kuteva (1999, 193) refers to as 'sedimentation' in which repeated usage might have led to progressive grammaticalisation. At the stage following 'sedimentation' itself this could be somewhat akin to the sort of "chaining" (as opposed to integrated) serial verb construction discussed in Hellan & Beermann (2002), which are monoclausal, involving a PRED along with (multiple) clausal XADJs which with SUBJ sharing with the matrix PRED. In Oriya, the event denoted by the XADJ precedes that denoted by the main PRED in some event sequencing. However in Arabic circumstantials, the event denoted within the circumstantial ADJ is concurrent to the event denoted by the main predicate (whatever the main predicate is). Examples such as (44) (with one of the few remaining *verbal* ACT.PTCPs in Maltese as the main predicate, followed by a imperfective form in the circumstancial adjunct which illustrates an adverbial circumstantial could be seen as a precursory structure. (45) provides the structure for (44a). Out of this type of structure, the XADJ developed into a clausal argument (XCOMP), resulting in a raising type structure, and due to further cohesion between the posture verb and the predicate in the complement clause, coupled with additional bleaching and grammaticalisation of the posture verb as an auxiliary, it further loses any PRED feature associated with it, such that the original embedded clause predicate is reanalysed as the matrix lexical predicate.

(44) a. Dieħl-a t-i-ġri
enter.ACT.PTCP-SGF 3F-FRM.VWL-run.IMPV.SG
'She is entering (while running/while she runs).'

b. Miexi j-għaġġel
walk.ACT.PTCP.SGM 3M-hurry.IMPV.SG
He is walking (while he hurries) i.e. walking quickly/hurriedly.'

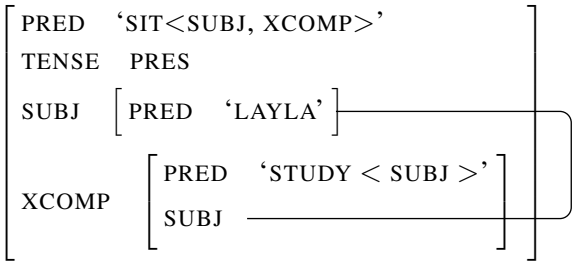
(45)
$$\begin{bmatrix} \text{TENSE} & \text{PRES} \\ \text{SUBJ} & \left[\text{PRED} \quad \text{'PRO'}\right] \\ \text{PRED} & \text{'ENTER}\langle\ \text{SUBJ}\ \rangle\text{'} \\ \text{XADJ} & \left\{\begin{bmatrix} \text{PRED} & \text{'RUN}\langle\ \text{SUBJ}\ \rangle\text{'} \\ \text{SUBJ} & \end{bmatrix}\right\} \end{bmatrix}$$

A possible trajectory from a structure of this sort would involve essentially three interrelated developments: (i) a tightening of the bond between the two verbal f-structures, so that the circumstantial adjunct becomes a clausal complement of

the lexical posture verb (ii) semantic widening of the sense of the posture verb (to eventual loss of lexemic meaning) and (iii) loosening of the selectional restrictions exerted by the posture verb over the subject. We further speculate that (at least) some synchronic *lexical* uses of the 'sit' verb may correspond to an intermediate stage in which the 'sit' verb takes a clausal complement and still places selectional restrictions on its subject. On the basis of this trajectory, we suggest that the lexical version of (46), i.e. the translation shown in boldface, corresponds to the f-structure in (47).

(46) layla gāʕd-a ta-dris
Layla sit.ACT.PTCP-SGF 3SGF-study.IMPV
Layla is sitting studying.
'Layla is studying.' Kuwaiti: Alaskar (PC)

(47)



Discussing this trajectory takes us too far afield: although we do see considerable common ground here, in terms of grammaticalisation patterns, with other constructions in the grammatical systems of vernacular Arabic, we leave this for future work. Some remarks are in order however, supporting the view that the verbs are more closely integrated in this structure than in a circumstantial adjunct. First note that NEG can only be expressed once, and this is obligatorily in the 'sit.ACT.PTCP' clause, irrespective of whether the reading is 'lexical' (as in (48) or fully grammatical (shown in (49) and (50)), while with circumstantial adjuncts, either or both of the main clause or adjunct clause can be independently marked for negation (and similarly for 'regular' COMP arguments). The behaviour of both the 'lexical' and the fully grammatical use of the 'sit' ACT.PTCP parallel what we find with auxiliated constructions in general, with NEG typically expressed in relation to the topmost verbal element (see (51) for example). The reading associated with 'semi'-lexical examples such as (46) and (49) can perhaps best be characterised as that of a 'complex' event, while the fully grammaticalised reading of (46) involves a single (temporally complex) event.

(48) layla mū gāʕid/gāʕd-a t-akil
Layla NEG sit.ACT.PTCP.SGM/SGF 3SGF-eat.IMPV
'Layla is not sitting and eating (....but playing, e.g.).' Kuwaiti: Alaskar (PC)

(49) layla mū gāʕid/gāʕd-a t-akil hal-ayyām
Layla NEG sit.ACT.PTCP.SGM/SGF 3SGF-eat.IMPV these-days

'Layla is not eating these days.' Kuwaiti: Alaskar (PC)

(50) al-ħarēm mū/mūš/mā-hum gāʕd-in/ǰāls-in
DEF-women NEG/NEG/NEG-3PL sit.ACT.PTCP.PL/sit.ACT.PTCP.PL
iy-sulf-un ʕan al-ʕirs al-ħin
3-talk.IMPV-3PL about DEF-wedding now
'The women are not talking about the wedding now.'
Hassawi: Al-Abdullah (2016, 61)

(51) aħmed mā kān gāʕid/ǰālis
Ahmed NEG be.PFV.3SGM sit.ACT.PTCP.SGM/sit.ACT.PTCP.SGM
iy-šuf al-mbarā llama itiṣal-t ʕli-h
3SGM-watch.IMPV DET-match when call.PFV-1SG on-3SGM.GEN
'Ahmed was not watching the match when I called on him.'
Hassawi: Al-Abdullah (2016, 62)

5 Conclusion

Although a significant amount of detailed descriptive work still remains to be done, we have shown that the grammaticalisation of a posture verb with a core lexical meaning of 'sitting' into an aspectual marker is found across the range of contemporary Arabic vernaculars. We have also shown that the associated range of interpretations in some dialects indicates diffusion beyond the central progressive meaning into a wider imperfective. Synchronically, we have argued that this construction should be treated as involving auxiliation rather than complex predicate formation. We have also argued that the evidence for a further grammaticalisation of the posture verb form into a copula is notably more widespread than acknowledged. In the course of our discussion, we have offered some speculations concerning the likely diachronic path to the synchronic situation in the Arabic vernaculars.

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Agreement in Asturian

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Abstract

We propose an LFG treatment for mixed agreement patterns in Asturian, where a given controller can at the same time control two agreement patterns. Under certain specific conditions, adjectives and pronouns show an ending in '-o' in opposition to masculine and feminine endings in '-u' and '-a'. This third ending has been previously considered a neuter gender inherited from Latin. We show this is not a third gender but a separate ending that is superimposed on the gender system and is based on the countability of the nuclear term. We propose an analysis based on the INDEX and CONCORD distinction by formulating agreement constraints that are sensitive to the count/mass distinction directly. We show that the basis for the choice for a given target is not linearisation based and propose a category based solution by which prenominal attributive elements are of category Â and agree in CONCORD and postnominal attributive and predicative elements are of category A and agree in INDEX.

1 Asturian: some general characteristics

Asturian is a Romance language spoken in Asturias, a region in northwestern Spain. Even though it is not the official language of the region –Spanish is–, its use is protected and regulated by law. This language has been catalogued as *definitely endangered* by UNESCO with an estimated figure of 100,000 native speakers (PROEL)[1]. There are three main dialectal areas: western, central and eastern. The standard variety is regulated by the Academy of the Asturian Language[2] and is based on the central area.

In general terms, Asturian is similar to other Iberian Romance languages. It shows mainly SVO order, with optionally overt subjects and is predominantly head initial:

(1) a. (Yo) atopé'l xatu na caleya
I find.PST.1SG=the.M.SG calf in.the.F.SG path

'I found the calf on the path.'

b. El páxaru roxu
the.M.SG bird.M red.M.SG

'The red bird'

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[1]Note that this –possibly generous– figure includes not only the area that is now Asturias, but also some other areas of Cantabria to the East, and as far as Extremadura to the South or even Portugal - in which it has been labelled as the Astur-Leonese family. Some might consider these varieties distinct enough to merit consideration; however, it is beyond the scope of this study to investigate the different varieties and so we will focus only on data from Asturias itself.

[2]http://www.academiadelallingua.com

2 The nominal system of Asturian

2.1 Nouns

Nouns in Asturian show gender and number distinctions. Gender groups nouns into masculine or feminine and number distinguishes between singular and plural nouns.

Gender is not always morphologically marked on the noun[3] but shows on the article/determiners:

(2) El debuyu
the.M.SG ripe-nut
'Ripe nut'

(3) La rescampladura
the.F.SG brightness
'The brightness'

(4) Los xingadorios
the.M.PL swing.PL
'The swings'

(5) Les fesories
the.F.PL hoe.PL
'The hoes/mattocks'

2.2 Adjectives

Adjectives also show gender and number distinctions. Gender splits between feminine and masculine. The most frequent ending for feminine adjectives is '-a' and for masculine we find '-u', '-án' or '-ín', even though this list is not exhaustive. Number then differentiates between singular and plural.

Masculine and feminine genders and number in adjectives are always an expression of agreement with the gender and number of the noun they modify.

(6) **La** saya esgatayad**a**
the.F.SG skirt ragged.F.SG
'The ragged skirt'

(7) **Les** sayes esgatayad**es**
the.F.PL skirt.PL ragged.F.PL
'The ragged skirts'

(8) **El** xilecu esgataya**ú**
the.M.SG vest ragged.M.SG
'The ragged vest'

(9) **Los** xilecos esgataya**os**
the.M.PL vest.PL ragged.M.PL
'The ragged vests'

There is a third ending: *-o*, that appears under specific conditions in contrast with feminine or masculine endings. When the adjective enters in an agreement relation with a mass noun, either postnominally or predicatively, it triggers the appearance of this ending, which we label MASS

[3]There are some tendencies, as is often the case in Romance languages, by which we can find that certain nominal endings correlate with gender, e.g. most nouns ending in '-a' are feminine or nouns in '-u' are generally masculine.

NEUTER (MN) as coined by Alonso (1962), a term that has pervaded the literature even though it is not very transparent[4]:

(10) **La** xente viey**o**/*vieya
the.F.SG people old.MN/old.F.SG

'Old people'

(11) **La** ropa esgataya**o**/*esgatayada
the.F.SG clothing ragged.MN/ragged.F.SG

'Ragged clothing'

This ending could be considered at first sight as a vestige of the Latin neuter, and some examples can be found in Spanish and Asturian in the form of pronouns, determiners and articles that appear with adjectives that are nominalised[5] and is used to designate inanimate, indeterminate or generic entities:

(12) Lo murnio ye que teamos enfrentaos
the.NEUT sad.NEUT be.PRS.3SG that be.PRS.SBJV.1PL opposed.PL

'What's sad is that we're opposed.' [Asturian (from ESLEMA)]

(13) No veo por qué lo bueno de otros tiempos tiene que perderse
NEG see.PRS.1SG for what the.NEUT good of other.PL time.PL have.PRS.3SG to lose.INF.REFL

'I don't see why the good of times past has to get lost.' [Spanish (from CREA)]

(14) Esto es lo que no me gusta
This.NEUT be.PRS.3SG the.NEUT that NEG DAT.1SG like.PRS.3SG

'This is what I don't like.' [Spanish]

However, as noted by Neira Martínez (1978) and Hualde (1989) among others, we do not have a three way (masculine, feminine, neuter) gender split for nouns in Asturian, as the term *mass gender* might suggest. We can assume that the external form of this ending is likely derived from the Latin neuter but this does not imply the existence of a class of nouns that show a neuter gender. This is clearly attested by the fact that gender classifies nouns only as masculine or feminine and prenominal elements such as articles, demonstratives or attributive adjectives do not show the MN ending but agree in gender with the noun as we will see in Section 3.

[4]Harmon (2007) labels this third ending MASS GENDER (MG) and not neuter, which is equally opaque. Perhaps more successful is the label *mass agreement* proposed by Fernández Ordóñez (2007a), which addresses more directly the fact that this agreement pattern is not based on lexical gender but rather on semantic features.

[5]DPD - Real Academia Española (2005) notes that *lo* can be considered an article because of its ability to nominalise adjectives and certain relative clauses, but it is also considered a pronoun by many linguists.

2.2.1 Count vs. mass nouns

Some nouns in Asturian always have a mass reference such as *lleche* 'milk', *dineru* 'money', *xente* 'people', *ropa* 'clothing', *lleña* 'wood', *sidra* 'cider', etc. In contrast, many nouns, while referring to the same entity reference, can be count in some contexts and non-count in others. In this case, there is a difference in meaning and interpretation: individual element vs. generic reality. This group includes for instance *fueya* 'leaf', *piedra* 'stone', *papel* 'paper', *café* 'coffee', *güesu* 'bone', etc. Generally speaking, these nouns do not show different endings for the count/non-count distinction: the neuter has no manifestation on the nuclear term, but is manifested on the adjective or referent[6]. There are three exceptional nouns which have MN forms:

1. fierru - 'a metal object' *vs.* fierro - 'iron'
2. pelu - 'one hair' *vs.* pelo - 'hair'
3. filu -'a thread' *vs.* filo - 'thread'

The fact that a noun is count or non-count, or more accurately, that it has a count or mass reading, will have repercusions for its agreement patterns (Academia de la Llingua Asturiana, 2001, p. 76) as we will see in the following section. The elements that require MN agreement appear always in the singular; the neuter is never associated with plural number.

3 Agreement

3.1 NP-internal agreement

Agreement inside the NP varies according to position and the countability features of the noun. Attributive adjectives, articles and other determiners that appear prenominally can only agree in gender- masculine or feminine- regardless of the type of noun:

(15) **El** famient**u** llobu
the.M.SG hungry.M.SG wolf
'The hungry wolf' [COUNT]

(16) **El** dur**u** carbón
the.M.SG hard.M.SG coal
'The hard coal' [NON-COUNT]

(17) **La** bon**a** neña
The.F.SG good.F.SG girl
'The good girl' [COUNT]

[6]However, there is a tendency in the spoken language to end some masculine nouns in *'-u'* if they are count and in *'-o'* if they are non-count.

(18) **La** sec**a** lleña
The.F.SG dry.F.SG wood

'The dry wood' [NON-COUNT]

For postnominal agreement we have two patterns depending on the countability of the noun:

1. If the noun is count, agreement will show masculine or feminine endings:

   (19) **El** llobu famient**u** anda pel monte
   the.M.SG wolf hungry.M.SG walk.PRS.3SG for=the.M.SG forest

   'The hungry wolf walks in the forest.' [COUNT]

   (20) **La** neña llist**a** escribe poesíes
   The.F.SG girl clever.F.SG write.PRS.3SG poem.PL

   'The clever girl writes poems.' [COUNT]

2. If the noun is non-count, the adjective will then show the MN ending:

   (21) **El** carbón dur**o** / *duru ambura bien
   The.M.SG coal hard.MN / hard.M.SG burn.PRS.3SG well

   'Hard coal burns well.' [NON-COUNT]

   (22) a. A la vera'l riu hai abond**a** piedra menud**o**
   PREP the.F.SG edge=the.M.SG river be.PRS.3SG much.F.SG stone small.MN

   'At the edge of the river, there is much small stone.' [NON-COUNT]

   b. A la vera'l riu hai piedra menud**o** abond**o**
   PREP the.F.SG edge=the.M.SG river be stone small.MN much.MN

   'At the edge of the river, there is much small stone.' [NON-COUNT]

As previously stated, some mass nouns can be used in a context where their reading is count. In such cases, agreement will follow the pattern of count nouns:

(23) Dio-y con un**a** piedra menud**a** en güeyu
hit.PST.3SG=DAT.SG with a.F.SG stone small.F.SG in eye

'He/she hit him/her with a small stone in the eye.' [count reading-a particular stone]

3.2 External agreement

Adjectives used predicatively also require MN agreement if the noun is non-count[7]:

[7]Count nouns require agreement in gender (MASC or FEM), as seen above for internal agreement. We are not including any more examples as this agreement pattern does not pose any major issues.

(24) **La** ropa ta tendí**o**
The.F.SG clothing be.PRS.3SG hang.PASTPART.MN

'The clothing is hung.' [NON-COUNT]

(25) **Esa** lleña$_i$ que pañó Xuan paezme mui sec**o**$_i$
That.F.SG wood that collect.PST.3SG Xuan seem.PRS.3SG=1.SG.REFL very dry.MN

'That wood that Xuan collected seems very dry to me.' [NON-COUNT]

Items in the sentence that refer to a non-count noun such as anaphoric pronouns or clitics also select the MN ending:

(26) Diz que nun-y gusta **la** lleche$_i$ pero nun pue
say.PRS.3SG that NEG-DAT.SG like.3SG the.F.SG milk but NEG can.PRS.3SG
pasar sin **ello**$_i$ calentin**o**
pass.INF without it.MN hot.DIM.MN

'He/she says he/she doesn't like milk but cannot do without it hot.' [NON-COUNT]

(27) **La** ropa muy viey**o** pues vende**lo**
the.F.SG clothing very old.MN can.PRS.2SG sell.INF=3.ACC.MN

'The very old clothing, you can sell.' [NON-COUNT]

Thus far we can summarise the agreement patterns of Asturian as follows: count nouns always require agreement in gender while mass nouns select gender agreement for determiners and prenominal attributive adjectives but select the MN ending for postnominal attributive adjectives, predicative adjectives and anaphoric referents.

We can therefore argue - based on the data shown so far- that the distinction between masculine, feminine and this mass neuter is not a three-way gender opposition inherited from Latin but a count/mass distinction that is superimposed on the masculine/feminine gender system.

4 Similar phenomena in Italian varieties

Kučerová & Moro (2011) note the existence of mixed agreement patterns in Central Italian dialects, which they claim have not received much attention in the literature. They note there is no synchronic, theoretically informed analysis - literature is mainly either diachronic or Romance-internal synchronic. There are two opposed diachronic views: this neuter descends from the Latin neuter or it can be evidence of survival of the ABLATIVE case (Hall Jr., 1968). They claim that the use of this special marking is both productive and highly stable, can be extended to words which did not exist in Latin and is also found on nominalised adjectives and infinitives, and occurs in contact-induced borrowings.

(28) So kumbratə[8] lə vinə. Lə so kumbratə pərkɛ ɛ bonə
AUX bought the.MN wine.MN itMN AUX bought because is good.MSG

I bought wine. I bought it because it's good. [Celano, Abruzzi (Kučerová & Moro, 2011, p. 7)]

Franco et al. (2015) provide more data from different varieties. They observe that in Mascioni, the opposition between count and mass is only available on determiners and quantifiers:

(29) a. l-[o]/ kweʃt-[o]/ kwell-[o] vin-(u)
the/ this/ that wine

b. kwell-[o] vin-(u) vecc-(u)
that wine old

'that old wine' [Mascioni, L'Aquila (Franco et al., 2015, p. 11)]

They claim that these Italian varieties indeed show a three gender opposition, which is not visible in varieties such as Mascioni due to the syncretism between masculine and neuter endings: "three genders can be present in the abstract syntax, though the vocabulary of Mascioni will include a single exponent, namely *-u*, for both masculine and neuter, unless merged with D/Q" (Franco et al., 2015, p.11).

They mention that in other varieties such as Amandola the neuter ending is also distinguished on lexical categories which proves further the existence of "three genders/N classes, namely masculine, feminine and neuter and the neuter corresponds to the Elsewhere N class, so that it will show up in environments where invariable inflections are selected" (Franco et al., 2015, p.12).

Kučerová & Moro (2011) summarise their approach with the following *empirical generalization* that they claim needs to be formulated in semantic terms (p. 7): "If a mass noun may be predicative, it triggers a default vocabulary insertion. If a mass noun must be referential, it triggers a 'marked' vocabulary insertion." They believe theirs to be the only formal attempt to analyse this phenomenon but it relies on very specific and abstract c-structural assumptions.

Franco et al. (2015) agree that this solution could work for some varieties such as Mascioni but criticise the fact that Kučerová & Moro (2011) do not make clear how to deal with the issue in other varieties or languages.

Indeed if we try to extrapolate Kučerová & Moro (2011)'s generalisation to Asturian we find that their account which predicts that a MN will only ever, in the cases of mixed agreement patterns, show MN and the default pattern of MSG, fails to account for the Asturian cases by predicting the wrong patterns, since we have seen that a mass noun –labelled predicative as opposed to referential by their account– can use both forms for data with generic interpretation. Furthermore, in Asturian both MASC and FEM are available in the contexts where MN is not required, which rules out a default vocabulary insertion:

(30) a. L**a** buen**a** lleche fresc**o** se toma templad**o**.
the.FEM.SG good.FEM.SG milk fresh.MN REFL take.PRS.3SG warm.MN

[8] Kučerová & Moro (2011) do not mention whether the participle forms *kumbratə* display MN or M.SG agreement, or whether they do not agree at all. I thank an anonymous reviewer for pointing this out.

Pruéba**lo**
try2.IMP=3.ACC.MN

'The good fresh milk is drunk warm. Try it.'

b. **El** buen vinu blanc**o** se toma frí**o**
the.MSG good wine white.MN REFL take.PRS.3SG cold.MN

'The good white wine is drunk cold.' (Fernández Ordóñez, 2007b, p. 59)

Since the analysis proposed by Kučerová & Moro (2011) cannot be satisfactorily applied to Asturian, we propose an analysis in the following section that addresses the mass/count distinction directly.

5 Proposed Analysis

5.1 Linearisation observations

First of all, let us consider the possibility that the basis for the choice of gendered or MN agreement for a given target is linear order. This could easily be assumed based on the data presented so far which seems to suggest this possibility. However, in predicative constructions, the adjective can precede the noun and still show MN, as in (31) and (32). So we discard linear order as a determining factor for the choice of agreement:

(31) onde l'aire güel a ocle y ye tibi**o** la
where the.M.SG=air smell.PRS.3SG PREP seaweed and be.PRS.3SG warm.MN the.FSG
rosada
dew

'where the air smells like seaweed and the dew is warm.'

(32) Con sidre aneyo güélvese moz**o** la xente vieyo
With cider mature.MN turn.PRS.3SG.REFL young.MN the.FSG people old.MN

'With mature cider old people turn young.'

5.2 Towards a category-based solution

We propose an analysis that assumes that prenominal and postnominal adjectives belong to different categories: prenominal adjectives are non-projecting $\hat{A}$ and postnominal adjectives are A, together with predicative adjectives. The idea of grouping together postnominal attributive adjectives and predicative adjectives is not far-fetched as they show comparable characteristics that separate them from prenominal attributive adjectives (*cf.* Lamarche (1991), Alexiadou (2014)).

Agreement involves CONCORD and INDEX distinctions by which indices reflect more semantic properties and concord captures values *ad formam* (Kathol, 1999). Our analysis builds on this distinction and is based on the analysis for the French Polite Plural Generalisation provided by Wechsler (2011).

We introduce a COUNTABILITY feature with +/- values and we take it to be an INDEX feature. Pronouns, predicative and postnominal attributive adjectives agree in INDEX and determiners and prenominal attributive adjectives would be dealt with by CONCORD agreement. This account is consistent with the semantic hierarchy proposed by Corbett (2006, p. 207):

(33) a. Agreement hierarchy:
attributive > predicate > relative pronoun > personal pronoun [9]

b. "For any controller that permits alternative agreements, as we move rightwards along the Agreement Hierarchy, the likelihood of agreement with greater semantic justification will increase monotonically (that is, with no intervening decrease)"

Since we are considering the possibility of two categories for adjectives, our rules for a noun phrase include the following:

(34) $\text{DP} \longrightarrow \underset{\uparrow=\downarrow}{\text{D}^{\text{o}}} \quad \underset{\uparrow=\downarrow}{\bar{\text{N}}}$

(35) $\bar{\text{N}} \longrightarrow \underset{\uparrow=\downarrow}{\text{N}^{\text{o}}} \quad \underset{\downarrow\in(\uparrow \text{ADJ})}{\text{AP}}$

(36) $\bar{\text{N}} \longrightarrow \underset{\uparrow=\downarrow}{\text{N}^{\text{o}}}$

(37) $\text{N}^{\text{o}} \longrightarrow \underset{\downarrow\in(\uparrow \text{ADJ})}{\hat{\text{A}}} \quad \underset{\uparrow=\downarrow}{\text{N}^{\text{o}}}$

(38) $\text{AP} \longrightarrow \underset{\uparrow=\downarrow}{\text{A}}$

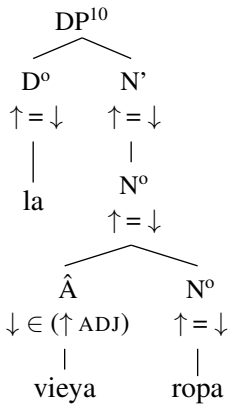
Let us now turn to applying the above rules to Asturian and exploring the constraints that are necessary for our analysis to predict the right combinations and rule out ill-formed ones:

(39) a. **La** viey**a** ropa
the.F.SG old.FSG clothing

'Old clothing'

[9] Fernández Ordóñez (2007b, p.61) adapts this hierarchy to the mass agreement patterns in Ibero-Romance varieties as follows: attributive > predicative > secondary predicate > personal and demonstrative pronoun; which shows the spreading of the MN in Asturian.

b.



c.

$$\begin{bmatrix} \text{PRED} & \text{`CLOTHING'} \\ \text{CONC} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{GEND} & \text{FEM} \end{bmatrix} \\ \text{DEF} & + \\ \text{ADJ} & \{ [\, \text{PRED} \quad \text{`OLD'} \,] \} \end{bmatrix}$$

d. *la: D°* (↑ CONC GEND) $=_c$ FEM
(↑ DEF) = +

vieya: Â (↑ PRED) = 'OLD'
((ADJ ∈ ↑) CONC GEND) $=_c$ FEM
((ADJ ∈ ↑) CONC NUM) $=_c$ SG

We see in (39) that both the determiner *la* and the prenominal attributive adjective *vieya* agree with the CONCORD values for GENDER of the noun *ropa*. Since INDEX agreement is not involved, the countability feature is not relevant in this case, which predicts the right combinations by ruling out *vieyo* (MN), and the CONCORD constraints for gender also rule out the masculine *vieyu*.

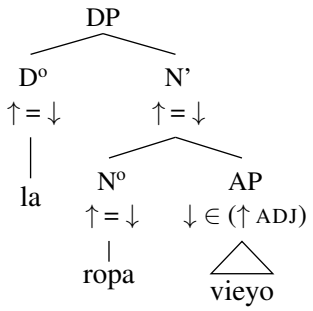
If we compare (39) with (40) below, we find that we now have a postnominal adjective, which is of category A and shows agreement in INDEX which now rules out the appearance of a feminine A, since such adjective can only appear with count nouns. The agreement for the determiner is still resolved by CONCORD agreement:

(40) a. **La** ropa viey**o**
the.F.SG clothing old.MN
'Old clothing'

b.

$$\begin{bmatrix} \text{PRED} & \text{`CLOTHING'} \\ \text{INDEX} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{COUNT} & - \end{bmatrix} \\ \text{CONC} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{GEND} & \text{FEM} \end{bmatrix} \\ \text{DEF} & + \\ \text{ADJ} & \{ [\, \text{PRED} \quad \text{`OLD'} \,] \} \end{bmatrix}$$

c.



[10]We treat the determiner as a cohead, but this could be easily adapted to a treatment as a specifier function.

d. *la:* D^o (↑ CONC GEND) $=_c$ FEM
(↑ DEF) = +

**vieya:* A (↑ PRED) = 'OLD'
(↑ SUBJ INDEX COUNT) $=_c$ +

vieyo: A (↑ PRED) = 'OLD'
((ADJ ∈ ↑) INDEX COUNT) $=_c$ −

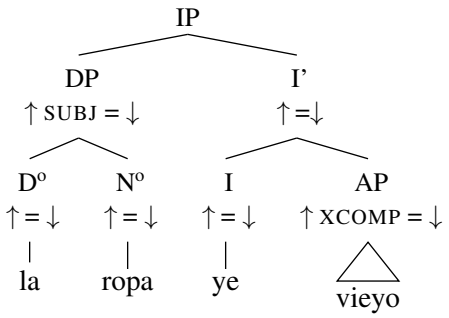
Let us now turn our sentence into a copular structure with a predicative adjective as below:

(41) a. **La** ropa ye viey**o**
the.F.SG clothing be.PRS.3SG old.MN
'The clothing is old.'

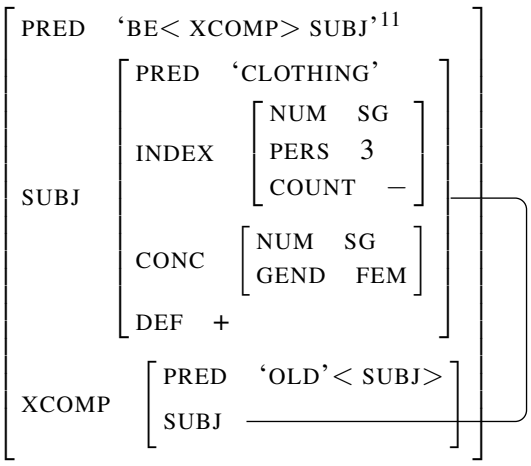
b. *la:* D^o (↑ CONC GEND) $=_c$ FEM
(↑ DEF) = +

vieyo: A (↑ PRED) = 'OLD'
(↑ SUBJ INDEX COUNT) $=_c$ −

c.



d.



In (41), we see the same mechanism but the target is now the INDEX features for COUNTABILITY of the SUBJECT. We can also easily combine prenominal and postnominal attributive adjectives and obtain the expected results:

(42) a. bon**a** lleche fresc**o**
good.F.SG milk fresh.MN
'Good fresh milk'

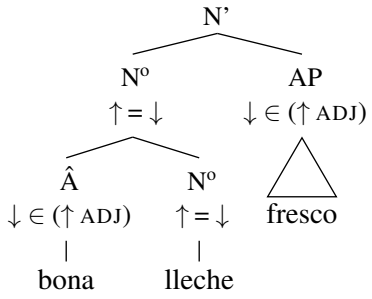
[11] Here we follow Dalrymple et al. (2004)'s approach to French copular complements.

b.
$$\begin{bmatrix} \text{PRED} & \text{`MILK'} \\ \text{INDEX} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{COUNT} & - \end{bmatrix} \\ \text{CONC} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{GEND} & \text{FEM} \end{bmatrix} \\ \text{ADJ} & \left\{ \begin{bmatrix} \text{PRED} & \text{`GOOD'} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{`FRESH'} \end{bmatrix} \right\} \end{bmatrix}$$

c. *bona:* Â $(\uparrow \text{PRED}) = \text{`GOOD'}$
$((\text{ADJ} \in \uparrow)\ \text{CONC GEND}) =_c \text{FEM}$
$((\text{ADJ} \in \uparrow)\ \text{CONC NUM}) =_c \text{SG}$

fresco: A $(\uparrow \text{PRED}) = \text{`FRESH'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c -$

d.

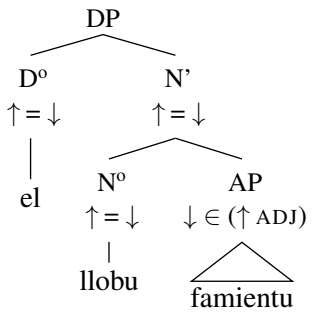


For postnominal attributive adjectives that modify count nouns, note that the COUNTABILITY feature will predict that we cannot have a MN ending but does not ensure that we get only either MASC or FEM endings, which would in turn predict the wrong combinations:

(43) a. El llobu famient**u**
the.M.SG wolf hungry.M.SG
'The hungry wolf'

b.
$$\begin{bmatrix} \text{PRED} & \text{`WOLF'} \\ \text{INDEX} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{COUNT} & + \end{bmatrix} \\ \text{CONC} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{GEND} & \text{MASC} \end{bmatrix} \\ \text{DEF} & + \\ \text{ADJ} & \left\{ \begin{bmatrix} \text{PRED} & \text{`HUNGRY'} \end{bmatrix} \right\} \end{bmatrix}$$

d.



c. *el: D°* $(\uparrow \text{CONC GEND}) =_c \text{MASC}$
$(\uparrow \text{DEF}) = +$

famientu: A $(\uparrow \text{PRED}) = \text{`HUNGRY'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c +$

**famiento:* A $(\uparrow \text{PRED}) = \text{`HUNGRY'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c -$

In (43c) we see that our rules correctly accept the MASC adjective *famientu* and rule out the MN *famiento*. However, this has not ruled out yet the FEM *famienta*, which is not a possible option since it is the wrong gender. As it stands, our rule does not provide any arrangements for gender and both *famientu* and *famienta* would potentially have the same lexical entry as below:

(44) *famientu:* A $(\uparrow \text{PRED}) = \text{'HUNGRY'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c +$

famienta: A $(\uparrow \text{PRED}) = \text{'HUNGRY'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c +$

This is, however, not a problem for our account, as GENDER is also an INDEX feature (Wechsler & Zlatić, 2003). Therefore, for count nouns, we have to specify constraints both for COUNTABILITY and GENDER in INDEX:

(45) *famientu:* A $(\uparrow \text{PRED}) = \text{'HUNGRY'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c +$
$((\text{ADJ} \in \uparrow)\ \text{INDEX GEND}) =_c \text{MASC}$

famienta: A $(\uparrow \text{PRED}) = \text{'HUNGRY'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c +$
$((\text{ADJ} \in \uparrow)\ \text{INDEX GEND}) =_c \text{FEM}$

This will result in the following f-structure for (43) by ensuring that only the MASC adjective *famientu* is available:

(46)
$$\begin{bmatrix} \text{PRED} & \text{'WOLF'} \\ \text{INDEX} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{GEN} & \text{MASC} \\ \text{PERS} & 3 \\ \text{COUNT} & + \end{bmatrix} \\ \text{CONC} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{GEND} & \text{MASC} \end{bmatrix} \\ \text{DEF} & + \\ \text{ADJ} & \left\{ \begin{bmatrix} \text{PRED} & \text{'HUNGRY'} \end{bmatrix} \right\} \end{bmatrix}$$

famientu: A $(\uparrow \text{PRED}) = \text{'HUNGRY'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c +$
$((\text{ADJ} \in \uparrow)\ \text{INDEX GEND}) =_c \text{MASC}$

**famienta:* A $(\uparrow \text{PRED}) = \text{'HUNGRY'}$
$((\text{ADJ} \in \uparrow)\ \text{INDEX COUNT}) =_c +$
$((\text{ADJ} \in \uparrow)\ \text{INDEX GEND}) =_c \text{FEM}$

Including GENDER will not affect the unacceptability of *famiento* as it fails to check the COUNTABILITY features imposed by the noun *lobo*. It also reflects our proposal that we are not dealing with a three gender system for Asturian and that we have gender on one side and countability as a separate feature[12].

[12]As mentioned by the editors, one might consider arguing that all noun phrases should have values for NUMBER, GENDER and COUNTABILITY in CONCORD and INDEX as they are all involved in obtaining the right combinations of agreement patterns. It remains to be discussed, however, whether we have a default value for all of them or if there is some sort of feature hierarchy - it seems that a – feature for COUNTABILITY is more prominent than the features for GENDER and it is also unclear how NUMBER interacts with them. This will be briefly discussed in Section 6 where

6 Some remarks about coordination

So far we have identified an interesting pattern of mixed agreement for Asturian and proposed a plausible analysis. It is interesting now to examine how mass nouns can combine in coordinated structures. This section will present some preliminary data. However, due to the limited data available and the diversity in judgement by speakers, we will not provide a full analysis here but will consider some possibilities that will be the subject for further research.

Academia de la Llingua Asturiana (2001) observes the following regarding coordination and agreement:

When the adjective/referent has to agree with more than one noun, it appears in the plural, regardless of the number of the nouns:

(a) If the nouns have the same gender, the adjective will show that same gender and plural number:

(47) **El** pá ya'**l** fíu son uvieín**os**
the.M.SG father and=the.M.SG son be.PRS.3PL from.Oviedo.M.PL

'The father and the son are from Oviedo.'

(48) **La** ma ya **la** fía son avilesin**es**
the.F.SG mother and the.F.SG daughter be.PRS.3PL from.Avilés.F.PL

'The mother and the daughter are from Avilés.'

(b) If the nouns have different gender, the adjective will show masculine gender and plural number:

(49) **El** parllamentu ya **la** conseyería tan esmolecí**os**
the.M.SG parliament and the.F.SG ministry be.PRS.3PL uneasy.M.PL
col tema
with=.M.SG topic

'The parliament and ministry are concerned about the issue.'

(50) **La** neña y **el** rapacín tan galdí**os**
the.F.SG girl and the.M.SG boy be.PRS.3PL exhausted.M.PL

'The girl and the boy are exhausted.'

However, there is no mention about how to resolve the agreement if one (or more) of the nouns is non-count. We find some contradictory information from Academia de la Llingua Asturiana (2001). On the one hand, it is clearly stated that "nouns and other elements that require neuter agreement always appear in the singular, the neuter is never associated with plural number,

we see competition between the NUMBER and COUNTABILITY features triggering different forms. However, due to the limited data and the ambiguity between count and mass readings, we will not be discussing this further in this paper.

which is also reflected on the agreement with the verb" (p.89); but also that "when one same adjective or referent has to agree with a group of two or more nouns, the adjective or referent have to appear in plural, regardless of the number of all or any of the nouns" (p. 342).

Obtaining data proves problematic, especially if we take into account that many mass nouns can have count interpretations. However, there seems to be some tendency that when we have one mass noun and one count noun, the plural does appear in the agreement with the adjective and verb. It seems also that we can discard the possibility that Asturian could show closest conjunct agreement, as various order combinations are possible[13]:

(51) a. **La** carne y **les** gambes taben riqu**es**
the.F.SG meat and the.F.PL prawn.PL be.PST.3PL tasty.F.PL

'The meat and the prawns were tasty.' [non count + count]

b. **Les** gambes y **la** carne y taben riqu**es**
the.F.PL prawn.PL and the.F.SG meat be.PST.3PL tasty.F.PL

'The prawns and the meat were tasty.' [count + non-count]

(52) a. **La** carne y **los** cachopos taben ric**os**
the.F.SG meat and the.M.PL cachopo.PL be.PST.3PL tasty.M.PL

'The meat and the cachopos (*Asturian dish*) were tasty.' [non-count + count]

b. **Los** cachopos y **la** carne taben ric**os**
the.M.PL cachopo.PL and the.F.SG meat be.PST.3PL tasty.M.PL

'The cachopos (*Asturian dish*) and the meat were tasty.' [count + non-count]

However, note that we also find instances where agreement is not resolved at all and even though we have the same adjective, it is repeated to agree separately with each noun as below:

(53) El Reinu de Lleón siguirá na mesma tradición del so antecesor norteñu

axuntando nuev**es** tierres y xente nuev**o**
join.PRESPART new.F.PL land.PL and people new.MN

'The Kingdom of León will continue the same tradition as its northener predecessor, gathering new lands and new people.'

(García Arias, 2016)

It remains to be seen what possibilities may arise when we coordinate two mass nouns. Judgements for these seem to differ drastically:

[13] We also found speakers that accepted MN agreement for all sentences in (51) and (52) arguing that the whole NP can be substituted by the pronoun *ello* 'it' :

(i) **La** carne y **les** gambes taba ric**o** = Ello taba rico
the.F.SG meat and the.F.PL prawn.PL be.PST.3SG tasty.MN = it be.PST.3SG tasty.MN
'The meat and the prawns were tasty = it (all) was tasty.'

(54) a. El carbón y [la madera dur**o**] ambur**en** bien
the.M.SG coal and the.F.SG wood hard.MN burn.PRS.3PL well

'The coal and the hard wood burn well.'

b. # [El carbón y la madera dur**o**] ambur**a** bien
the.M.SG coal and the.F.SG wood hard.MN burn.PRS.3SG well

'The hard coal and wood burn well.'

(55) Pañaron [lleña y yerba sec**o**] /*secas /*secos
collect.PST.3.PL wood and grass dry.MN /dry.F.PL /dry.M.PL

'They collected dry wood and grass.'

It is worth noting that in (55), the possibility of having anything other than MN agreement was rejected, possibly due to the fact that the two nouns *yerba* 'grass' and *lleña* 'wood' are only used with mass interpretation.

We will leave out cases of coordination of a count noun with a mass noun, but we can outline the following tentative f-structures for the less complex cases such as (54a) and (55), where we have coordination of mass nouns showing either plural or MN agreement –and therefore not plural[14]:

(56)
$$\begin{bmatrix} \text{PRED} & \text{'BURN} < \text{SUBJ} > \text{'} \\ \text{SUBJ} & \left[\begin{array}{ll} \text{INDEX} & \begin{bmatrix} \text{NUM} & \text{PL} \\ \text{PERS} & 3 \end{bmatrix} \\ \text{CONJ} & \text{AND} \\ & \left\{\begin{bmatrix} \text{PRED} & \text{'COAL'} \\ \text{DEF} & + \\ \text{INDEX} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{COUNT} & - \\ \text{PERS} & 3 \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{'WOOD'} \\ \text{DEF} & + \\ \text{INDEX} & \begin{bmatrix} \text{NUM} & \text{SG} \\ \text{COUNT} & - \\ \text{PERS} & 3 \end{bmatrix} \\ \text{ADJ} & \{[\text{PRED} \quad \text{'HARD'}]\} \end{bmatrix}\right\} \end{array}\right] \\ \text{ADJ} & \{[\text{PRED} \quad \text{'WELL'}]\} \end{bmatrix}$$

(57)
$$\begin{bmatrix} \text{PRED} & \text{'COLLECT} < \text{SUBJ, OBJ} > \text{'} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{INDEX} & \begin{bmatrix} \text{NUM} & \text{PL} \\ \text{PERS} & 3 \end{bmatrix} \end{bmatrix} \\ \text{OBJ} & \left[\begin{array}{ll} \text{INDEX} & \begin{bmatrix} \text{COUNT} & - \\ \text{PERS} & 3 \end{bmatrix} \\ \text{CONJ} & \text{AND} \\ & \left\{\begin{bmatrix} \text{PRED} & \text{'WOOD'} \\ \text{INDEX} & \begin{bmatrix} \text{COUNT} & - \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \text{PRED} & \text{'GRASS'} \\ \text{INDEX} & \begin{bmatrix} \text{COUNT} & - \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \end{bmatrix} \\ \text{ADJ} & \{[\text{PRED} \quad \text{'DRY'}]\} \end{bmatrix}\right\} \end{array}\right] \end{bmatrix}$$

In (56) we have two singular nouns but plural agreement on the verb. This is unproblematic if we follow Dalrymple & Kaplan (2000)'s view that INDEX features are non-distributive and as such are associated with the set that represents the coordinate structure independent of the individual features of each conjunct. INDEX agreement is typically relevant for NP external agreement. In (55) we have two mass nouns and one MN adjective that modifies both of them. We have argued that postnominal adjectives also agree in INDEX.

[14] See Belyaev et al. (2015) for a recent treatment of problematic patterns of agreement in coordination.

Note that two singular nouns triggered plural verb agreement in (56) but the plural is ruled out for (55). It seems that somehow the feature for COUNTABILITY imposes the necessary constraints, thus preventing the appearance of a plural adjective. However, the question arises as to why those constraints do not seem to apply in (56) when we also have two mass nouns but the plural verb is actually preferred over a singular one as in (54b)[15].

In contrast with (55), in (58) two options were accepted: one with MN in (58a) and the possibility of having a plural as in (58b).

(58) a. La tele da pa mañana agua y aire frí**o**
the.F.SG TV give.PRS.3SG for tomorrow water and air cold.MN

b. La tele da pa mañana agua y aire frí**os**
the.F.SG TV give.PRS.3SG for tomorrow water and air cold.M.PL

'The TV forecasts cold rain and wind for tomorrow.'

There is probably a different nuance in meaning and we could possibly argue that (58b) refers to specific meteorological phenomena such as *it is going to rain/be windy*, which could have a specific interpretation –a particular event– whereas (58a) might refer to the rain and wind themselves as mass entities, thus triggering the MN agreement. This is, however, very difficult to assess from the little data obtained. Similarly, in (59) below, we might have a subtle distinction between homogenous and heterogeneous reference and that is possibly why again the two possibilities were accepted:

(59) a. **El** quesu y **la** carne tab**a** ric**o**
the.M.SG cheese and the.F.SG meat be.PST.3SG tasty.MN

b. **El** quesu y **la** carne tab**en** ric**os**
the.M.SG cheese and the.F.SG meat be.PST.3PL tasty.M.PL

'The cheese and the meat were tasty.'

The data above raises interesting issues. Firstly, it has to be determined how accurate the semantics of each noun is before we can decide whether we have an instance of *true* mass reference and therefore we can expect MN agreement and also singular forms of the verbs in copular sentences, for instance. If that turns out to be the case, it will be interesting to examine and decide how to best treat coordination for Asturian, maybe following the theory of feature resolution proposed by Dalrymple & Kaplan (2000) and introducing sets of abstract features, possibly for NUMBER, that can then undergo a set union operation. However, this cannot be proberly examined until the right data can be found and all the semantic nuances disentangled.

[15]Note that the coordinate structure in (54) functions as SUBJ and as OBJ in (55). We cannot do away with the definite article in (54) and it is not clear if the addition of an article in (55) would trigger different patterns - and perhaps different readings.

7 Summary and conclusion

We have presented and examined the agreement patterns of Asturian. Asturian shows previously unanalysed mixed agreement patterns by which a feature of COUNTABILITY is superimposed on a masculine/feminine gender system.

We provided evidence and argued that this split is not a case of a three-gender system. We also provided some counter arguments against an existing Distributed Morphology analysis for comparable data in central varieties of Italian. We then proposed an LFG analysis by formulating constraints that are sensitive to the count/mass distinction directly. We also showed that the different patterns are not triggered by linear order and sketched an analysis that considers prenominal elements belong to the category $\hat{\text{A}}$ whereas postnominal attributive adjectives, predicative adjectives, and anaphoric pronouns are of category A. The former agree in CONCORD and the latter in INDEX and answer to specific GENDER and COUNTABILITY constraints. We believe this approach to agreement in Asturian makes the right predictions for the data examined.

We also briefly considered how to extend our analysis to coordinated structures. We presented some basic data and examined the reasons for the choice of agreement, even though the data was not sufficient. We raised some interesting questions about the data presented and briefly proposed this could be analysed through feature resolution, which is proposed as the subject for further research in Asturian agreement.

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Multiword Expressions and Lexicalism

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Abstract

Multiword expressions (MWEs) such as idioms exhibit a tension between phrase-like and word-like properties. Much recent work has treated idioms as exclusively phrase-like, by positing special idiom versions of the words they contain. In this paper, I argue that such approaches are unappealing, and suggest that by following the ideas of Abeillé (1995), we can provide a more satisfying analysis that respects the special status of MWEs. This is implemented by replacing the context-free grammar standardly assumed for LFG c-structures with a Tree Adjoining Grammar (Joshi et al. 1975). This allows us to represent idioms in a single place, even when their parts can be individually modified and/or targetted by morphosyntactic operations.

1 Background

1.1 Multiword expressions

Multiword expressions (MWEs) are of interest to linguistic theory because of the tension they exhibit between a divided (phrase-like) and a unitary (word-like) nature. Consider the idiom in (1):

(1) *take the biscuit* 'be egregious/shocking'

This is clearly made up of multiple, independently recognisable English words, which inflect individually (for example, the past tense form is *took the biscuit* not *take the biscuit-ed*), i.e. it is like a common-or-garden phrase. At the same time, however, it has a unitary, and non-compositional, semantics, which only emerges when the words are used together. Notice that neither word can bear (some part of) the idiomatic meaning alone:[1]

(2) a. #What a dramatic biscuit! ($\neq$ What a dramatic shock/outrage!)
b. #That really takes it. ($\neq$ That's really egregious/shocking.)

Because of their idiosyncratic semantics, and the fact that the parts must co-occur, it seems necessary that these expressions be stored somehow.

The scope of the label 'MWE' is broad, and includes such phenomena as periphrases, nominal compounds, phrasal verbs, and idioms (Baldwin & Kim 2010). These each raise their own analytical problems, but the common challenge which they pose is how to resolve the tension between their word-like and phrase-like

[†]For helpful and insightful discussion on this topic, I would like to thank Doug Arnold, Ash Asudeh, Alex Biswas, Mary Dalrymple, Timm Lichte, John Lowe, Stephen Pulman, and Manfred Sailer. Thanks also to the two anonymous reviewers for their constructive feedback. This research was carried out while I was the recipient of a UK Arts and Humanities Research Council grant (grant no. AH/L503885/1), which I gratefully acknowledge.

[1]Here and throughout, the # marker of semantic oddity is used to indicate that the intended idiomatic reading is not available.

properties.[2] The focus of this paper is idioms (on which there is a considerable literature: see e.g. Katz & Postal 1963; Chomsky 1980; Nunberg et al. 1994), but much of what is said carries over to the analysis of other kinds of MWE as well.[3]

1.2 Idioms

Idioms are non-compositional in the sense that their meanings are not a function of the literal meaning of their parts and the way they are put together. Their meanings therefore have to be learned, and oftentimes seem to be just as arbitrary as any given lexical entry. For example, although *kick the bucket*, *look a gift horse in the mouth*, and *shoot the breeze* might all have originated in perfectly coherent metaphors, it is now the case that for many, if not most, speakers they are synchronically opaque. (All the same, as Nunberg et al. 1994: 492–493, fn. 2, point out, speakers do recognise that *some* figuration is at play, they may just have no idea what particular metaphor is being evoked.)

In spite of their non-compositional semantics, idioms nonetheless appear in the syntax as multiple, distinct word forms, and these can be separated, modified, and, as mentioned, inflected individually. It is this (morpho)syntactic flexibility which makes idioms challenging for linguistic analysis: ideally, they should be stored locally, as a unit, to account for their unitary properties, but their parts must also be individually accessible to the syntax, and may ultimately end up separated. For, although some idioms share the limited syntactic flexibility of periphrases and other kinds of MWEs like compounds (as in (3)), others show a considerable degree of freedom, whereby their parts can end up arbitrarily far apart (as in (4)).

(3) a. Old Man Mose kicked the bucket.

[2] Ackerman et al. (2011) discuss this tension in morphology under the rubric of the *principle of unary expression*, whereby each lexeme is preferably to be expressed in syntax as "a single morphophonologically integrated and syntactically atomic word form", and how this is challenged by the facts of periphrasis, where cells in a lexeme's paradigm appear to be filled by more than one word form.

[3] Although, of course, not all of what is said carries over to the analysis of all other kinds of MWE. For example, as a reviewer sensibly points out, simple nominal MWEs like 'New York' or 'Jack the Ripper' can plausibly be treated as 'words with spaces' (Sag et al. 2002), i.e. as atomic lexical items that just so happen to be written as multiple words. That said, however, it is clear that these expressions are not totally immune to linguistic analysis, as evidenced by word play – 'Newer York', 'Jack the former Ripper', etc. – and so we might prefer to represent them as full NPs, with the accompanying internal structure, but mark them in some way so as to 'close off' their internal structure in normal usage.

On the other hand, there are complex predicates and light verb constructions (LVCs), also often considered to be MWEs. These are (at least semi-)productive, and (to some extent) follow systematic combinatorial rules. They thus constitute a different class of MWEs, analytically speaking, from the semantically idiosyncratic idioms I examine in this paper. This is not just a self-serving distinction on my part: LVCs, at least, also exhibit markedly different psycholinguistic properties from idioms, being *harder* to process than literal expressions (Wittenberg & Piñango 2011), unlike idioms which are *easier* to process. This points to a more complex kind of semantic composition for LVCs, perhaps along the lines outlined by Lowe (2015) for complex predicates, and a less complex kind for idioms, along the lines outlined in this paper.

b. #The bucket was kicked (by Old Man Mose).
c. #Which bucket did Old Man Mose kick?
d. #The bucket that Old Man Mose kicked was {sudden/sad/...}.

(4) a. He pulled strings to get me assigned to his command.
b. Strings were pulled to get me assigned to his command.
c. Which strings did he pull to get you assigned to his command?
d. The strings that he pulled got me assigned to his command.

Similarly, although some kinds of idiom only allow so-called 'external' modification (Ernst 1981), whereby adjectives which appear inside the expression actually take scope over the whole idiom meaning (delimiting a domain, as in (5)), many allow extensive internal modification or quantification over sub-parts of their meaning (as in (6)).

(5) *External modification*:
a. Musicians keep composing songs 'til they **kick the proverbial bucket**.
(= ... 'til, proverbially speaking, they kick the bucket.)
(GloWbE)[4]
b. Britney Spears [...] **came apart at the mental seams**.
(= Mentally, Britney came apart at the seams.)
(http://bit.ly/2jZmYKP)
c. Let's say [...] you want to **return the oral sex favour** he happily gives to you.
(= In the domain of oral sex, you want to return the favour.)
(http://bit.ly/2y4jeOx)

(6) *Internal modification*:
a. Delhi's politicians **pass the polluted buck**.
(The issue which is being avoided is polution.)
(http://on.ft.com/2y4fbBJ)
b. Maybe by writing this book I'll offend a few people or **touch a few nerves**.
(= I will upset a few people or annoy someone in a few ways.
$\neq$ I will cause the same irritation multiple times.)
(http://bit.ly/2y56ibi)
c. Tom won't **pull family strings** to get himself out of debt.
(The connections which Tom won't exploit are family ones.)
(http://bit.ly/2y4tKFg)

This syntactic flexibility exacerbates the tension between the divided and unitary nature of idioms, since it sharpens the feeling that they are made up of words which enter the syntax individually, and yet they still retain their idiosyncratic, and collocationally restricted, semantics.

[4]Corpus of Global Web-based English (Davies 2013).

In this paper, I address one common theme in recent work on idioms, which seeks to resolve this tension by coming down on one side of it, treating idioms as truly phrasal, being made up of special versions of the words they contain, and having no unitary identity. I demonstrate that there are a number of problems with this approach, both theoretical and empirical, and argue that it cannot be sustained. Instead, I advocate a change to the LFG architecture, increasing the power of c-structure using a Tree Adjoining Grammar, which enables us to adopt a version of Abeillé's (1988, 1995) approach to idioms.

2 The lexical ambiguity approach

One common approach to idioms in lexicalist theories is what I propose to call the *lexical ambiguity* approach (LA). In such an approach, idioms are treated as made up of special versions of the words they contain, which combine to give the appropriate meaning for the whole expression. For example, words like *pull* and *strings* become ambiguous, meaning either **pull**′ and **strings**′ in the literal phrase *pull strings*, or **exploit**′ and **connections**′ in the idiom. This kind of approach resolves the tension in favour of treating idioms as phrase-like: they are no longer seen as single lexical items, but rather collections of separate lexical items which conspire to create the overall meaning.

Examples abound in the literature: Sailer (2000) in HPSG, Kay et al. (2015) in SBCG, Lichte & Kallmeyer (2016) in LTAG, and Arnold (2015) in LFG, for instance. Not all of what I discuss in this section is relevant to all of these approaches, and so it should not be read as a direct rebuttal of the explicit claims they make, but rather as an objection to the overall philosophy which they share.

2.1 Strengths of LA

Before my objections, however, let us consider the strengths of such an approach. LA is particularly well suited to explaining so-called decomposable idioms (what Nunberg et al. 1994 call *idiomatically combining expressions*), where the meaning of the whole can be distributed across the parts. Examples of this include *pull strings*, as mentioned, where *pull* $\approx$ **exploit**′ and *strings* $\approx$ **connections**′, as well as *spill the beans*, where *spill* might be identified with **divulge**′ and *beans* with **secrets**′. Other examples are given in (7) and (8).

Since the idiom meaning is assigned to the individual words in LA, this immediately explains the fact that parts of these idioms can be separated by syntactic operations, as in (7), or that they are open to internal modification and/or quantification, as in (8), because they are simply ordinary words, and can undergo all the processes ordinary words can.

(7) a. Cantor duly ran to teacher and **the beans got spilled**.
(http://bit.ly/2k6741B)

b. Who's at the centre of the **strings that were quietly pulled**?
(http://imdb.to/2y87Ilf)
c. Wait until next month, and we'll see **which bandwagon he jumps on**.
(http://bit.ly/2k25tcR)

(8) a. Yet from Carnap's point of view, Quine's argument in §5 is **beside the main point**, which is whether the notion of a semantical rule is a purely logical one.
(http://bit.ly/2k3EL3N)
b. Sorting out that little mess required **pulling several strings**.
(http://bit.ly/2k1aQZQ)
c. Brace yourselves as Claudine **spills some untold beans**.
(http://bit.ly/2k1spZY)

2.2 Problems with LA

Despite this obvious advantage, by essentially ignoring the tension which MWEs pose, and coming down entirely on one side of it, LA leaves a number of questions to be answered, some of which, I suggest, cannot be answered satisfactorily.

2.2.1 Selectional restrictions

If *pull* can mean **exploit′** and *strings* can mean **connections′**, we clearly have to prevent them occurring apart from one another:

(9) a. #You shouldn't pull his good nature.
($\neq$ . . . exploit his good nature.)
b. #Peter was impressed by Claudia's many strings.
($\neq$ . . . Claudia's many connections.)

The most straightforward way to do this is to treat idiom formation as a kind of limit case of selectional restriction, and make those restrictions mutual:[5]

(10) *pull* V $(\uparrow \text{PRED}) = \text{`pull}_{id}\text{'}$
$(\uparrow \text{OBJ PRED FN}) =_c \text{strings}_{id}$

(11) *strings* N $(\uparrow \text{PRED}) = \text{`strings}_{id}\text{'}$
$((\text{OBJ} \uparrow) \text{PRED FN}) =_c \text{pull}_{id}$

All lexical theories will have some way of identifying individual lexemes; in this case, we use the PRED feature, but other frameworks have similar options (the *lex-id* or LID features in HPSG/SBCG, for example).

[5] Gazdar et al. (1985) propose to instead enforce these restrictions in the semantics, by making use of partial functions (so that idiomatic functions are undefined unless they are passed their idiomatic complements as arguments). Unfortunately this elegant solution runs into insoluble problems when it comes to relative clauses, and will necessarily over- or undergenerate. See Pulman (1993: 50f.) for details.

As written, however, the restrictions in (10) and (11) are too strong, since this idiom can passivise, and so it is not true that *strings* must be the *object* of *pull*:

(12) Strings were pulled for you, my dear. Did you really think the Philharmonic would take on a beginner like you?
(http://bit.ly/2y8gIqF)

One way to loosen the restriction is by moving the constraint from f-structure to s-structure (or, equivalently, to a-structure, if one prefers a different architecture):

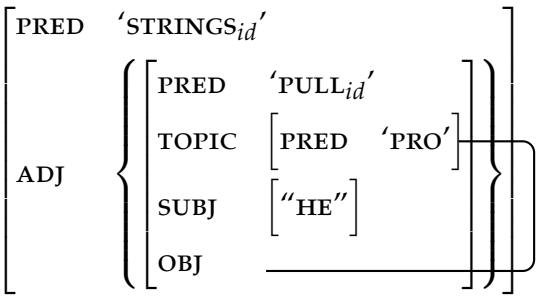
(13) *pull* V $(\uparrow \text{PRED}) = \text{`pull}_{id}\text{'}$
$((\uparrow_{\sigma} \text{ARG}_2)_{\sigma^{-1}} \text{ PRED FN}) =_c \text{strings}_{id}$

(14) *strings* N $(\uparrow \text{PRED}) = \text{`strings}_{id}\text{'}$
$((\text{ARG}_2 \uparrow_{\sigma})_{\sigma^{-1}} \text{ PRED FN}) =_c \text{pull}_{id}$

Instead of requiring that idiomatic *strings* be the object of idiomatic *pull*, we require that it be its second/internal argument.

But this doesn't help with relative clauses:

(15) *The strings (that) he pulled...*



In the standard analysis of restrictive relative clauses such as this, the word *strings* bears no direct relation to *pull*: it is not its object nor its ARG_2 – the anaphoric element is instead – so (15) shouldn't be licensed.[6] Falk (2010) sees this as evidence for an 'unmediated' analysis of relative clauses, where we abandon the anaphoric element which mediates between the clauses in favour of a direct relationship between the predicate of the relative clause and the head noun. If we stick with the 'mediated' version, however, we cannot explain the distribution of some idioms, at least not without introducing *ad hoc* disjunctive specifications of the relationship between their parts.

[6]Miriam Butt (p.c.) suggests that a properly articulated argument structure would solve this problem, by allowing a single argument (say, the internal argument of *pull*) to be multiply realised (as both the head noun *strings* and the relative pronoun, either overtly or merely functionally), but I do not see how this is intended to be cashed out formally. Firstly, all versions of a-structure appeal to some variety of (Lexical) Mapping Theory to link arguments to GFs, and (L)MT assigns only a single GF to each argument. Secondly, if a-structure is positioned in the correspondence architecture before c-structure, as it is by Butt et al. (1997), it cannot permit a single argument to map to two separate realisations, because the relation α from a-structure to c-structure is a function.

2.2.2 Non-decomposable idioms

Although LA looks strong when it comes to decomposable idioms, it is not so clear how such an approach should handle non-decomposable ones, like *kick the bucket*, *blow off steam*, *shoot the breeze*, etc. (what Nunberg et al. 1994 call *idiomatic phrases*), where there is no obvious way of breaking down the meaning of the idiom such that its parts correspond to the words that make up the expression.

Assuming a resource-sensitive semantics, as is common practice in LFG (e.g. Asudeh 2012), we are forced to say that only one of the words in the expression bears the meaning, and the rest are semantically inert. For example, perhaps there is a $kick_{id}$ which means **die′**, and selects for special semantically inert forms the_{id} and $bucket_{id}$.

But the choice of where to locate the meaning is ultimately arbitrary. While it might intuitively seem to make sense to assign it to the verb, since it is the head of the VP which makes up the expression, formally it makes no difference: we may as well have $bucket_{id}$ meaning **die′**, or even the_{id}, provided they select for the other inert forms and then pass their meaning up to the whole VP.[7]

In addition, we also now face a huge proliferation of semantically inert forms throughout the lexicon.[8] What is worse, each of these must be restricted so that it does not appear outside of the idiomatic context. For example, say that we want a semantically vacuous *the* to use in *kick the bucket*. To prevent it appearing spuriously elsewhere (e.g. **The Kim sneezed*), it must, as discussed in Section 2.2.1, impose restrictions on what it can occur with. But if it says that it must be the specifier of idiomatic *bucket* (or the specifier of the object DP of idiomatic *kick*), then it cannot appear in other idioms which involve the word *the*, such as *shoot the breeze*. The *the* in *shoot the breeze* must be different from the one which appears in *kick the bucket*, since it imposes different selectional restrictions. But this means that we need as many *the*s as there are expressions which include it. Instead of

[7] One possible argument for the head-based analysis is that VP idioms systematically retain the aspect of the literal use of the verb (McGinnis 2002):

(i) a. Hermione was dying for weeks.
b. #Hermione was kicking the bucket for weeks.
[*Kick* is punctual: the only idiomatic reading of (ib) would be that Hermione died repeatedly, whereas (ia) can describe a single, protracted dying event.]

(ii) a. Harry ate his vitamins {in two seconds flat/*for five minutes}.
b. Harry ate his words {in two seconds flat/*for five minutes}.

However, I think this is part of the much larger issue of how much the literal meaning of an idiom persists in its figurative use. Cf. also Ernst (1981) and his discussion of examples like *pulling [Malvolio's] cross-gartered leg*, where a modifier appropriate to the literal but not figurative meaning is used.

[8] Arnold (2015) suggests using manager resources to eliminate the need for semantically inert forms, for example by having a special idiomatic *kick* which simply throws away the meaning of *the bucket*. Arnold himself notes a number of shortcomings of this approach, since it makes the wrong predictions about modification and cannot easily explain variation in syntactic flexibility. See the Appendix for more details.

having to expand the lexicon by as many entries as there are idioms, we have to expand it by as many entries as there are *words in idioms*. This seems suspect from an analytical point of view, and undoes much of the elegance of LA.

2.2.3 Processing

Swinney & Cutler (1979) showed that idioms are processed in the same way as regular compositional expressions; i.e. there is no special 'idiom mode' of comprehension which our minds switch into when confronted with idiomatic material. At the same time, these authors and others have found that idiomatic meanings are processed faster and in preference to literal ones (Estill & Kemper 1982; Gibbs 1986; Cronk 1992; i.a.). These findings are challenging for LA, for, in the LA approach, semantic composition of idioms is exactly the same as of literal expressions. There is no reason to think idioms should be processed any faster; if anything, we might expect them to be slower, since they involve ambiguity by definition.

3 Extending the power of c-structure

If we do not represent idioms as units, it is difficult to ensure that they always appear in the correct collocational environments. It is also difficult to handle instances where the semantics is itself seemingly unitary. Finally, it is a mystery why idioms should be processed faster than literal expressions, when formally they are identical. Rather, all of these findings plead for what I would imagine seems intuitively appealing anyway: that idioms are inserted *en bloc*, being stored in the lexicon as units, albeit with some internal structure.

The major obstacle to this in LFG is that the non-local character of idioms is ill-suited to the strict locality of context-free grammar rules. What I propose, therefore, is to add power to the c-structure component so that such non-local relations *are* statable. Tree Adjoining Grammar (TAG: Joshi et al. 1975; Abeillé 1988), with its 'extended domain of locality', offers such a possibility.

3.1 LTAG

In this subsection, I introduce very briefly the key features of TAG. For a fuller introduction, see Abeillé & Rambow (2000).

Whereas a context-free grammar is a string-rewriting system, a TAG is a tree-rewriting system. This means that, in a TAG, trees, not words, are the elementary components of the grammar. 'TAG' is a broad term for a mathematical formalism, just as 'context-free grammar' is. Lexicalised TAG (LTAG) is the linguistically relevant subtype, where each tree must be 'anchored' by at least one word form (Schabes et al. 1988).

A TAG consists of a set of *elementary trees* and the two operations of *substitution* and *adjunction* for combining them. In the next two parts, I discuss these two components in turn.

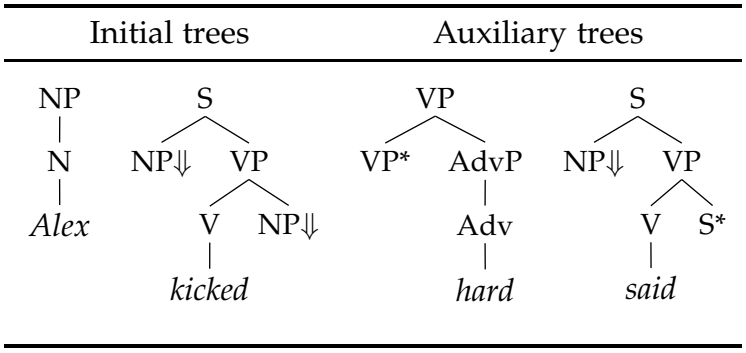


Table 1: Some elementary trees

3.1.1 Elementary trees

Elementary trees come in two types: *initial* and *auxiliary* (Table 1). An initial tree is a tree where all of the frontier nodes are either terminals or else non-terminals marked as *substitution sites* by a down arrow (⇓).[9] Substitution sites correspond to the arguments of a predicate.

An auxiliary tree is an elementary tree in which one of the frontier nodes is specified as the *foot* node, and marked with an asterisk (*). This node must be labelled with the same symbol as the root node of the auxiliary tree.

Predicates are associated with *tree families*, sets of trees which represent their potential syntactic realisations. For example, Figure 1 shows part of the tree family for a transitive verb, including active and passive voice versions, relative clauses headed by the subject or object, and *wh*-questions where the subject or object is fronted. Such tree families are shared by all verbs of a particular class, and so we omit the specific head verb and mark the node where it appears with a lozenge (◊). Nodes marked with brackets are really abbreviations for pairs of trees, one where the subtree rooted in the bracketed node appears and one where it is absent.

One thing to note about TAG elementary trees is that because we are no longer restricted to the strict locality of context-free rules, *viz.* a node and its daughters, we obtain what is called an *extended domain of locality*: what counts as local, i.e. what can appear in a single object in the grammar, has expanded. Subject-verb agreement, for example, no longer needs to be mediated via features passed up to the VP (so that in reality we have subject-VP agreement), since the subject and the verb now both appear in the same elementary structure, and so dependencies between them can be directly encoded.

Abeillé (1988, 1995) has observed that such an extended domain of locality offers a particularly natural way of describing idioms. We simply allow elementary trees to be 'multiply anchored', so that more than one frontier node is filled by a terminal node, as in (16):

[9] I depart from standard TAG practice of using ↓ so as to avoid confusion with the LFG metavariable.

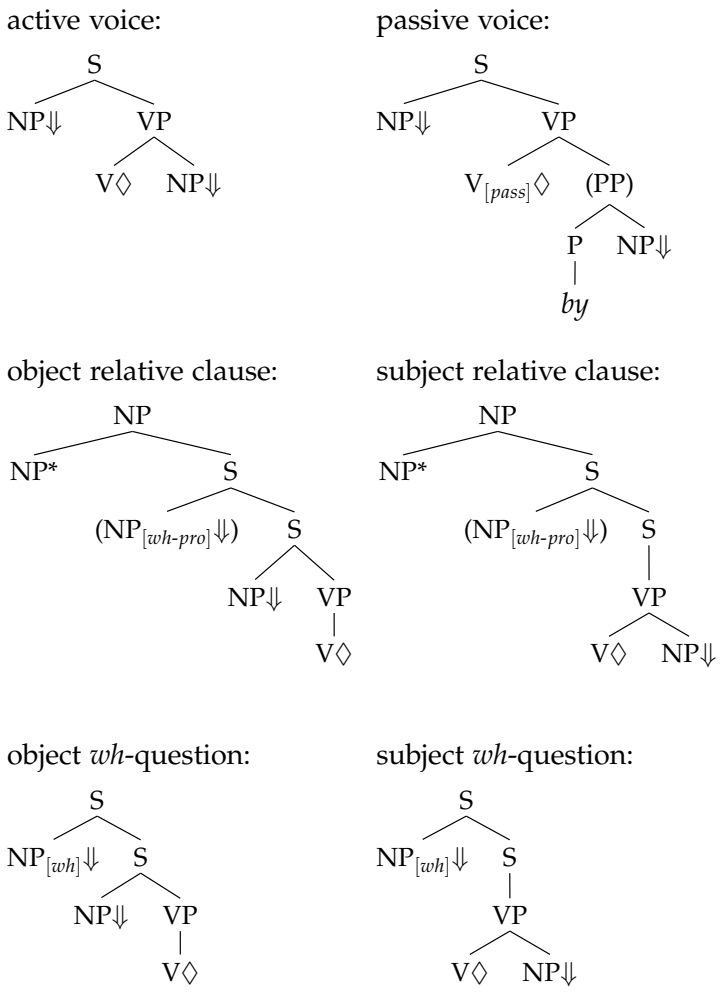
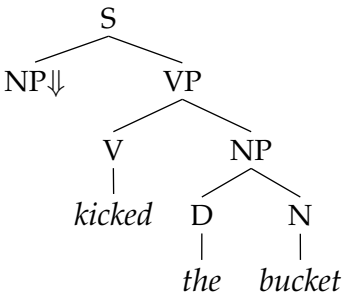


Figure 1: (Partial) tree family for a transitive verb

(16)

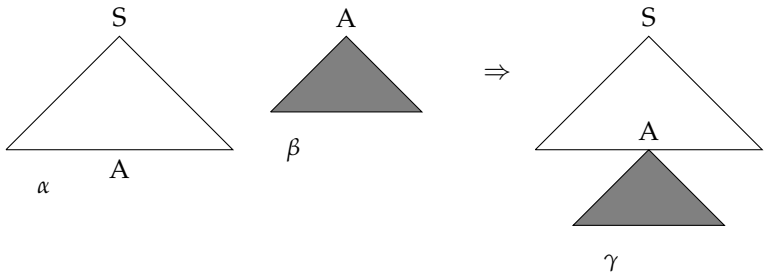


In this way, single lexical entries can contain more than one word form.

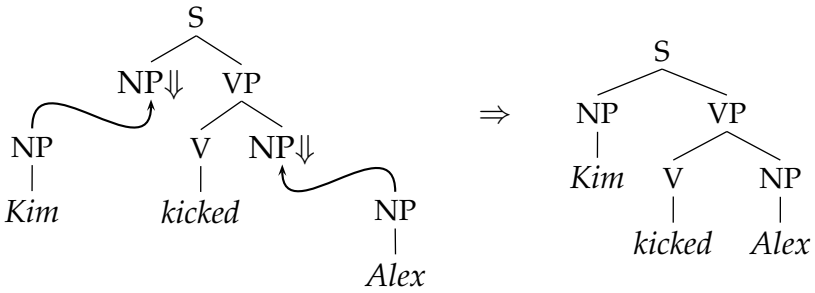
3.1.2 Substitution and adjunction

TAG provides two operations for manipulating elementary trees. Substitution is simply the replacement of an appropriate substitution site by an elementary or derived tree whose root node matches the symbol at the substitution site. This is illustrated schematically in (17), and with a linguistic example in (18):

(17)

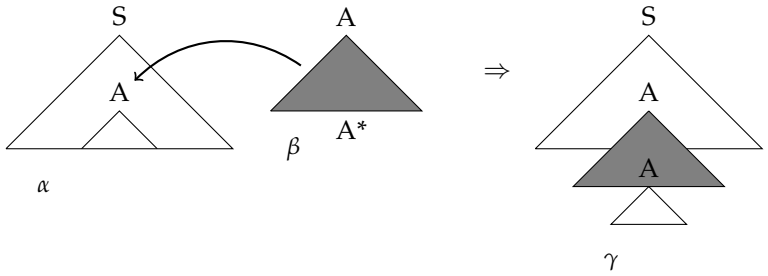


(18)



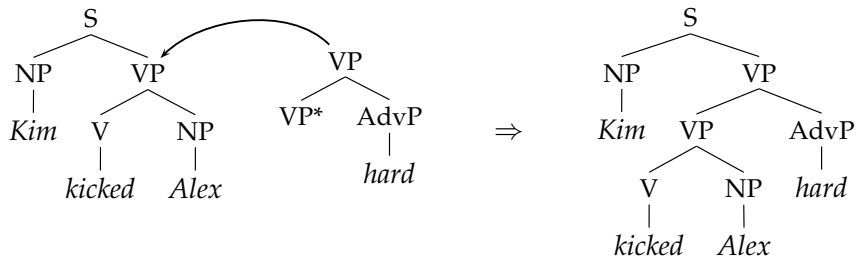
Adjunction is shown schematically in (19):

(19)



To adjoin β into α, we remove the subtree rooted in A from α, replace it with β, and then attach the subtree which we removed to the foot node of β. This produces a larger tree, γ. In effect, the auxiliary tree is inserted at the adjunction site and 'expands' the node around itself. This is commonly used to model the behaviour of modifiers, which adjoin to the node they modify:

(20)



In addition to modifiers, this is also how LTAG accounts for unbounded dependencies. As we saw in Figure 1, *wh*-dependencies are encoded locally in the elementary trees for a verb. Sentential embedding verbs are modelled as auxiliary trees in TAG, and this means that they can be adjoined to the interior nodes in such *wh*-extraction trees. The result of this is that such trees can grow from the inside out, meaning that the *wh*-element and the verb can end up arbitrarily far apart, even though they are represented locally in the lexicon. We will see an example of this in §3.3. This ability to represent relationships locally, even though the parts involved may ultimately appear separated, is one of the key advantages of the TAG approach to idioms.

3.2 TAG-LFG

Before we see exactly how this approach deals with the idiom facts identified above, let us see how a TAG can be incorporated into the LFG architecture.

In standard LFG, a lexical entry is a triple (W, C, F), where W is a word form, i.e. the terminal node in the phrase-structure tree, C is a c-structure category, i.e. the pre-terminal node, and F is a functional description, i.e. a set of expressions spelling out additional linguistic information via the correspondence architecture. In TAG-LFG, a lexical entry is instead a triple $(\langle W \rangle, T, F)$, consisting of a list of word forms, a tree, provided by some metagrammar, and a functional description.[10] An example is given in Figure 2.

The word forms occur as a list because the trees for MWEs will be multiply anchored. For regular lexical entries, this list will be a singleton. The word form list is separated from the tree because the two elements of the entry come from different parts of the grammar: the word forms come from the morphology, and the trees from the 'syntactic lexicon' where tree schemata are stored. The lexical anchors, marked with $\Diamond$s, are numbered according to the list index of the word form that is to be inserted there.

The functional description remains the same, although it now allows reference to more remote nodes, and so instead of $\uparrow$ or $\downarrow$ I use node labels as a shorthand for

[10] A metagrammar (Candito 1996; Crabbé et al. 2013) is a formal system for describing generalisations both across and within grammars. For example, the fact that all transitive verbs will have tree families that contain many of the same trees can be captured by shared inheritance in a type hierarchy of the familiar kind.

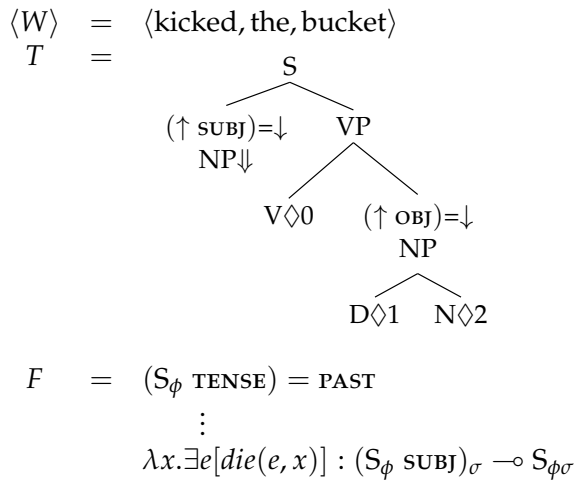


Figure 2: TAG-LFG lexical entry for *kicked the bucket*

the nodes in question.[11,12]

Crucially, by complexifying c-structure in this way, we do not change the overall computational complexity of LFG. TAGs are mildly context sensitive, which makes them more powerful than context-free grammars, but it has been shown that LFGs in general are already more than mildly context sensitive, owing to the power of f-structure (Berwick 1982).[13]

3.3 Accounting for the idiom facts

In this subsection, we put to use the formalism just introduced, and demonstrate how the TAG-based approach to idioms is implemented.

Differences in syntactic flexibility can be represented in the different tree families which the idioms are related to. For instance, *kick the bucket* would not include any trees in its tree family beyond the simple active voice. If we think of tree families as types in a hierarchy, then *kick the bucket* only inherits from the active voice tree type. This level of granularity in types is needed because other words and idioms inherit different combinations of the basic tree schemata. Idioms like *spill the beans*, for example, are readily passivisable, but distinctly odd in questions or

[11] In reality, the node labels are not the nodes: they are the output of a node labelling function λ applied to each node (Kaplan 1995).

[12] In addition, since the functional descriptions must be resolved once all adjunctions and substitutions have taken place, we cannot see the trees as being manipulated derivationally by the operations of substitution and adjunction. Rather, we view the trees as *tree descriptions* (Vijay-Shanker 1992), which, together with the combining operations, license a set of derived trees which make up the grammatical sentences of the language in question. Cf. the notion of context-free grammar rules as 'node admissibility conditions' (McCawley 1968) already taken as standard in LFG.

[13] TAG-LFG is analogous to a feature-based TAG where recursive feature structures are permitted, which sets it apart from standard FTAG, e.g. that advocated by Vijay-Shanker & Joshi (1988), where such recursion is banned precisely in order to prevent FTAG from becoming intractable like LFG.

relative clauses:

(21) a. Jimmy Schementi spilled the beans back in August.
(http://bit.ly/2xKbtuh)
b. The beans were spilled back in August.
c. #The beans that Jimmy spilled back in August have caused problems for us.
d. #Which beans did Jimmy spill back in August?

Then there are verbs like *cost* which do not passivise, but can have their objects relativised on. (Object questions here are likewise dubious when in the form of a *which*-phrase.)

(22) a. The horses cost two thousand pounds.
b. *Two thousand pounds was/were cost (by the horses).
c. Emma [. . .] indignantly pledges to repay him the two thousand pounds that the horses cost.
(http://bit.ly/2xITrsb)
d. {What/#Which two thousand pounds} did the horses cost?

And of course there are regular transitive verbs and fully flexible idioms like *pull strings*, where all four possibilities are attested:

(23) a. We ate the rice and beans with delight.
b. The rice and beans were eaten with delight.
c. Our only reward then was rice and beans which we ate with delight.
(http://bit.ly/2yGktQ2)
d. What/Which rice and beans did you eat?

(24) a. We are pulling strings to find them jobs.
(http://bit.ly/2xIxSYO)
b. Strings were pulled in the US and Mexico to ensure this happened.
(http://bit.ly/2xJcORO)
c. Thanks to some strings we pulled with our partners, we're giving away 1000 gifts an hour.
(http://bit.ly/2xIarP7)
d. Which strings did he pull to visit Dreamworks?!
(http://bit.ly/2xIjKyt)

An articulated inheritance hierarchy of tree schemata can capture these different types of predicate, and so we can use the same tools to describe the different types of idioms. This is of course descriptive rather than explanatory, and it is possible there are semantic/conceptual motivations behind some of the restrictions, but I do not address this question here.

The internal modifiability of decomposable idioms can be achieved by simply associating more than one meaning constructor with their lexical entries, account-

ing for their internal modifiability. Figure 3 gives an entry for active voice *pulled strings*, including meaning constructors corresponding to the verb and its argument.

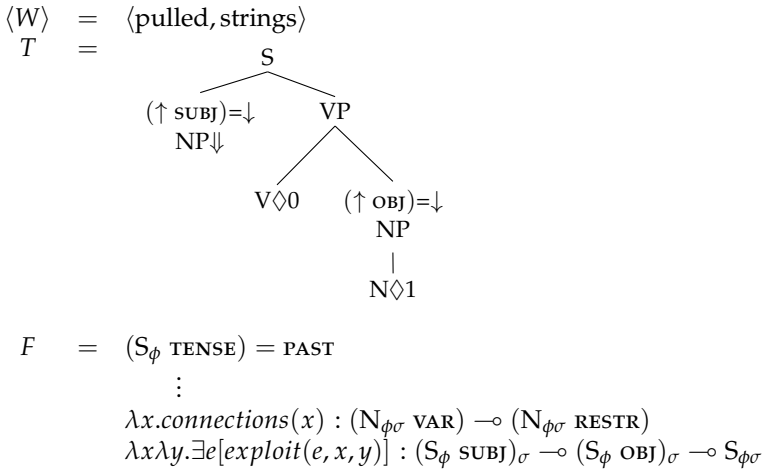


Figure 3: TAG-LFG lexical entry for *pulled strings*

The long-distance dependency facts fall out straightforwardly from the standard TAG approach. As noted, the presence of adjunction as a combining operation means that long-distance dependencies can be encoded locally in the lexicon. This is as true for sub-parts of idioms as it is for *wh*-dependencies and the like. Figure 4 gives an example for the relative clause-containing NP *strings Kim claimed Sandy pulled*. We start with the relative clause elementary tree for *strings... pulled*, and through adjunction of the embedding verb *claimed*, the parts of the idiom are separated. This could of course be repeated indefinitely.

Finally, the TAG-based approach also aligns with the psycholinguistic findings, as noted by Abeillé (1995). A parse involving an idiom will involve fewer elementary trees: in *Alex kicked the bucket*, for example, it will only involve the trees for *Alex* and for *kicked the bucket*, instead of the four trees *Alex*, *kicked*, *the*, and *bucket*. On the assumption that a simpler parse is faster, this makes sense of the increased processing speed found with idioms.

4 Conclusion

Idioms and other MWEs exhibit a tension between their phrase-like and word-like tendencies. Current work in lexicalist and other formal frameworks seems to be in favour of ignoring this tension and coming down entirely on one side of it, by treating idioms as phrases made up of special homophonous versions of the words they contain. I advocate an alternative, based largely on Abeillé's (1995) earlier work on idioms in French.

Part of the problem is that a context-free c-structure has too narrow a definition of locality to describe the relationship between the parts of idioms directly, and

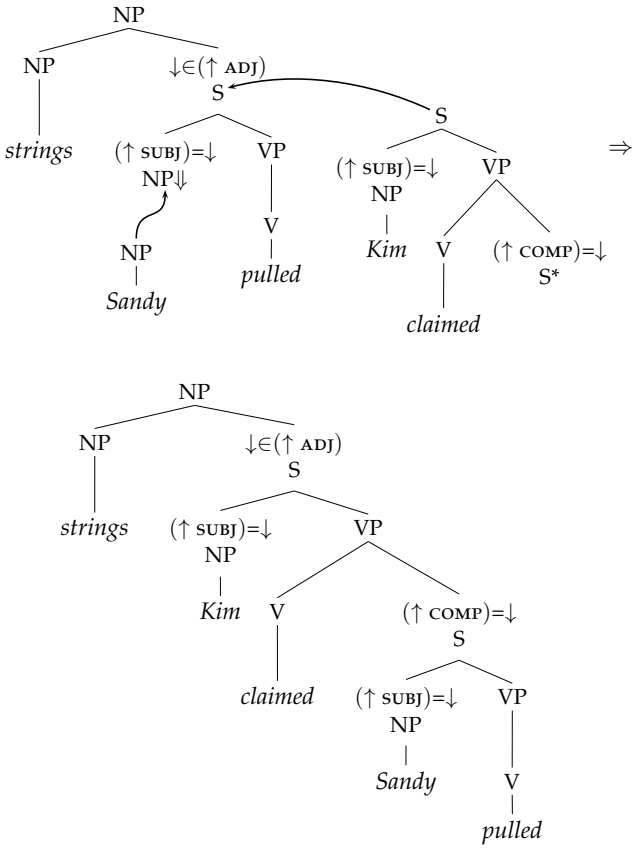


Figure 4: Derivation of *strings Kim claimed Sandy pulled*

such a relationship cannot easily be modelled at other levels of description either. By using a TAG instead, we can take advantage of the extended domain of locality this formalism offers, and also the operation of adjunction it provides: this makes it possible to describe the relationships between idiom parts locally, even if they are ultimately realised arbitrarily far apart. This allows us to describe each idiom in one place, in the lexicon, while still recognising its multiword status by associating it with more than one word form. Further work is needed to investigate the best way to develop a metagrammar which incorporates LFG annotations. It is possible that standard LFG c-structure rules might form the basis of such a metagrammar, thus offering a pleasing way to incorporate existing analyses into the new framework.

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Appendix

Arnold's (2015) approach to idiom composition uses manager resources to eliminate the need for many semantically inert forms, although it still requires ambiguity of the head word. For instance, idiomatic *kick* has the meaning constructor in (25):

(25) $\lambda x \lambda Q.\exists e[die(e,x)] : (\uparrow \text{SUBJ})_\sigma \multimap [[(\uparrow \text{OBJ})_\sigma \multimap \uparrow_\sigma] \multimap \uparrow_\sigma] \multimap \uparrow_\sigma$

This consumes the meaning constructor for literal *the bucket*, which has the form given in (26), and discards the meaning.

(26) $\lambda P.the(b, bucket(b), P(b)) : \forall H[\uparrow_\sigma \multimap H] \multimap H$

In fact, it is possible to implement this at the phrasal level and in this way avoid having any lexical ambiguity (cf. Asudeh et al.'s 2013 approach to constructions). We associate a disjunction of idiom templates with the VP rule, including, e.g. KICK-THE-BUCKET:

(27) VP $\rightarrow$ V′
($\{$@KICK-THE-BUCKET$|\ldots\}$)

(28) KICK-THE-BUCKET :=
($\uparrow$ PRED FN) $=_c$ kick
($\uparrow$ OBJ PRED FN) $=_c$ bucket
($\uparrow$ OBJ SPEC PRED FN) $=_c$ the

$\lambda P \lambda y.\exists e[die(e,y)] : [(\uparrow \text{SUBJ})_\sigma \multimap \uparrow_\sigma] \multimap (\uparrow \text{SUBJ})_\sigma \multimap \uparrow_\sigma$

This consumes the meaning constructor for *kick the bucket* once it has been composed, and then returns the idiom meaning as a dependency on the subject.

Such an approach also allows an extension to decomposable idioms:

(29) SPILL-THE-BEANS :=
$(\uparrow \text{PRED FN}) =_c \text{spill}$
$((\uparrow_\sigma \text{ARG}_2)_{\sigma^{-1}} \text{PRED FN}) =_c \text{bean}$

$\lambda P \lambda x \lambda y. \exists e[divulge(e, x, y)] :$
$[(\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{ARG}_2) \multimap \uparrow_\sigma]$
$(\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{ARG}_2) \multimap \uparrow_\sigma$

$\lambda Q \lambda v. secret(v) : [(\uparrow_\sigma \text{ARG}_2 \text{ VAR}) \multimap (\uparrow_\sigma \text{ARG}_2 \text{ RESTR})] \multimap$
$(\uparrow_\sigma \text{ARG}_2 \text{ VAR}) \multimap (\uparrow_\sigma \text{ARG}_2 \text{ RESTR})$

However, this approach ultimately seems untenable, since it makes entirely the wrong predictions about modification (a point which Arnold 2015 notes): since the manager throws away the object's meaning, it can do this just as well before or after that meaning is modified, as it will correspond to the same Glue expression in either case. This predicts two things: (a) that modification should be possible in cases like *kick the bucket*, but simply have no effect on the meaning, and (b) that modification should be ambiguous in cases like *spill the beans*, either affecting the meaning or not, depending on the order of composition. Neither of these predictions is borne out: internal modification of *bucket* is not innocuous, but results in a loss of idiomaticity, as in (30), and interpreting internal modification in cases like (6), above, is not optional.

(30) #Sandy kicked the red/painful/sudden/… bucket.

A technical get out is available at least in the *kick the bucket* cases. As Arnold (2015) suggests, we can include the following constraint in the idiomatic head (or, equally, the template):

(31) $\neg(\uparrow \text{OBJ ADJ})_{\sigma_{\langle et,et \rangle}}$

This prevents the object having normal $\langle et, et \rangle$ modifiers, but allows expressive/ emotive modifiers, as in (32), which are presumed to have a different semantic type (Potts 2005):

(32) Alex kicked the proverbial/bloody bucket.

This is purely stipulative, however, and, what is more, it doesn't help in any way with the internally modifiable cases, where such modifiers explicitly *are* allowed. The issue there seems to be much more fundamental, since there is no straightforward way to enforce a particular ordering on a Glue derivation, which is ultimately what is required.

Glue Semantics and Locality

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Abstract

In this paper I explore the idea that Glue Semantics enriched with additional unary connectives could provide a natural account of some (positive) locality conditions on binding. I argue that the additional connectives can be independently, semantically motivated.

1 Introduction

One of the major advantages of the LFG architecture when it comes to binding theory, which is exploited in classic references such as Dalrymple (1993), is that binding constraints for pronouns can be lexically specified by the pronouns themselves. The fine degree of control afforded by this seems to be necessary to account for the variation in binding possibilities even within individual languages. But what form should those constraints take? Standardly, they are stated at the level of f-structure, possibly including reflexes in f-structure of c-structure or s-structure relations. In this paper I will suggest that some binding constraints[1] can profitably be stated in the lexical-*semantic* specifications of pronouns in Glue Semantics, in the sense that the linear logic formulae within meaning constructors contributed by lexical items make derivations of unavailable readings impossible. The advantage of this approach is that, under it, certain binding constraints are seen to be at least partly semantically motivated.

The paper is structured as follows. In Section 2 I revisit some very basic binding facts and a mainstream existing account of them in LFG. In Section 3 I define an extension to a fragment of linear logic standardly assumed for Glue Semantics, and show how it can be used to account for the data described in Section 2. In Section 4 I extend the fragment further to account for data that seem to more clearly indicate semantic constraints on binding. Section 5 concludes.

2 Obligatorily local binding in English

As an example of the binding constraints on the English third-person reflexive pronoun *herself*, we note that (1) has an interpretation paraphraseable as shown in (1-a), but not as shown in (1-b).

(1) Patricia thinks that Martha trusts herself.

a. $\Rightarrow$ Patricia thinks that Martha trusts Martha.

b. $\not\Rightarrow$ Patricia thinks that Martha trusts Patricia.

[†]My thanks to rest of the SynSem group at the University of Oslo and to the audience at the LFG17 Conference for comments, questions and suggestions.

[1]I will focus on *positive* binding constraints.

Broadly speaking, syntactic frameworks are united on the explanation for why *herself* can't refer back to *Patricia* in (1): the reflexive pronoun must find its antecedent within some domain of locality that it's contained in, and *Patricia* is outside that domain. In LFG, it is usual to define the relevant domain of locality at f-structure, and in this particular case the domain is the minimal SUBJ-containing f-structure (the 'minimal complete nucleus'). This idea can be encoded formally by giving *herself* the (partial) lexical entry shown in (2), adapted[2] from Dalrymple (1993) and Dalrymple et al. (1999), where the final line gives the lexical semantics of the pronoun in Glue Semantics (henceforth Glue).

(2) *herself* NP

$(\uparrow \text{PRED}) = \text{'herself'}$

$\%A = ((\quad \text{GF}^* \quad \text{GF} \uparrow) \text{GF})$
$\quad\quad\quad \neg(\rightarrow \text{SUBJ})$

$\lambda x(x, x) : \%A \multimap (\%A \otimes \uparrow)$

What is crucial to see is that, on this account, the locality condition on antecedence for the reflexive pronoun is enforced by the off-path constraint $\neg(\rightarrow \text{SUBJ})$, so in the f-structure for (1) shown in (3), $\%A$ can't resolve to g because the path $(f \text{ COMP OBJ})$ fails to satisfy the off-path constraint since $(f \text{ COMP})$ $(= h)$ has a subject.

(3)
$$f : \begin{bmatrix} \text{PRED} & \text{'think'} & \\ \text{SUBJ} & g : \begin{bmatrix} \text{PRED} & \text{'Patricia'} \end{bmatrix} & \\ \text{COMP} & h : \begin{bmatrix} \text{PRED} & \text{'trust'} & \\ \text{SUBJ} & i : \begin{bmatrix} \text{PRED} & \text{'Martha'} \end{bmatrix} & \\ \text{OBJ} & j : \begin{bmatrix} \text{PRED} & \text{'herself'} \end{bmatrix} & \end{bmatrix} & \end{bmatrix}$$

With respect to an example like (1), the contribution of the present paper is to eliminate the need for the off-path constraint in favour of an account that rules out the interpretation paraphrased in (1-b) at the level of meaning composition. In Glue, interpretations of constituents are paired with formulae of a fragment of linear logic, constraining their combinatory potential according to linear logic proof theory. This makes the linear logic fragment a **type logic** in the style of (type-logical) categorial grammar, which, in turn, opens up the possibility of using ideas and techniques from categorial grammar. In this paper, I will adapt the analysis of Morrill (1990) of the clause-boundedness of expressions like *herself* to Glue, in terms of an extra, semantically-motivated, connective in the fragment of lin-

[2]One major change is that I'm use a local name instead of the s-structure attribute ANTECEDENT, because I won't be assuming s-structures at all in this paper and instead will give Glue entries based on f-structure labels. This change should not be crucial for anything that follows.

	Elimination	Introduction
$\multimap$	$\dfrac{\begin{array}{c}\vdots\\ f : A \multimap B\end{array} \quad \begin{array}{c}\vdots\\ a : A\end{array}}{f(a) : B}\ \multimap_E$	$\dfrac{\begin{array}{c}[v : A]^n\\ \vdots\\ f : B\end{array}}{\lambda v.f : A \multimap B}\ \multimap_{I,n}$ Exactly one hypothesis discharged.
$\otimes$	$\dfrac{\begin{array}{c}\\ \vdots\\ x : A \otimes B\end{array} \quad \begin{array}{c}[a : A]^m\ [b : B]^n\\ \vdots\\ c : C\end{array}}{c[\pi_1(x)/a][\pi_2(x)/b] : C}\ \otimes_{E,m,n}$	$\dfrac{\begin{array}{c}\vdots\\ a : A\end{array} \quad \begin{array}{c}\vdots\\ b : B\end{array}}{(a, b) : A \otimes B}\ \otimes_I$
$\Box$	$\dfrac{\begin{array}{c}\vdots\\ f : \Box X\end{array}}{{}^{\vee}f : X}\ \Box_E$	$\dfrac{\begin{array}{c}\vdots\\ f : X\end{array}}{{}^{\wedge}f : \Box X}\ \Box_I$ Provided that every path back to an open premise includes an independent sub-proof of a $\Box$-formula.

Figure 1: Rules of inference

ear logic used. The result is that no proof that would generate the interpretation paraphrased in (1-b) is derivable.

3 Accounting for the locality effect in Glue

3.1 Logic

The rules of inference for the fragment of linear logic to be used in the Glue implementation are given in Figure 1 in tree-style natural deduction format, along with term assignments in the meaning representation language.[3] In a fuller fragment, some form of quantification would be added as well, but it will not be necessary for this paper.

The idea, following Montague (1973), is that the interpretation of an expression of the meaning language (here, intensional lambda calculus) is taken relative to a possible world $w \in W$, and that in this sense $^{\wedge}$ expresses intensionalization and $^{\vee}$

[3]Some people might find it more transparent to see the rules for $\Box$ stated in the sequent calculus:

$$\frac{\Gamma, f : A \vdash g : B}{\Gamma, h : \Box A \vdash g[{}^{\vee}h/f] : B}\ \Box_L \qquad \frac{\Box\Gamma \vdash f : A}{\Box\Gamma \vdash {}^{\wedge}f : \Box A}\ \Box_R$$

where Γ is a multiset of formulae and $\Box\Gamma$ is a multiset of $\Box$-formulae (formulae that have $\Box$ as their main connective).

expresses extensionalization, as defined in (4).

(4) For any term x and any type τ:

a. $s{\to}\tau$ is a type.

b. If $x :: \tau$ then ${}^{\wedge}x :: s{\to}\tau$, and $[\![{}^{\wedge}x]\!]^w =$ the function f such that for any $w' \in W$, $f(w') = [\![x]\!]^{w'}$.

c. If $x :: s{\to}\tau$ then ${}^{\vee}x :: \tau$, and $[\![{}^{\vee}x]\!]^w = [\![x]\!]^w(w)$.

The side condition on the $\Box$-introduction rule shown in Figure 1 is perhaps a little complicated, but for the cases to be discussed in this paper it can be adequately (over)simplified as 'Provided that every premise on which X depends is a $\Box$-formula'.[4] Together, these rules give $\Box$ the behaviour of necessity in S4 modal logic. It also has the same right (promotion) and left (dereliction) rules that ! has in standard linear logic—without the structural rules that ! has, of course (Moortgat, 2011, 136–138).

3.2 Implementation

Given that the semantic effect of $\Box$ is intensionalization, we expect that at the level of meaning composition in Glue, some expressions will be required to combine with $\Box$-formulae, for example, verbs that take a propositional complement like *think*. This is reflected in the skeleton lexicon for (1) shown in (5) which, for example, gives think the type $s{\to}((e{\times}(s{\to}t)){\to}t)$. (5) also shows how the labels are resolved when instantiated as shown in the f-structure (3).

(5)

Patricia	$\rightsquigarrow$	${}^{\wedge}\mathsf{p} : \Box\uparrow$
	$\Rightarrow$	${}^{\wedge}\mathsf{p} : \Box g$
thinks	$\rightsquigarrow$	$\mathsf{think} : \Box(((\uparrow \textsc{subj}) \otimes \Box(\uparrow \textsc{comp})) \multimap \uparrow)$
	$\Rightarrow$	$\mathsf{think} : \Box((g \otimes \Box h) \multimap f)$
Martha	$\rightsquigarrow$	${}^{\wedge}\mathsf{m} : \Box\uparrow$
	$\Rightarrow$	${}^{\wedge}\mathsf{m} : \Box i$
trusts	$\rightsquigarrow$	$\mathsf{trust} : \Box(((\uparrow \textsc{subj}) \otimes (\uparrow \textsc{obj})) \multimap \uparrow)$
	$\Rightarrow$	$\mathsf{trust} : \Box((i \otimes j) \multimap h)$

For *herself* I propose the lexical entry shown in (6). On the syntax side, the

[4] That the simplified condition is inadequate can be seen from the example deduction below, which is invalid according to the simplified condition but valid according to the official condition.

$$\dfrac{\dfrac{a \multimap \Box b \quad a}{\Box b} \multimap_E \quad \dfrac{\Box(\Box b \multimap c)}{\Box b \multimap c}\,\Box_E}{\dfrac{c}{\Box c}\,\Box_I} \multimap_E$$

Neither of the premises $a \multimap \Box b$ or a is a $\Box$-formula, but from them $\Box b$ is derived.

$$\dfrac{\dfrac{\dfrac{\mathsf{trust} : \Box((i \otimes j) \multimap h)}{{}^{\vee}\mathsf{trust} : (i \otimes j) \multimap h}\,\Box_E \qquad \dfrac{\dfrac{{}^{\wedge}\mathsf{m} : \Box i}{\mathsf{m} : i}\,\Box_E \quad [x : j]^1}{(\mathsf{m}, x) : i \otimes j}\,\otimes_I}{{}^{\vee}\mathsf{trust}(\mathsf{m}, x) : h}\,\multimap_E}{***}\,\Box_I$$

Figure 2: An unsuccessful attempted derivation of ${}^{\vee}\mathsf{think}(\mathsf{p}, {}^{\wedge}({}^{\vee}\mathsf{trust}(\mathsf{m}, \mathsf{p})))$

sole difference from 2 is the lack of an off-path constraint, as discussed above.

(6) *herself* NP

$$\%A = ((\text{GF}^{+} \uparrow)\ \text{GF})$$
$${}^{\wedge}(\lambda x(x, x)) : \Box(\%A \multimap (\%A \otimes \uparrow))$$

This time, the functional description alone does not rule out the resolution $\%A := g$, identifying the antecedent of *herself* with *Patricia*. However, that identification is ruled out at the level of Glue in that no linear logic proof of a type-t conclusion can be constructed given the premises that result from making that identification. Two failed attempts to derive such a conclusion are shown in Figures 2 and 3. The attempt shown in Figure 2 fails because $\Box$ introduction is not valid: the path back to the open premise $x : j$ does not contain an independent sub-proof of a $\Box$-formula. The attempt shown in 3 fails because $\otimes$ elimination is not valid, since j was not hypothesized ($\Box j$ was). Meanwhile, given the resolution $\%A := i$, whereby the antecedent of *herself* is identified with *Martha*, a type-t conclusion *is* derivable. This is shown in Figure 4.

4 Another case of locality corresponding to opacity

A crucial factor in the account presented in Section 3.2 is that $\Box$-introduction is required in order to derive any interpretation of (1-b), because semantically the verb *think* selects for a proposition (not just a truth value) as its complement, and so the interpretation of the embedded clause must be intensionalized, which corresponds to $\Box$-introduction on the linear logic side. On this account, then, the relevant domain of locality for *herself* is defined semantically, as a proposition. A proposition naturally corresponds syntactically to a minimal complete nucleus at f-structure, and so it is not surprising that the domain of locality should be definable in that way as well.

The account also relies on the lexical semantics given to the reflexive pronoun in Glue; if, instead of (6), it had the lexical semantics shown in 7, then it *would* be able to take an antecedent outside the minimal proposition containing it (the interested reader is invited to check that the strategy pursued in Figure 3 would succeed in this case). This point will become important when we consider other domains of locality.

(7) ${}^{\wedge}(\lambda x(x, {}^{\wedge}x)) : \Box(\%A \multimap (\%A \otimes \Box\uparrow))$

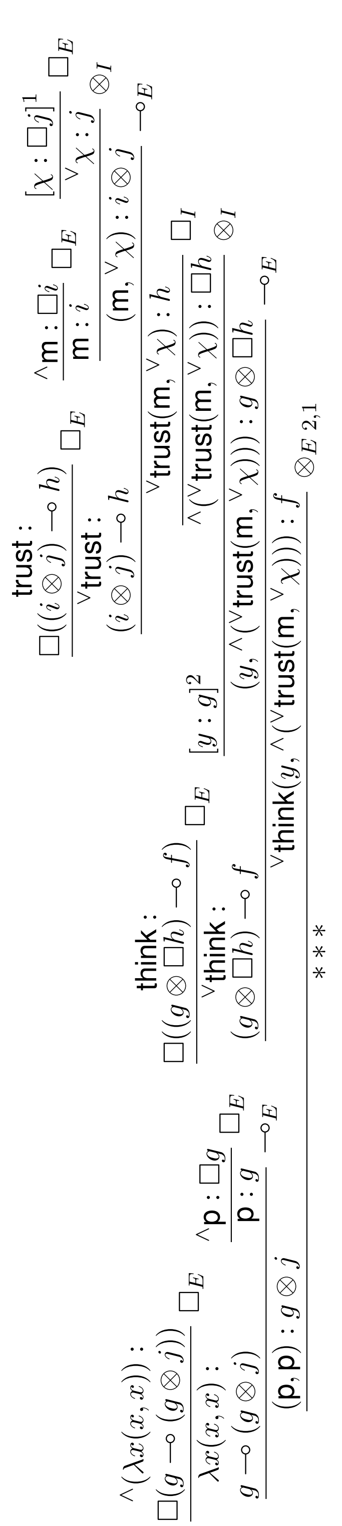

Figure 3: Another unsuccessful attempted derivation

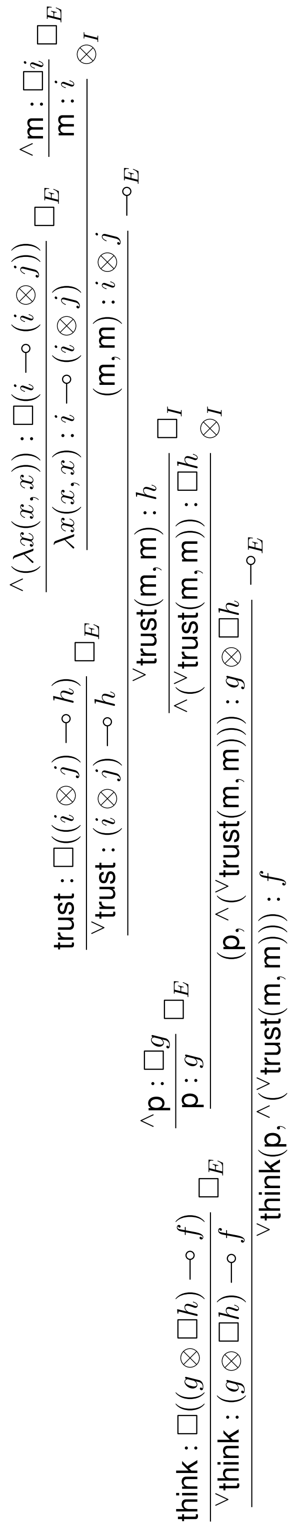

Figure 4: Successful derivation of $^{\vee}\mathsf{think}(\mathsf{p}, {}^{\wedge}({}^{\vee}\mathsf{trust}(\mathsf{m},\mathsf{m})))$

4.1 The Østfold Norwegian data

The correspondence between semantically and syntactically-definable domains when considering (1) invites the question: are there any examples of a semantically-definable domain that is relevant for binding constraints and that doesn't obviously correspond to a syntactically-definable domain? Stausland Johnsen (2009, 103) contends that the answer to this question is 'yes', specifically that

> In Østfold Norwegian, (ØN), the 3. person reflexive *seg* can be bound out of a tenseless complement clause.

Here, 'tenseless' is to be understood as a semantic property. In particular, Stausland Johnsen (2009) argues that for ØN the relevant constraint in this case is not finiteness, as is claimed by Hellan (1988). As evidence, he offers the contrasts shown in (8) and (9) below, for finite and non-finite complements respectively.

(8) a. *Reven$_i$ sa/trudde/frykta at noen jakta på seg$_i$
the fox said/believed/feared that someone chased on REFL
'The fox said/believed/feared that someone was hunting him.'

b. Reven$_i$ hørte/så/lukta at noen jakta på seg$_i$
the fox heard/saw/smelled that someone chased on REFL
'The fox heard/saw/smelled that someone was hunting him.'

(9) a. *Læreren$_i$ ba elevene stå bak seg$_i$
the teacher told the students stand.INF behind REFL
'The teacher told the students to stand behind him.'

b. Læreren$_i$ lot elevene stå bak seg$_i$
the teacher let the students stand.INF behind REFL
'The teacher allowed the students to stand behind him.'

The surface observation is that whether or not *seg* can be bound from outside its minimal clause depends on the verb embedding that clause, and not the finiteness or otherwise of that clause; contrary to Hellan's generalizations, in (8-b) *seg* can be bound from outside a finite clause containing it, and in (9-a) *seg* cannot be bound from outside a non-finite clause containing it. Furthermore, the generalization can be made that the verbs that allow a *seg* in their complement to be bound from outside it are exactly those verbs that select a semantically tenseless complement, in the sense that the complement cannot 'carry temporal reference non-overlapping with the matrix' (Wiklund, 2007, 39). See (Stausland Johnsen, 2009, §4.1) for the relevant evidence for finite complements and (Wiklund, 2007, Chapter 3) for non-finite complements.

4.2 Extending the logic

To handle the semantics of temporality, we will take interpretations of expressions relative to a time $t \in T$ in addition to a possible world as characterized in (4).

In this sense, $^{\blacktriangle}$ expresses intensionalization and $^{\blacktriangledown}$ expresses extensionalization, as defined in (10).

(10) For any term x and any type τ:

a. $i{\to}\tau$ is a type.

b. If $x :: \tau$ then $^{\blacktriangle}x :: i{\to}\tau$, and $[\![^{\blacktriangle}x]\!]^t =$ the function f such that for any $t' \in W$, $f(t') = [\![x]\!]^{t'}$.

c. If $x :: i{\to}\tau$ then $^{\blacktriangledown}x :: \tau$, and $[\![^{\blacktriangledown}x]\!]^t = [\![x]\!]^t(t)$.

In Glue, we add another unary connective to the linear logic fragment to handle int/extensionalization with respect to times: ■. The rules of inference for this connective are the same as those for □; they are shown (along with term assignments) in (11).

(11)

■-elimination	■-introduction
$\dfrac{\begin{array}{c}\vdots\\ f : \blacksquare X\end{array}}{^{\blacktriangledown}f : X}\ \blacksquare_E$	$\dfrac{\begin{array}{c}\vdots\\ f : X\end{array}}{^{\blacktriangle}f : \blacksquare X}\ \blacksquare_I$ Provided that every path back to an open premise includes an independent sub-proof of a ■-formula.

The crucial elements of the analysis of ØN *seg* to be presented here are that:

- Meaning constructors introducing temporal operators require arguments of type $i{\to}t$, which means that in Glue they require ■-formulae. This follows from the semantic definitions of the meaning language.
- Verbs like *å be* 'to request' project a temporal operator onto their complement clause, whereas verbs like *å se* 'to see' don't. This operationalizes the claim that *å be* requires its complement to be semantically tensed, while *å se* requires its complement to be semantically tenseless, and also implements (for *å be* and verbs like it) the suggestion from Stowell (1982) that some infinitive clauses are semantically marked for (something like) future tense.[5]
- The lexical semantics of *seg* is such that it can escape the embedding induced by □, but not that induced by ■. This is a stipulation.

The result is that the temporal operator projected by verbs like *å be* acts as a 'trap' that prevents *seg* from 'escaping' from the embedded clause.

[5]This future tense marking is not explicit in the notation given. We can make it explicit by defining the term tell like this:

$$\mathsf{tell} \stackrel{\text{def}}{=} {}^{\wedge\blacktriangle}(\lambda a.{}^{\blacktriangledown\vee}\mathsf{tell}_*(\pi_1(a), \pi_1(\pi_2(a)), {}^{\wedge}(\lambda x.\mathbf{F}({}^{\blacktriangledown\vee}\pi_2(\pi_2(a))(x)))))$$

Concretely, suppose that we have the f-structure shown in (12) and the skeleton lexical entries shown in (13)–(14), which are instantiated as shown based on the f-structure labels in (12).[6]

(12)
$$f:\begin{bmatrix}\textsc{pred} & \text{'tell'/'let'}\\ \textsc{subj} & g:\text{“the teacher”}\\ \textsc{obj} & h:\text{“the students”}\\ \textsc{xcomp} & i:\begin{bmatrix}\textsc{pred} & \text{'stand'}\\ \textsc{subj} & \\ \textsc{obl}_{\textsc{loc}} & j:\begin{bmatrix}\textsc{pred} & \text{'behind'}\\ \textsc{obj} & k:\text{“seg”}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

(13) *læreren* $\rightsquigarrow$ $\hat{}^{\blacktriangle}\mathsf{t} : \square\blacksquare\uparrow$
$\Rightarrow$ $\square\blacksquare g$

lot $\rightsquigarrow$ let :
$\square\blacksquare(((\uparrow \textsc{subj}) \otimes ((\uparrow \textsc{obj}) \otimes \square((\uparrow \textsc{xcomp subj}) \multimap (\uparrow \textsc{xcomp})))) \multimap \uparrow)$
$\Rightarrow$ $\square\blacksquare((g \otimes (h \otimes \square(h \multimap i))) \multimap f)$
$\hat{}^{\blacktriangle}(\lambda p.\mathbf{P}(^{\blacktriangledown}p)) : \square\blacksquare(\blacksquare\uparrow \multimap \uparrow)$
$\Rightarrow$ $\square\blacksquare(\blacksquare f \multimap f)$

ba $\rightsquigarrow$ tell :
$\square\blacksquare(((\uparrow \textsc{subj}) \otimes ((\uparrow \textsc{obj}) \otimes \square\blacksquare((\uparrow \textsc{xcomp subj}) \multimap (\uparrow \textsc{xcomp})))) \multimap \uparrow)$
$\Rightarrow$ $\square\blacksquare((g \otimes (h \otimes \square\blacksquare(h \multimap i))) \multimap f)$
$\hat{}^{\blacktriangle}(\lambda p.\mathbf{P}(^{\blacktriangledown}p)) : \square\blacksquare(\blacksquare\uparrow \multimap \uparrow)$
$\Rightarrow$ $\square\blacksquare(\blacksquare f \multimap f)$

studentene $\rightsquigarrow$ $\hat{}^{\blacktriangle}\mathsf{s} : \square\blacksquare\uparrow$
$\Rightarrow$ $\square\blacksquare h$

stå $\rightsquigarrow$ $\mathsf{stand} : \square\blacksquare(((\uparrow \textsc{subj}) \otimes (\uparrow \textsc{obl}_{\textsc{loc}})) \multimap \uparrow)$
$\Rightarrow$ $\square\blacksquare((h \otimes j) \multimap i)$

bak $\rightsquigarrow$ $\mathsf{behind} : \square\blacksquare((\uparrow \textsc{obj}) \multimap \uparrow)$
$\Rightarrow$ $\square\blacksquare(k \multimap j)$

(14) *seg* NP
$\%A = ((\textsc{gf}^{+} \uparrow)\ \textsc{gf})$
$\hat{}^{\blacktriangle}(\lambda y(y, \hat{}y)) : \square\blacksquare(\%A \multimap (\%A \otimes \square\uparrow))$
$\Rightarrow \square\blacksquare(g \multimap (g \otimes \square f))$

Note that the lexical entry for *ba* requires its complement to be ■-marked as well as □-marked. Where (with *lot*) only □-marking is required, e.g. in the interpretation of (9-b), it is possible to derive an interpretation in which *seg* is bound to

[6]For simplicity's sake, the definite descriptions have been represented as constants.

læreren, as shown in Figure 5. Where ■-marking is required, e.g. in the interpretation of (9-a), it is not possible to derive such an interpretation. One attempt to do so is shown in Figure 6, which is analogous to the failed attempted derivation of (1-b) shown in Figure 2, in that it fails because ■ introduction is not valid: the path back to the open premise $v : \Box k$ does not contain an independent sub-proof of a ■-formula. Assuming a linear logic hypothesis of the form $\blacksquare k$ or $\Box\blacksquare k$ instead of $\Box k$ would also fail, this time in way analogous to the failed attempted derivation of (1-b) shown in Figure 3.

5 Conclusion

In this paper I have shown that certain positive binding constraints can be stated in Glue, following on from Morrill's analysis in a a categorial grammar setting. That analysis, in turn, is at least partly based on Hepple's treatment of extraction islands. Hepple (1990), though, does not give his unary connectives the semantic interpretation in terms of intensionalization presented here; in fact, for him they are semantically inert.

A semantically inert modality is likewise possible in Glue, and/or we could have (like Hepple) a family of modalities with an inclusion relation among them to model different kinds of locality conditions. In an LFG setting, however, there is no obvious motivation that I can see for approaching binding constraints from Glue unless, as is the case for the examples considered in this paper, the modalities used are semantically motivated, because binding theory on the basis of f-structure is so well-developed. However, it may well be worth considering a Glue approach to other constraints on interpretation, for example constraints on quantifier scope, which are comparatively much less-widely discussed in LFG. I leave this to future research.

Figure 5: Interpretation of (9-b) with long-distance binding

Figure 6: A failed attempt to derive an interpretation of (9-a) with long-distance binding

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Modelling (In)definiteness, External Possessors and (Typological) Variation in Hungarian Possessive DPs

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Abstract

In this paper I set out to model the encoding of definiteness in Hungarian possessive DPs with particular attention to the (non)complementarity of definiteness markers and possessive markers. I develop a formal LFG account of the relevant phenomena. Its essence is that I propose that in Hungarian DPs the DEF feature is nonunifiable. Naturally, the definite article always encodes this feature, while some possessor types also encode it, and others do not. The latter can only require that this feature should be present in the possessive DP. It is in this way that I capture the (non)co-occurrence of the definite article and various possessors.

1 Introduction

Previous LFG analyses of Hungarian possessive DPs have mostly concentrated on basic morphosyntactic issues: the treatment of pro-drop, c-structure representation and the grammatical/discourse functions of nominative and dative possessors, see, for instance, Laczkó (1995), Chisarik & Payne (2001), Laczkó (2010) and Charters (2014). In this paper, I will address the following additional issue: the encoding of definiteness in possessive DPs with particular attention to the (non)complementarity of definiteness markers and possessive markers. I will examine both general and dialectal variation in this domain in a typological context, and I will also take DPs with external possessors into consideration. I will propose a formal LFG account of the relevant phenomena. Its essence is that I assume that in Hungarian DPs the DEF feature is nonunifiable. The definite article always contributes the [+DEF] feature value, and various types of possessors may or may not contribute this value. When a possessor does contribute it, the nonunifiability of this feature precludes the presence of the definite article. This is how I capture the complementarity of the given possessor type and the article. Possessors that must co-occur with the article are assumed not to contribute the [+DEF] feature value; instead, they constrain its existence in the possessive DP, which means that they prescribe the presence of the article. This is how I capture the co-occurrence of the two elements.

The structure of the paper is as follows. In section 2, I present the relevant Hungarian facts in a typological context. In section 3, I develop my analysis of the major possessive DP types. In section 4, I conclude.

2 The basic facts

In this section, first I present the construction types under investigation (2.1), and then I put them in a typological context (2.2).

2.1. Definiteness and Hungarian possessive DPs

(A) Hungarian possessive DPs have nominative or dative possessors, see (1a) and (1b), respectively, and when they are present in the possessive DP, the interpretation of this DP is always definite.

(1) a. *Kati* *toll-a*
Kate.NOM pen-her[1]
'Kate's pen'

b. *Kati-nak* *a* *toll-a*
Kate-DAT the pen-her
'Kate's pen'

c. *a* *(te)* *toll-ad*
the you.NOM pen-your
'your pen'

(B) The possessed noun agrees with the possessor, see (1a-c), and possessor pro-drop is possible (typical), see (1c).

(C) When the possessor is a nominative pronoun, the definite article must be present, see (1c). (Dative pronominal possessors very rarely occur within possessive DPs.) When the pronominal possessor is dropped, the definite article must be present under normal circumstances, see (1c). Optionally it can be absent when the possessive DP is a topic.

(D) When the possessor is a nonpronominal DP (whether definite or indefinite), the definite article must not be present in standard Hungarian, but the interpretation of the possessive DP is always definite (which is straightforwardly indicated by the definite objective conjugation of the verb), see (2).

(2) *János* *olvas-t-a* | *Kati* | *vers-é-t.*
John.NOM read-PAST-3SG.DEF | Kate.NOM | poem-her-ACC
| *a* *lány*
| the girl.NOM
| *egy* *lány*
| a girl.NOM
'John read Kate's / the girl's / a girl's poem.'

[1] In Hungarian, even 3SG pronouns are not gender sensitive. For simplicity's sake, in this paper I will consistently use the feminine English pronoun (*she* and its other forms) in the glosses, and when there is a 3SG possessive suffix attached to the noun head I will gloss it as *-her*.

In (2), the possessors are in nominative case. When they are dative case-marked, they follow the pattern in (1b), in which case the definite article is standardly present; hence, the definiteness of the entire possessive DP is directly encoded.

(E) In addition to this standard pattern, there is a dialectal variant (mainly in the Trans-Tisza region): when the possessor is expressed by a personal name, the definite article must be present in the possessive DP, see (3).

(3) a. *János* *lát-t-a* *Kati-t.*
John.NOM see-PAST-3SG.DEF Kate-ACC
'John saw Kate.'

b. *János* *lát-t-a* *a* *Kati* *toll-á-t.*
John.NOM see-PAST-3SG.DEF the Kate.NOM pen-her-ACC
'John saw Kate's pen.'

The peculiarity of this dialect is that personal names are normally used without the definite article, but when they are possessors, they must be preceded by the definite article. Compare the first possessor in (2) and the possessor in (3) in this respect. In this dialect then the definite article clearly belongs to the entire possessive DP (and not to the possessor), thereby following the pattern of nominative personal pronoun possessors, see (1c).[2]

(F) The (always dative-marked) possessor can occur externally to the possessive DP.[3] In such cases, when the possessed DP contains the definite article, the interpretation is definite, as usual, see (4a). When it does not contain the definite article, the interpretation of the possessed DP is indefinite. This is partially supported by the morphology of the verb: a great number of speakers use the indefinite object marking paradigm of the verb (while others keep the definite marking paradigm, although the interpretation of the noun phrase is indefinite here, too), see (4b).

(4) a. *Kati-nak* *olvas-t-ad* *a* *vers-é-t?*
Kate-DAT read-PAST-2SG.DEF the poem-her-ACC
'Did you read Kate's poem?'

b. *Kati-nak* *olvas-t-ad/-ál* *vers-é-t?*
Kate-DAT read-PAST-2SG.DEF/-2SG.INDEF poem-her-ACC
'Did you read one / several poem(s) by Kate?'

[2] Interestingly, there is a third dialectal pattern (most typical in the Budapest area) in which personal names are always combined with the definite article; thus, in this variant *Katit* 'Kate.ACC' would be preceded by *a* 'the' in both (3a) and (3b).

[3] For an overview of previous GB/MP analyses and a recent MP analysis of Hungarian external possessors, see É. Kiss (2014).

2.2. The typological context

Consider the following typological generalizations from Carlier et al. (2016).[4,5]

> (a) From the point of view of *morphosyntax*, there is a *typological split* between languages that allow *possessive* and *definiteness markers* to *co-occur* within one and the same DP […], and those in which the markers in question are *in complementary distribution*, (2016: 1).
>
> (b) On the semantic side, languages again are *split* in that some have markers of possession that impose an *exhaustive quantification* on the domain *denoted by the possessee nominal* (in the sense that the resulting DP is normally taken to denote the totality of individuals with the relevant nominal property related to a given possessor), while other languages do *not* have *such possessives*, (2016: 1).
>
> (c) Moreover, there is evidence for the *typological alignment* of the morphosyntactic and semantic splits identified above. That is, on the one hand, it is precisely in those cases *where possessive markers trigger exhaustive quantification* that they are in *complementary distribution with definiteness markers*; on the other, languages which *do not have exhaustivity-triggering possessives*, seem to mark, if at all, *specificity* (in the sense of Enç 1991); *partitive type* **(**in terms of Heusinger 2002) *rather than definiteness*, (2016: 2).[6]

In the light of the typological characteristics and generalizations in (a)-(c) above, Hungarian exhibits a rather mixed picture, see Table 1 (next page).

Haspelmath (1999) makes the following generalizations.

- The complementarity of definiteness marking and possessive marking for the encoding of definiteness (exhaustivity) is due to a simple economy principle: the presence of the possessor is a sufficient form of expressing the definiteness of the entire possessive DP. The basis for this is that possessive DPs have a very high chance of being definite.
- If a language does not have this complementarity, it ranks another principle (i.e. OT-style violable constraint) higher: explicitness. This

[4] This was a workshop proposal for *the 50th Annual Meeting of the Societas Linguistica Europaea (SLE)*, Zürich, 10-13 September, 2017. The title of the workshop was: *Definiteness, possessivity and exhaustivity: formalizing synchronic and diachronic connections*.

[5] The emphases are mine, TL.

[6] For lists of languages manifesting various types and for examples, see Carlier et al. (2016).

explains the difference between languages with complementarity and languages with noncomplementarity.

Hungarian exhibits a mixed picture in this respect as well, see Table 1.

(a)	(i) Pronominal nominative possessors must co-occur with the definite article. (ii) When the pronominal possessor is dropped, the definite article must be present (optionally, it can be dropped if the possessive DP is a topic). (iii) Nonpronominal dative possessors must co-occur with the definite article (dative pronominal possessors are vanishingly rare *within* possessive DPs). (iv) Nonpronominal nominative possessors strictly reject the presence of the definite article. (v) In the Trans-Tisza dialect personal name possessors in the nominative behave in the same way as pronominal nominative possessors.
(b)	(i) When there is an overt possessor in the DP (irrespective of the presence or absence of the definite article), the interpretation of this DP is strictly exhaustive. (ii) When there is no overt possessor and the definite article is present, the interpretation of this DP is strictly exhaustive. • In this case there is either pro-drop or there is an external possessor in the dative. (iii) When there is no overt possessor and no definite article. • There is pro-drop, and the default interpretation is nonexhaustive (optionally the interpretation can be exhaustive if the possessive DP is a topic). • There is an external possessor in the dative, and the interpretation is strictly nonexhaustive.
(c)	The alignment of exhaustivity and the complementarity of the definite article (i) holds in the case of nonpronominal nominative possessors; (ii) does not hold in the case of pronominal nominative possessors and dative possessors.

Table 1. The expression of definiteness in Hungarian possessive DPs

3 An LFG analysis

My key idea for capturing the (non)complementarity of the definite article and the possessor in an LFG framework is as follows. The definite article always encodes the [+DEF] feature value for the matrix DP, i.e. it has the standard lexical representation, as shown in (5).

(5) *a(z)*, D (↑ DEF) = +

The (either definite or indefinite) possessor *can* also encode this feature. However, this feature is nonunifiable[7] in Hungarian. In the standard dialect, nonpronominal possessors do encode this feature; therefore, the presence of the definite article is blocked. Pronominal possessors, by contrast, are "weak" in this respect: they cannot encode definiteness; therefore, the presence of the definite article is required. I capture this formally by associating a constraining equation with these pronouns to this effect:

(6) (↑ DEF) =c +

Dative possessors follow suit: they do not encode definiteness, either; instead, they also require the presence of the definite article. The special characteristic feature of the Trans-Tisza dialect is that it treats personal name possessors in the same way as pronominal possessors. Below, I spell out the formal details of my analysis of the major types of Hungarian possessive DPs.

3.1. Overt possessors within the possessive DP

3.1.1. Nonpronominal nominative possessors

It is this possessor type that blocks the occurrence of the definite article in possessive DPs in Hungarian. I capture this by assuming that the possessor itself contributes the [+DEF] feature value, and this precludes the insertion of

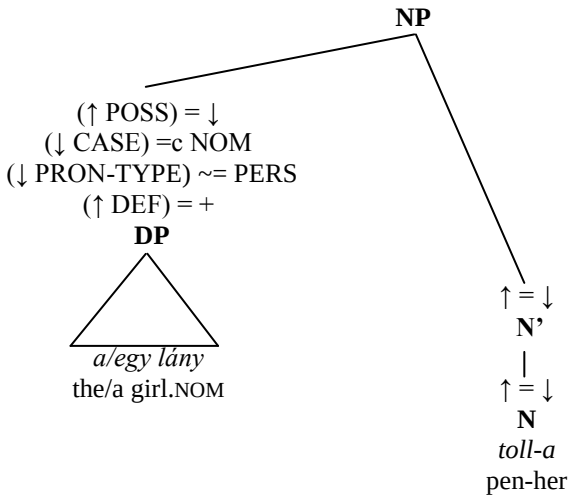
[7] By a feature being nonunifiable I mean the same as Dalrymple's (2001) assumption that certain features cannot be multiply instantiated, and I use the nonunifiability term in this sense throughout this paper. Consider the following quote (Dalrymple (2001: 107). "In some cases, the value of a feature other than the PRED feature might be required to be uniquely contributed; for instance, the value of the TENSE feature is contributed by only a single form, and multiple contributions are disallowed:

(58) a. *Is David yawning?*
b. **Is David is yawning?*

An *instantiated symbol* can be used as the value of the TENSE attribute in such a situation. Like a semantic form, an instantiated symbol takes on a unique value on each occasion of its use. In general, any syntactic uniqueness requirement for a feature can be imposed by the use of an instantiated symbol as the value of that feature."

the article, given that the DEF feature is nonunifiable. Consider the representation of *a/egy lány tolla* 'the/a girl's pen' in (7).[8]

(7)



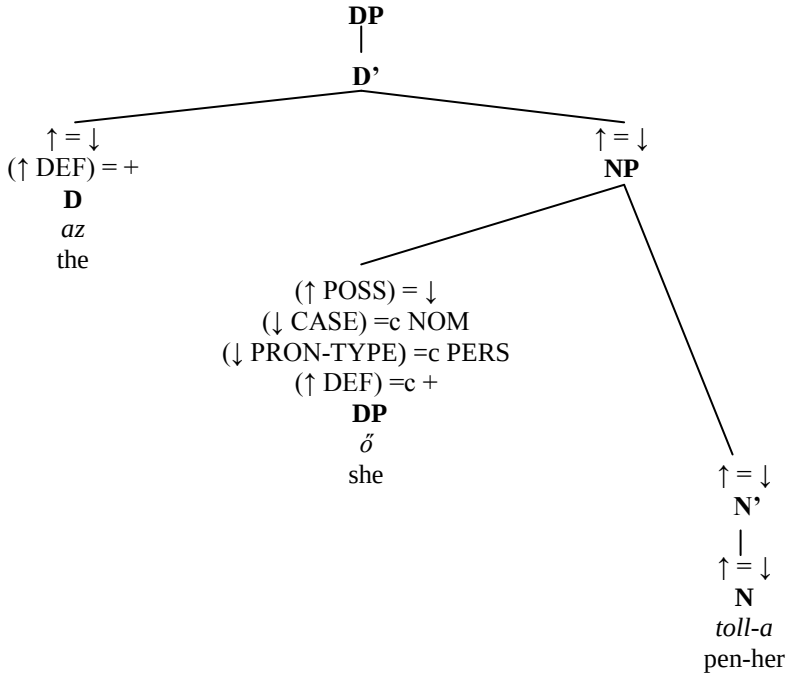
The first three equations are the annotations I generally associate with nominative possessors in Hungarian DPs, which occupy the Spec,NP position. The DP in this position has the possessor grammatical function: (↑POSS) = ↓, it has to be in nominative case: (↓CASE) =c NOM, and it is in a possessive DP. The crucial annotations assigned to the possessor DP in my current approach are the fourth and the fifth. They encode the following ingredients of the analysis: if the possessor is nonpronominal: (↓PRON-TYPE) ~= PERS, it itself contributes the definiteness feature: (↑DEF) = +.

3.1.2. Pronominal nominative possessors

Consider the representation of *az ő tolla* 'her pen' in (8) and compare it with (7).

[8] As in Laczkó (1995, 2010), I subscribe to Szabolcsi's (1994) DP analysis of Hungarian noun phrases. However, when there is no need for a DP projection from an LFG perspective, I use the NP maximal projection, as in (7).

(8)



The first three annotations associated with the pronominal possessor in (8) are the same as those associated with the nonpronominal possessor in (7). The other two annotations in (7) and (8) are "mirror images" of each other, respectively. In (7) the two annotations encode that (i) the possessor must not be a (personal) pronoun, and (ii) it contributes the [+DEF] feature value. In (8), by contrast, it is constrained that (i) the possessor must be a pronoun, and (ii) the [+DEF] feature value must be present in the possessive DP (but it is not contributed by the possessor). Instead, it is contributed by the definite article, see the relevant annotation associated with it.

In the modelling of the Trans-Tisza dialect, the standard (↓PRON-TYPE) =c PERS equation has to be disjunctively augmented by (↓NOUN-TYPE) =c PERS. This formally captures the fact that in this variant of Hungarian personal name possessors behave in the same way as pronominal possessors.

The following legitimate question may arise at this point. Why are nominative possessors too weak to encode the [+DEF] feature value themselves? There are at least three factors that may play a role in this.

(A) Possessor pronouns are typically dropped (unless they have a discourse function), and Hungarian DPs are head-final. From this it follows that in a possessive DP with possessor pro-drop the definiteness of the DP would be recognized at the end of processing the entire DP. As opposed to this, DPs with overt (either definite or indefinite) nonpronominal possessors (which are, obviously, obligatory constituents) have these possessors at their left edge. Thus, the definiteness of the entire DP can be encoded by these

obligatory possessors already at the beginning of processing the DP. It is to be noted that at earlier stages in the history of Hungarian, pronominal possessors were also in complementary distribution with the definite article, then their co-occurrence became available optionally, and now this co-occurrence is obligatory. My suspicion is that the extremely high frequency of pro-drop and the processing factor as described above jointly contributed to the obligatory co-occurrence of the two constituents to a great extent.

(B) 1st and 2nd person OBJ pronouns trigger indefinite agreement on the verb as opposed to 3rd person pronouns, which trigger definite agreement. Compare (9a) and (9b).

(9) a. *Kati* *lát-ott* *engem/téged.*
Kate.NOM see-PAST.3SG.INDEF me/you
'Kate saw me/you.'

b. *Kati* *lát-t-a* *őt.*
Kate.NOM see-PAST-3SG.DEF her
'Kate saw her.'

It should be obvious that the "weakness" of these 1st and 2nd person pronouns is not semantic in nature, since in an ordinary speech situation the speaker and the addressee can be most definitely identified. Consequently, this seems to be a formal (agreement) peculiarity of these pronouns. Even so, this formal weakness may have an (albeit) minor effect here.

(C) 3PL nonpronominal and pronominal possessors follow radically different (i.e. contrasting) agreement patterns. Here I only give a simplified (and theory-neutral) overview of the relevant facts (which have a huge generative literature).[9] Compare (10a) and (10b).

(10) a. *a* *lány-ok* *toll-a*
the girl-PL.NOM pen-her
'the girls' pen'

b. *az* *ő* *toll-uk*
the she pen-their
'their pen'

[9] These very special cases of possessor concord in Hungarian are generally referred to as "anti-agreement". For a variety of analyses in the GB/MP tradition, see, for instance, Szabolcsi (1994), Dikken (1999), and É. Kiss (2014).

c. **az ők toll-a*
the they pen-her
'their pen'

d. **az ők toll-uk*
the they pen-their
'their pen'

As (10a) shows, a nonpronominal possessor naturally carries (encodes) the relevant person and number features, while the morphology of the noun head only encodes 3rd person,[10] and it does not agree for person. By contrast, as (10b) illustrates, in the case of pronominal possessors, it is the agreement inflection of the noun head that encodes the features of the 3PL possessor correctly, and the (droppable) pronoun has the 3SG form. This is another formal issue (see point (B) above), but notice that in theory the 3PL pronominal possessor could follow the (anti-agreement) pattern of the plural nonpronominal possessor: (10a), but, as shown in (10c), it does not. Or, alternatively, it could also trigger the ordinary agreement pattern, but, as shown in (10d), it does not. These facts may be partially due to the droppability of the pronominal possessor: when it is dropped, the correct person and number specification can only be encoded by the agreement morphology of the head noun. However, this should not preclude the possibility of the "normal" pattern in (10d), but it does, as reflected by the ungrammaticality.

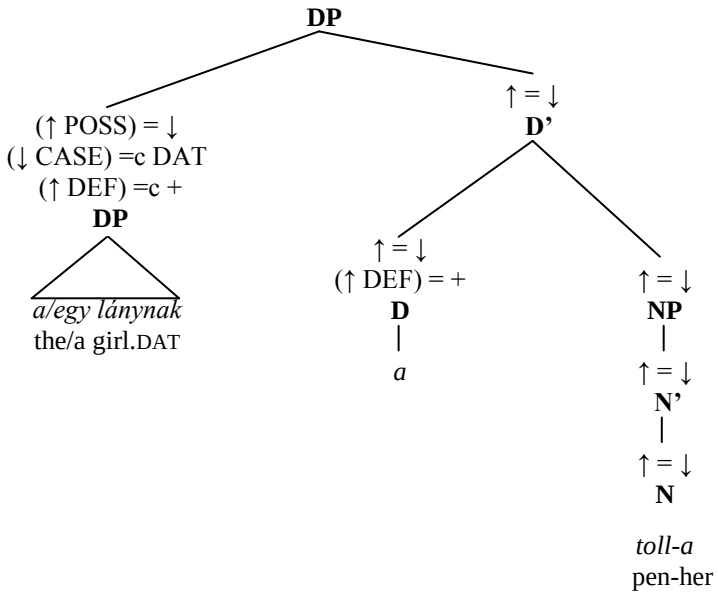
3.1.3. Dative possessors

Consider the representation of (11) in (12).

(11) *a/egy lány-nak a toll-a*
the/a girl-DAT the pen-her
'the/a girl's pen'

[10] At most, because there are also proposals to the effect that the morpheme in question only encodes possessivity, and it does not encode any agreement features: either 3SG or just 3rd person, see, for instance, Bartos (2000).

(12)



The first three annotations assigned to the possessor DP[11] in Spec,DP directly correspond to the first three annotations associated with the nominative possessor in Spec,NP, except that in (12) the case constraint is dative. The crucial aspect of my analysis is formalized by the last annotation: (↑DEF) = c+. Just like nominative pronominal possessors, these dative possessors do not contribute the [+DEF] feature value; instead, they only require the presence of this value. In this way, they make the presence of the definite article obligatory.

3.2. Definite article within the possessive DP and no overt possessor

3.2.1. Pro-drop

Consider the version of (1c) that does not contain an overt possessor in (13).

(13) *a* *toll-ad*
the pen-your
'your pen'

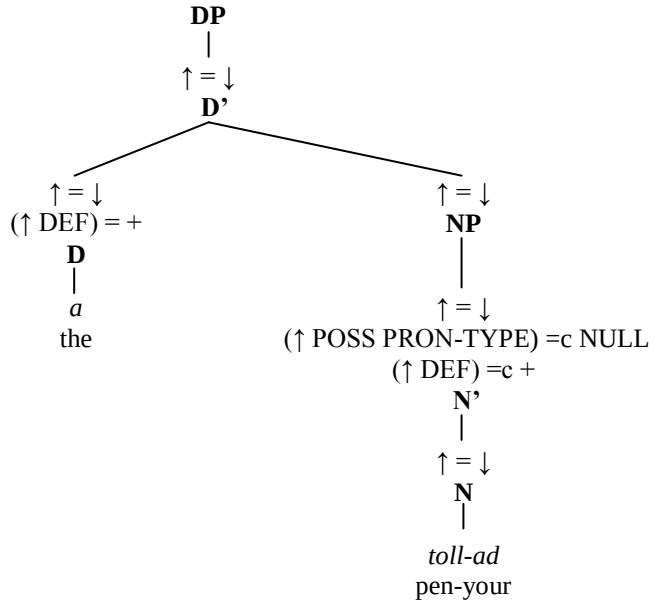
[11] A reminder is in order here: pronominal possessors in the dative are vanishingly rare *within* possessive DPs. However, they are absolutely acceptable (and, indeed, the only option) as external possessors.

The default interpretation of such a DP is that of ordinary pro-drop. For instance, this interpretation is appropriate when the DP occurs in a sentence like that in (14).

(14) *Le* *es-ett* *a* *toll-ad* *a* *padló-ra.*
down fall-PAST.3SG.INDEF the pen-your the floor-onto
'Your pen fell to the floor.'

Consider the representation of (13) as used in (14).

(15)



The first two annotations assigned to the N' node should be familiar from previous representations. The third one constrains this configuration to a covert (i.e. phonetically null) pronominal possessor. The fourth, which is the constraining equation I deploy in my current analysis, requires the presence of the [+DEF] feature value; therefore, the definite article must be inserted.

This scenario is made more complex by the fact that, as I pointed out in section 2.1, in the case of pro-drop the definite article can also be dropped provided that the matrix possessive DP is a topic. This can be modelled by augmenting the (↑ DEF) =c + annotation in the following way:

(16) { (↑ DEF) =c +
| (TOPIC ↑)
(↑ DEF) = + }

That is, if the DP is a topic then the N' node can contribute the [+DEF] value, and then the definite article must not be inserted. Also note that when the first conjunct in (16) is used, the DP can still be the topic.

In Laczkó (1995) I analyze possessor pro-drop in the mainstream LFG manner. I assume that when the pronominal possessor is overt in the possessive DP, the nominal inflection only encodes possessivity and the agreement features. When there is no overt pronominal possessor, the same inflectional morphology also contributes the possessor's PRED feature value: 'PRO'.[12] This contribution is always available as an option, but it leads to a grammatical output iff there is no overt possessor pronoun present in the DP. The reason for this is that an expressed pronoun does have its own 'PRO' PRED feature value and the contribution of the morphology of the noun head would "double" this; however, PRED features do not unify in LFG.[13]

3.2.2. External possessor

When a possessive DP like (13) occurs in a sentence like (17), the dative DP outside the possessive DP is interpreted as the external possessor of this DP.

(17) *Neked* *es-ett* *le* *a* *toll-ad* *a* *padló-ra.*
you.DAT fall-PAST.3SG.INDEF down the pen-your the floor-onto
'YOUR pen fell to the floor.'

In this example the external possessor is in the preverbal focus position of the sentence. I assume that it is associated with the following annotations.

(18) (↑ SUBJ POSS) = ↓
(↓ CASE) =c DAT

This means that this dative DP constituent expresses the possessor of the possessive DP (which is the subject of the sentence in (17)). It has its own PRED feature, 'PRO' in this case. It should be clear that the sentence can only be grammatical if there is no overt (pronominal) possessor within the possessive DP, and there is no pro-drop interpretation within that DP. In either case, there would be a 'PRO' PRED feature value realized within the possessive DP, and then the presence of the external possessor would be illegitimate, because its 'PRO' PRED feature value could not be integrated, as it could not be unified with the 'PRO' expressed within the possessive DP. It should be obvious from the foregoing discussion that nonpronominal external possessors can be analyzed in exactly the same way, see (19).

[12] The relevant annotation associated with the +Poss tag in the XLE implementation of the analysis is this: (↑ POSS PRED) = 'PRO'.

[13] Note that the essence of my analysis of encoding definiteness in Hungarian possessive DPs is based on the assumption of a similar ban on unifiability.

(19) *Kati-nak* *es-ett* *le* *a toll-a* *a padló-ra.*
Kate-DAT fall-PAST.3SG.INDEF down the pen-her the floor-onto
'KATE'S pen fell to the floor.'

The situation is the same except that the dative external possessor is more meaningful: its PRED is 'KATE', and this cannot (or, rather, must not) unify with a 'PRO' PRED within the possessive DP, whether that 'PRO' is contributed by an overt pronoun in the possessive DP or by the possessive morphology of the head noun (on a pro-drop scenario).

3.3. No definite article and no overt possessor within the possessive DP

Recall that a possessive DP has a strictly exhaustive interpretation if it contains an overt possessor and/or the definite article. A nonexhaustive interpretation is available if neither element is present in the DP. There are two possibilities here: (i) a pro-drop interpretation of the DP, see section 3.3.1 and (ii) the combination of the possessive DP with an external possessor, see section 3.3.2.

3.3.1. Pro-drop

A reminder: even this "no definite article and no overt possessor" configuration can have a definite (exhaustive) interpretation optionally provided that the matrix possessive DP is a topic, see the second disjunct in (16) in section 3.2.1. However, the default interpretation is indefinite (nonexhaustive). Consider the example in (20).

(20) *Megérkez-ett* *a* *híres* *költő.*
arrive-PAST.3SG the famous poet.NOM
'The famous poet has arrived.'

Te *olvas-tál* *már* *vers-é-t?*
you.NOM read-PAST-2SG.INDEF yet poem-her-ACC
'Have you read a / several poem(s) by her yet?'

Here the dropped possessor pronoun of the possessive DP *versét* 'her poem.ACC' is anaphorically bound by *a híres költő* 'the famous poet', and the possessive DP has an indefinite (nonexhaustive) interpretation. In order to model this scenario, we need to augment (16) by a third disjunct, see (21).

(21) { (↑ DEF) =c +
| (TOPIC ↑)
(↑ DEF) = +
| (↑ DEF) =c – }

These three disjuncts have the following effects in a pro-drop configuration. First: the matrix DP is constrained to have the [+DEF] value; therefore, the definite article must be present (and the interpretation of the matrix DP is exhaustive). Second: when the matrix DP is a topic, the N' constituent itself can contribute the [+DEF] value; therefore, the use of the definite article is blocked (and the interpretation of the matrix DP is exhaustive). Third: the matrix DP is constrained to have the [–DEF] value; therefore, the use of the definite article is blocked (and the interpretation of the matrix DP is nonexhaustive).

3.3.2. External possessor

Consider the sentence in (22).

(22) *Kati-nak* *te* *olvas-tál* *már* *vers-é-t?*
Kate-DAT you.NOM read-PAST-2SG.INDEF yet poem-her-ACC
'Have you read a / several poem(s) by her yet?'

In this example *Katinak* [Kate.DAT] functions as the external possessor of the *versét* [poem.her.ACC] DP, and the interpretation of the DP is strictly nonexhaustive. Notice that for this analysis to work I do not have to modify or augment any aspect of the account I am developing here for the following reasons.

(A) The treatment of the external possessor in (22) is the same as in the case of the external possessor belonging to a definite possessive DP: it receives the same kinds of annotations, compare (18) in section 3.2.2 and (23).[14]

(23) (↑ OBJ POSS) = ↓
(↓ CASE) =c DAT

(B) Just like in the case of definite possessive DPs with external possessors, the inflectional morphology of the head noun within the possessive DP cannot contribute the 'PRO' PRED value to the possessor

[14] The only difference is that in the relevant examples in (17) and (19) in section 3.2.2 the DP (with a dative external possessor) has the subject grammatical function, while in (22) the corresponding DP has the object function.

(following the pro-drop scenario), because this would lead to the duplication of PRED features, which are nonunifiable: a 'PRO' PRED value would come from the nominal morphology and another PRED value would come from the external possessor.

4 Conclusion

In this paper, I have examined the encoding of definiteness in Hungarian possessive DPs with particular attention to the (non)complementarity of definiteness markers and possessive markers, and I have proposed a formal LFG analysis of the relevant phenomena.

In the light of the typological generalizations discussed in section 2.2, Hungarian manifests a rather mixed picture, see Table 2.[15]

COMPLEMENTARITY	• (Droppable) Pronominal nominative possessors and dative possessors must co-occur with the definite article. • Nonpronominal nominative possessors strictly reject the presence of the definite article.
EXHAUSTIVITY	• When there is an overt possessor in the possessive DP and/or the DP contains the definite article, the interpretation of this DP is strictly exhaustive. • The nonexhaustive interpretation is available iff neither element is present within the possessive DP, and in this case we have either pro-drop or an external possessor in the dative.
ALIGNMENT	The alignment of exhaustivity and the complementarity of the definite article with possessors • holds in the case of nonpronominal nominative possessors; • does not hold in the case of pronominal nominative possessors and dative possessors.

Table 2. Complementarity, exhaustivity and alignment in Hungarian possessive DPs

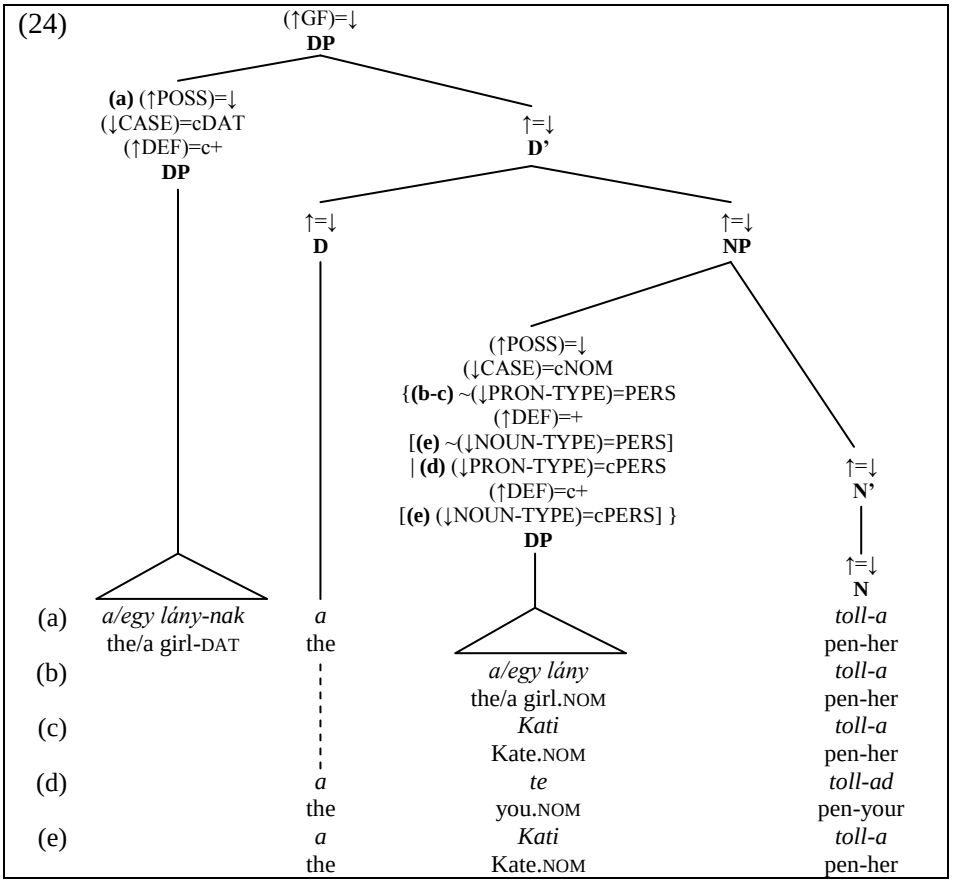
The essence of my LFG analysis is as follows. I assume that in Hungarian DPs the DEF feature is nonunifiable. The definite article always contributes the [+DEF] feature value, and various types of possessors may or may not contribute this value. When a possessor does contribute it, the nonunifiability of this feature precludes the presence of the definite article. This is how I

[15] Here I only highlight the major aspects of the complexity of this picture.

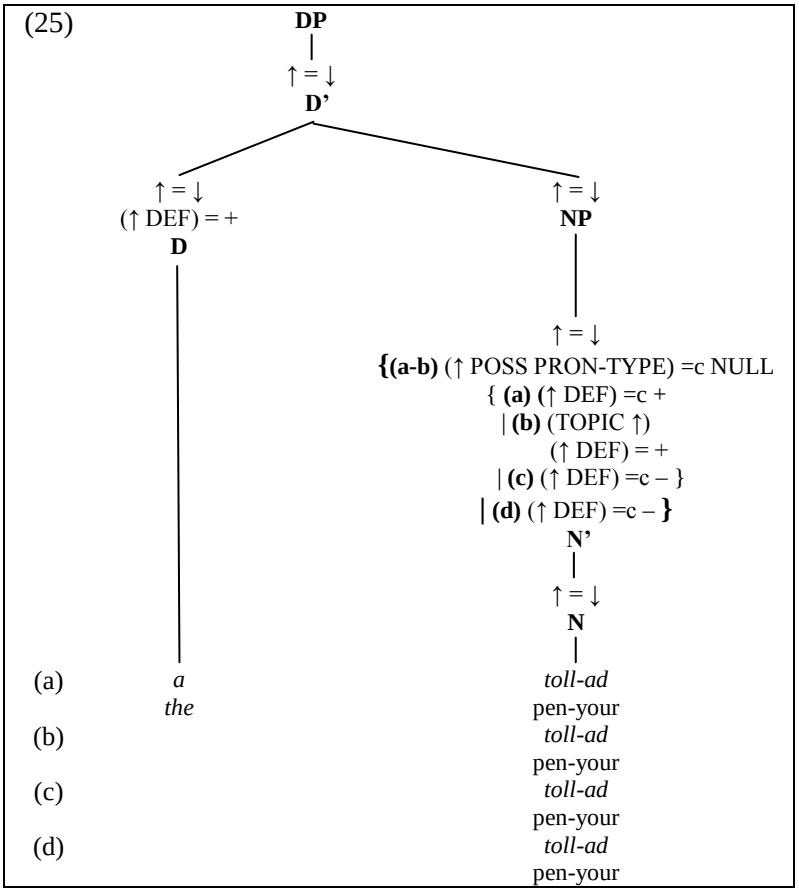
capture the complementarity of the given possessor type and the article. Possessors that can co-occur with the article are assumed not to contribute the [+DEF] feature value; instead, they constrain its existence in the possessive DP, which means that they prescribe the presence of the article. This is how I capture the co-occurrence of the two elements.

In (24) I present the structural-annotational details of my analysis of possessive DPs with overt possessors, and in (25) I present those of my analysis of possessive DPs without overt possessors.

(24)



(e) represents the special property of the Trans-Tisza dialect



(b) exemplifies the exhaustive interpretation of the possessive DP when it is a topic

(c) illustrates the nonexhaustive interpretation of the possessive DP when there is pro-drop

(d) demonstrates the nonexhaustive interpretation of the possessive DP when there is an external possessor

In this paper I have developed an analysis of the relevant present day Hungarian phenomena. One of the two anonymous reviewers remarks that the nonunifiability assumption as I express it seems to be "a brute stipulation", and they suggest the following alternative: "In my Hungarian grammar, there are no cases of unifying two DEF [sic!]". My response to this criticism is as follows.

- The crucial factor is the contrasting behaviour of nominative pronominal and nonpronominal possessors. I think my suggestions about the possible reasons for this situation are valid.

- At the same time, capturing this contrast calls for some kind of stipulation anyhow (even in my reviewer's wording), and it appears to me that carrying this out along the nonunifiability lines at least has the flavour of raising this solution to some principled level.[16]
- I plan to explore the diachronic context of these Hungarian phenomena in future work. A preliminary look at the history of the relevant facts suggests that at earlier stages the nonco-occurrence of the definite article and possessors was characteristic of more constructions than in present day Hungarian. Thus, the appropriate generalization in the spirit of the analysis I have proposed in this paper is that earlier the nonunifiability of the DEF feature values affected more elements in Hungarian possessive DPs than now.

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[16] Recall that in LFG it is not only PRED feature values that are assumed not to be unifiable (i.e. reject multiple instantiation). Dalrymple (2001) points out that TENSE feature values, for instance, cannot be instantiated more than once, either, see Footnote 7.

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Norwegian Pseudocoordination with the Verb *drive* 'carry on': Control, Raising, Grammaticalization

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Abstract

A pseudocoordination looks like a coordination of two verb phrases, but its grammatical properties are different from those of coordination. In this paper, I propose that most pseudocoordinations are equi constructions with anaphoric control - a revision of the analysis in Lødrup (2002). A pseudocoordination with properties of its own has *drive* 'carry on' as its first verb. Its use could be described as aspectual, or maybe rather pluractional. It is shown how *drive* in its different uses shares grammatical properties with aspectual verbs, and finds a place in their system. Pseudocoordination with *drive* is not always an equi construction. In colloquial Norwegian, pseudocoordination with *drive* can also be used as a raising construction. This seems to be a new phenomenon, which has developed through grammaticalization.

1. Introduction[1]

In Scandinavian grammar, the term pseudocoordination is used of sentences such as (1)-(4).

(1) Da satt han og arbeidet
then sat he and worked
'Then he sat there working.'
(2) Da drev han og arbeidet
then carried.on he and worked
'Then he was working.'
(3) Da ringte han og klaget
then called he and complained
'Then he called and complained.'
(4) Da tok hun og kysset ham
then took she and kissed him
'Then she (suddenly) kissed him.'

A pseudocoordination might look like a coordination of two verb phrases. However, their grammatical properties are clearly different from those of regular coordinations, as has been discussed several times (e.g. Lødrup 2002, 2017, and references there).

The set of first verbs that allow pseudocoordination in Scandinavian is rather heterogeneous. Pseudocoordinations with different verbs show

[1] I have received valuable input from audiences at Forum for Theoretical Linguistics (Oslo, October 2016), Workshop on Pseudo-Coordination and Multiple Agreement Constructions (Venice, May 2017), Variation and Change in the Verb Phrase (Oslo, May 2017), and LFG17 (Konstanz, July 2017). I would especially like to thank Dag Haug and Daniel Ross for discussion. Thanks are also due to the proceedings editors and the anonymous reviewers.

different grammatical behavior (Lødrup 2002). Pseudocoordinations have been reported in several languages (see Ross 2016 and references there), but there is no assumption here that pseudocoordinations are a unitary phenomenon across or within languages. In my view, the only common property of pseudocoordinations is the ill-understood requirement that the first verb and the verb following it must have the same inflectional form (Lødrup 2014a, 2014b). This requirement must be the reason the grammatical word preceding the second verb is usually the coordinator (Norwegian *og* 'and'), and not the infinitival marker (Norwegian *å* 'to'). However, in Norwegian speech, these two words are usually pronounced the same way (Endresen 1995), and they are sometimes mixed up in writing. (I have corrected this in example sentences from texts in the following.)

In this paper I discuss Norwegian pseudocoordinations with *drive* as the first verb. They are interesting in that they have properties that are clearly different from those of other pseudocoordinations. The verb *drive* is difficult to translate; it means something like 'carry on', 'keep on', or simply 'do'. Examples are (2) above, and (5). (Example (5) and most other examples are from the www, either directely or indirectly through the NoWaC corpus of web texts. Some of them are lightly edited.)

(5) Vi drev og laget et dansenummer
we carried.on and made a dance.act
'We were making a dance act.'

In part 2, some general properties of *drive* are introduced, including its aspectual function and its subject role. Part 3 establishes that *drive* can be either an equi verb with anaphoric control or a raising verb. Similarities between *drive* and aspectual verbs are discussed in part 4. The diachrony of *drive* is touched upon in part 5, especially the grammaticalization of the raising verb. In part 6, pseudocoordination with *drive* is compared to other pseudocoordination, and it is shown how *drive* is special.

2. *drive* introduction

2.1 General

Norwegian and Swedish and Danish pseudocoordinations are generally very similar. However, the relevant use of *drive* is unknown in Swedish and Danish, and also in Old Norse, Icelandic, and Faroese (Heycock and Petersen 2012).

Pseudocoordination with *drive* has a colloquial air. Dictionaries characterize it as "popular, familiar" (*folk[elig]*, *fam[iliært]*, Norsk Riksmålsordbok), and "especially colloquial" (*især muntlig*, Stor norsk

ordbok). Behrens et al. (2013) considers it not to be a part of the standard language.

The distribution of pseudocoordinations with *drive* in different genres shows a striking skew. Table 1 gives the results of some corpus searches. The second column shows the number of words (approximately) per pseudocoordination with *drive*, and the third column the percentage.

Table 1

Genre	**Words per *drive***	**Percentage**
Oslo speech	6 500	0.01538
Norwegian dialects	10 300	0.00970
Fiction	38 300	0.00261
Non-fiction	535 000	0.00018
Newspapers, periodicals	2 000 000	0.00004

Search string: *drive* lemma + 0-2 words + *og* + verb
All hits were controlled, and irrelevant hits discarded.
Corpora: Norsk talespråkskorpus - Oslodelen, Nordic Dialect Corpus, Leksikografisk bokmålskorpus

In corpora of spoken language, pseudocoordinations with *drive* are common. In a corpus of Oslo speech, there is one per ca 6500 words. The frequency is somewhat lower in a corpus of speech from various Norwegian dialects. In writing, the construction is less frequent. Fiction is the genre with most hits. In non-fiction, there is one per ca 535 000 words. In newspapers and periodicals, there is one per 2 million words, which means that pseudocoordinations with *drive* are about 300 times less frequent than in the corpus of Oslo speech.

In discussions of Norwegian pseudocoordination, the option of *drive* is routinely mentioned, but discussions are usually focused upon sentences with posture verbs. Short discussions of *drive* can be found in Faarlund et al (1997:648-50), Lødrup (2002), Hesse (2009:118-23), and Vagstad (2010:15-16). One shortcoming of what has been written on *drive* is that the full range of its actual use has not been taken into account. This paper is based upon data from the www, as mentioned in part 1.

Norwegian, as well as Swedish and Danish, has a pseudocoordination verb that can be synonymous with *drive*, namely *holde på* 'carry on'. (See Blensenius 2015a on Swedish *hålla på*.) An example is (6).

(6) Holder på og peser med maskina mi
carry on and pant with machine.DEF my
'(I) am stressing out with my machine.'

However, *holde på* 'carry on' differs from *drive* (and all other pseudocoordination verbs) in that it can alternatively take a complement in the infinitive. The infinitive is the common option, and intuitions about its use in pseudocoordination are uncertain.

2.2 Aspect

In pseudocoordinations with *drive*, the second predicate denotes an activity that extends over some time, as in (7), or it is a telic predicate which is given an incomplete interpretation, as in (8) and (9) (Faarlund et al 1997:648-49).

(7) Jeg driver og leser til førerkortet
I carry.on and read to driver.license
'I am reading for the driver's license.'
(8) Vi drev og laget et dansenummer
we carried.on and made a dance.act
'We were making a dance act.'
(9) Yngstemann driver og forlater redet nå
junior carries.on and leaves nest.DEF now
'Junior is leaving home now.'

drive can also give habitual and iterative interpretations, as in (10) and (11) (Faarlund et al 1997:649-50). It is usually not used with stative verbs, cf. (12).

(10) Hun drev og hostet og harket i bakgrunnen
she carried.on and coughed and hawked in background.DEF
'She was coughing and hawking in the background.'
(11) Hun drev og sa hun veide 50 kg i fjor
she carried.on and said she weighed 50 kilo in last.year
'She used to say that she weighed 50 kilo last year.'
(12) *Hjertet driver og symboliserer kjærligheten
heart.DEF carries.on and symbolizes love.DEF
'The heart symbolizes love.' [intended]

drive could be seen as a kind of general imperfective, covering progressive, habitual, and iterative. It would then be expected that it could be used with stative verbs. As an alternative, pseudocoordination with *drive* could be described as pluractional - there is usually a "plurality of action". (This was proposed for Swedish pseudocoordination with *hålla på* 'carry on' by Blensenius 2015a.) The subject often performs repeated actions, or the same part of an action, not necessarily oriented toward a result. Pluractionality is in general not compatible with stativity; this explains why (12) is not possible.

Pseudocoordinations with *drive* sometimes show a secondary subjective meaning that can be found in progressives in various languages (see e.g.

Breed 2017): It can make a statement more intense, and it can make the event denoted by the second verb appear as something negative, probably because it implies that there is "too much" of the action. An example of this negative effect is (13) from the Norwegian Bible (2011 translation, Jeremia 29, 26). This negative use is also - unexpectedly - possible with some stative verbs, as in (14).

(13) alle disse som er fra vettet og driver og profeterer ..
all these who are out.of mind.DEF and carry.on and prophesy
'all these who are out of their minds and keep prophesying'
(14) Mannen driver og synes synd på seg selv
man.DEF carries.on and feels sorry for REFL self
'The man feels sorry for himself.'

2.3 Agentivity

It has been claimed that *drive* must take an agentive second predicate (Hesse 2009:121, Vagstad 2010:16). This might be taken to be the most unmarked, and probably the original way of using *drive*. However, the generalization is not true of actual language use today, and this fact will play an important part in the discussion here. Two examples are (15) and (16).

(15) Du er en av dem som driver og får kunstneriske kriser
you are one of them who carry.on and get artistic crises
'You are one of them who keep getting artistic crises.'
(16) Vannet driver og forsvinner fra dusjene
water.DEF carries.on and disappears from showers.DEF
'The water keeps disappearing from the showers.'

Some sentences with non-agentive verbs might sound a bit substandard to me, but they are acceptable. Sentences such as (17)-(20) with copula verbs, passive verbs and verbs with an expletive subject are a bit more marked, but not unacceptable.

(17) Møkkahesten driver og blir tam
shit.horse.DEF carries.on and becomes tame
'The shit horse is getting tame.'
(18) Jeg driver ikke og blir refusert to ganger daglig
I carry.on not and become rejected two times daily
'I don't get rejected twice a day.'
(19) Det dreiv og hoppa rådyr rundt på jordet
EXPL carried.on and jumped roes around on field.DEF
'Roes were jumping around in the field.'

(20) når det driver og blåser sånn som det gjør
when EXPL carries.on and blows such as EXPL does
'when it is blowing like it is'

3. Grammatical properties

I take the traditional position that Scandinavian pseudocoordinations are - usually - subordinating constructions (Lødrup 2002, 2014a). This is the position of the great Danish grammarians Jespersen (1895) and Diderichsen (1957:156), and the Norwegian Western (1921:47-54). The first verb takes a verbal complement, "an infinitive in disguise" (Jespersen 1895:170, original wording *en forklædt infinitiv*). There are, however, pseudocoordinations that call for a complex predicate analysis. A clear case is those with *ta* 'take' (Lødrup 2002, Vannebo 2003); see section 6.2.

What is then the grammatical status of *drive*? It could first be noted that *drive* differs from all other pseudocoordination verbs - except the clearly grammaticalized *ta* 'take' - in that its syntactic and semantic properties are clearly different inside and outside pseudocoordination. In a pseudocoordination, *drive* cannot take an argument of its own,[2] unlike other pseudocoordination verbs such as e.g. *sitte* 'sit' and *ringe* 'call, as shown in (21)-(22).

(21) Da satt han (på kontoret) og arbeidet
then sat he in office.DEF and worked
'He was working (in his office) then.'
(22) Da ringte han (til mamma) og klaget
then called he to mom and complained
'He called (his mom) and complained then.'

Lødrup (2002) proposed briefly that there are two pseudocoordination verbs *drive*, one agentive equi verb and one subject-to-subject-raising verb. Some speakers might have an agentive equi verb *drive* only. To the extent that they exist, these are the speakers that Hesse (2009:121) and Vagstad (2010:16) base themselves on when they say that *drive* takes agentive second verbs only. These speakers have what one might assume to represent an older and more original use of *drive*. Other speakers can use *drive* as a raising verb in sentences such as (15)-(20) above. Why could it then be necessary to assume

[2] *drive* can be combined with the particle *på* (literally 'on'), which makes *drive* unambiguously agentive. With this particle, *drive* can be used with the same meaning inside and outside of pseudocoordination.
(i) Han drev på (og arbeidet)
he carried.on on and worked
'He kept on (working).'

that these speakers have two verbs *drive*? An alternative could be that there is only one verb *drive* - the raising verb. However, there is at least one phenomenon that makes it necessary to assume that *drive* can be an agentive equi verb.[3] The verb can passivize; it then takes an expletive subject, as in (23) and (24).

(23) Det drives og lages nye nettsider
EXPL carry.on.PASS and make.PASS new webpages
'New web pages are being made.'
(24) Det drives og forskes på det nu
EXPL carry.on.PASS and research.PASS on it now
'It is being researched now.'

The analysis of passives such as (23)-(24) raises some challenges. Lødrup (2002) and (2014b) assumed that agentive *drive* - as well as most other pseudocoordination verbs - takes an XCOMP with functional control (called VCOMP in Lødrup 2002). The simplified f-structure for *Vi driver og forsker* 'we carry.on and research' is then as in (25).

(25)
PRED 'drive <(↑SUBJ) (↑XCOMP)>'
SUBJ [PRED 'vi']
XCOMP [SUBJ, PRED 'forske <(↑SUBJ)>']
VFORM PRESENT

However, this analysis is not compatible with passives such as (23)-(24). A verb that takes a complement with obligatory subject control is not expected to passivize ("Visser's generalization", Bresnan 1982:354). An alternative is to assume that the agentive *drive* takes anaphoric control, and that the second part of the coordination is a COMP with a PRO subject. The simplified f-structure for *Vi driver og forsker* 'we carry.on and research' is then as in (26).

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[3] Another phenomenon that seems to require an agentive equi verb *drive* is the presentational focus construction.
(i) Det driver noen og reparerer taket på nabohuset
EXPL carries.on somebody and repairs roof.DEF on neighborhouse.DEF
'Somebody is repairing the roof of the neighborhouse.'
This kind of sentences seem to require the agentive *drive* (Lødrup 2002). For some reason, a raised argument cannot normally be the object in a presentatonal focus sentence (Lødrup 2004:74).
(ii) *Det pleier noen å reparere taket på nabohuset
EXPL uses somebody to repair roof.DEF on neighborhouse.DEF
'Somebody uses to repair the roof of the neighborhouse.' [intended]
This phenomenon does not seem to be well understood.

(26)
PRED ‘drive <(↑SUBJ) (↑COMP)>’
SUBJ [PRED ‘vi’]
COMP [SUBJ PRO; PRED ‘forske <(↑SUBJ)>’]
VFORM PRES

When there is anaphoric control, there is no reason *drive* should not take the impersonal passive. A new problem then arises concerning the second parts of (23)-(24). They look like impersonal passives (e.g. *og forskes på det nu* ‘and research.PASS on it now’). However, they cannot have an expletive PRO subject, because expletive subjects of the *there* type cannot control PRO. It is therefore necessary to reconsider the analysis of the second part of these pseudocoordinations.

The point of departure for an alternative analysis is the general requirement that the pseudocoordination verb and the first verb following *og* 'and' must have the same inflectional form. The Norwegian morphological passive is usually considered inflectional (e.g. Enger 2000). One could therefore assume that the passivity of the second verb is not real - it is an active verb that has a passive form because of the requirement for "same inflectional form". With this analysis, PRO realizes the external role of the second verb. It is controlled by the implicit agent of the first verb. The simplified f-structure for *Det drives og forskes* 'EXPL carry.on.PASS and research.PASS' is then as in (27).

(27)
PRED ‘drives <(↑COMP)> (↑SUBJ)’
SUBJ [FORM ‘det’]
COMP [SUBJ PRO; PRED ‘forske <(↑SUBJ)>’]
PASSIVE +
VFORM PRESENT

The structure is the same as for e.g. (28).

(28) Det fortsettes å forske
EXPL continue.PASS to research
‘They continue doing research.’

Speakers who allow both raising sentences such as (15)-(20) and passives such as (23)-(24) must be assumed to have two verbs *drive* - an equi verb and a raising verb. It should be mentioned, however, that the passive of *drive* does not seem to be very frequent.

4. The larger picture

4.1 *drive* as an aspectual verb

Outside pseudocoordination, the verb *drive* has different meanings. It can be intransitive and mean 'be in motion'[4], as in (29), or transitive and mean 'put in motion', etc. as in (30).

(29) Båten driver
boat.DEF drifts
'The boat is drifting.'
(30) Han driver kuene hjem
he leads cows.DEF home
'He leads the cows home.'

More interesting in this context is its use with the meaning 'run', 'keep going', 'be occupied with'. The verb then takes an object, as in (31) or an oblique PP with the preposition *med* 'with', as in (32).

(31) Han driver et firma
he runs a company
'He runs a company.'
(32) Firmaet driver med reklamesalg
company.DEF carries.on with advertising.sale
'The company sells advertising.'

Especially interesting in this context is the use of *drive* in sentences in which the PP has an infinitival as its complement, as in (33). In these sentences, the action has to be agentive and intentional (Faarlund et al. 1997:648).

(33) Firmaet driver med å selge reklame
company.DEF carries.on with to sell advertising
'The company sells advertising.'

Hesse (2009:120) proposed that sentences such as (33) were the starting point for the diachronic development of pseudocoordination with *drive*. In my analysis, the syntactic structure of (33) with a PP and an infinitive is not very

[4] This verb can also be used with the transferred meaning 'walk aimlessly around'. It can then be found in pseudocoordination, such as (i). This must be seen in connection with the fact that movement verbs such as *gå* 'walk' can take pseudocoordination.
(i) Om dagen driver han rundt og studerer sine medmenneskers oppførsel
in day.DEF drifts he around and studies his fellow.citizens.POSS behavior
'In the day, he drifts around, studying the behavior of his fellow citizens.'

different from that of a pseudocoordination with the agentive *drive*. In both cases there is a complement construction with a PRO subject.

drive finds its place in the system of aspectual verbs. Aspectual verbs can occur with or without this kind of PP (Lødrup 2004:77-78), cf. (34).

(34) Han begynte / sluttet / fortsatte (med) å spille munnspill
he started stopped continued with to play harmonica
' Han started / stopped / continued playing the harmonica.'

It is not easy to pinpoint what the preposition contributes to the meaning. It is as if the sentences with the preposition tend to picture the content of the infinitival as a whole - maybe a job or a project or a hobby - even if it consists of parts that are not consecutive in time. Without the preposition, (34) could simply mean that 'he' started or stopped or continued playing the harmonica which he brought with him to the party. With the preposition, it would be more natural to understand the playing as e.g. a new hobby.[5]

The effect of the preposition is the same with *drive*. The sentences with the preposition tend to picture the content of the infinitival as a whole. A good example is (35) - the next sentence in the text says that this is actually also a kind of profession (Norwegian: *Det er faktisk et slags yrke det også*).

(35) en mann som driver med å slippe duer i bryllupsfeiringer
a man who carries.on with to release doves in wedding.celebrations
'a man who releases doves in wedding celebrations'

There seems to be no habitual or iterative interpretation of *drive med*. Examples (36)-(37) (constructed on the basis of (10)-(11) above) are strange, and give the impression that the subordinate event is a kind of project or hobby for the subject.

(36) #Hun drev med å hoste og harke i bakgrunnen (constructed)
she carried.on with to cough and hawk in background.DEF
'She was coughing and hawking in the background.' [intended]
(37) # Hun drev med å si hun veide 50 kg i fjor (constructed)
she carried.on with to say she weighed 50 kilo in last.year
'She used to say that she weighed 50 kilo last year.' [intended]

[5] A complication is that there is an ambiguity here. What is said concerns these PPs understood as complements. They could, however, also be understood as adjuncts, which is the only option in (i). The preposition can then be replaced by *ved* 'by'.
(i) Han begynte showet med å spille munnspill
he started show.DEF with to play harmonica
'He started the show by playing the harmonica.'

Aspectual verbs have been assumed to be ambiguous between equi and raising since Perlmutter (1970). This assumption has been discussed several times, for example Fukuda (2007) argues (for English) against assuming an equi option. For Norwegian, passives such as (28) above, reproduced as (38), give evidence for an equi option, because passivization requires an external role (Lødrup 2004:76-77).

(38) Det fortsettes å forske
EXPL continue.PASS to research
'They continue doing research.'

With a preposition, the aspectual verbs cannot take raising - this true of both the aspectual verbs and *drive*, as shown in (39)-(40).

(39) *Det fortsatte med å regne
it continued with to rain
'It kept raining.' [intended]
(40) *Det drev med å regne
it carried.on with to rain
'It was raining.' [intended]

An explanation of the ungrammaticality of (39)-(40) must be based upon the fact that the PP creates an extra layer in the syntactic structure, in which the infinitive is the object of the preposition. In LFG, raising to subject is not allowed out of an object (only out of an XCOMP, see Ørsnes 2006).

It has been shown that *drive* follows the pattern of the aspectual verbs. In pseudocoordinations, *drive* can take an agentive subject and a COMP with anaphoric control, or it can be a raising verb and take an XCOMP with functional control. With a PP, it can only be agentive and take anaphoric control. The difference from aspectual verbs is that *drive* without the preposition induces the pseudocoordination requirement that the second verb must have the same inflectional form as the first verb.

4.2 Restructuring

Passive sentences such as (41)-(42) need a separate discussion.

(41) (dette skal ikke) drives og debatteres gjennom avisen
this shall not carry.on.PASS and discuss.PASS through paper.DEF
'One should not be discussing this in the paper.'
(42) Har en del egg som drives og klekkes
have a part eggs that carry.on.PASS and hatch.PASS
'(I) have some eggs that are hatching.'

Both *drive* and the second verb have passive morphology, and the grammatical subject realizes the internal argument of the second verb. These sentences are so-called long passives. The passivized predicate consists of two verbs that have restructured to constitute one complex predicate in a monoclausal construction.[6] The simplified f-structure for *Noen egg drives og klekkes* 'some eggs carry.on.PASS and hatch.PASS' is then as in (43).

(43)
$$\begin{bmatrix} \text{PRED } \text{‘drives-klekke<(}\uparrow\text{SUBJ)>’} \\ \text{SUBJ [PRED ‘egg’]} \\ \text{PASSIVE +} \\ \text{VERBFORM PRESENT} \end{bmatrix}$$

The option of restructuring is another similarity between *drive* and aspectual verbs. Aspectual verbs often show restructuring, for example in Romance (see e.g. Cinque 2004). This is also the case in Norwegian, where aspectual verbs can be found in long passives (Lødrup 2014c); an example is (44). (Note that long passives in Norwegian often have passive second verbs; this is seen as a kind of agreement in Lødrup 2014b, 2014c.)

(44) Dette må fortsettes å gjøre(s)
this must continue.PASS to do.(PASS)
‘We must continue to do this.’

The existence of long passives with aspectual verbs does not imply that aspectual verbs are always parts of complex predicates. For example, sentence (38) above could not have a complex predicate, because the passive only affects the aspectual verb. The same point could be made for *drive*. Sentences such as (18) above, in which the passive only affects the second verb, show that *drive* cannot be assumed to always be a part of a complex predicate.

[6] There is admittedly another possible analysis of sentences such as (41)-(42). One could assume that the second verb is the "real" passive, while the first verb is the raising verb which agrees in inflectional form. This kind of analysis is needed for certain Norwegian sentences with e.g. *behøve* ‘need’ (Sells 2004, Julien and Lødrup 2013). However, this analysis could also be applied to sentences with aspectual verbs such as (44) (Julien and Lødrup 2013). This alternative analysis also involves restructuring (Sells 2004, Julien and Lødrup 2013), so the point about restructuring still stands.

5. The development of pseudocoordination with *drive*

It was mentioned that pseudocoordination with *drive* is unknown in Old Norse and the other Scandinavian languages. It is not possible to track its origin in texts, because Norwegians wrote Danish for centuries. When writing pure Danish became less important, in the late 19th century, pseudocoordination with *drive* could be found. Example (45), from 1889, is from a novel by the author Bjørnstjerne Bjørnson. Example (46), from 1882, is from the periodical Fedraheimen (written in what was later called Nynorsk). The habitual use of *drive* seems to be established from the oldest examples, such as (46).

(45) In i en lystig spansk vise drev han og sang værs efter værs
in in a merry Spanish song carried.on he and song verse after verse
'He was singing verse after verse into a merry Spanish song.'

(46) Dotteri Athenaïs, ho driv og vaskar for Folk
daughter.DEF Athenaïs she carries.on and washes for people
'The daughter Athenaïs washes for other people.'

The development of the raising verb *drive* seems to be going on now. I have not come across the raising verb *drive* in 19th-century texts; it is not clear if this is accidental, or if the raising option did not exist then. (Systematic searches are not possible, for various reasons.) It is maybe telling that no dictionaries or grammars that I have checked give examples with the raising verb.

The development of the raising verb involves a bleaching of the verb's meaning. Especially important is the reduction of the 'do something' component, which leads to the loss of an external role, and the rise of the raising verb. The verb's meaning is now primarily aspectual / pluractional, and there is a different control relation, functional control of an XCOMP.

This kind of development is well known from the grammaticalization of other verbs in the languages of the world. A rather parallel case is verbs for 'go' and 'come'. Process verbs are often grammaticalized to what Heine and Kuteva (2002:52) call "auxiliaries denoting tense or aspect functions". Their examples are verbs meaning 'begin', 'come to', 'do', 'finish', 'go to', 'keep', 'leave' and 'put'. What is special in the case of *drive* is that there is again a development that increases the parallel with the aspectual verbs. After the rise of the raising verb, *drive* follows the pattern of the other aspectual verbs: It can be an equi verb with the preposition *med* 'with', an equi verb without the preposition, or a raising verb (without the preposition).

6. Comparison with other pseudocoordinations

6.1 General

Pseudocoordination is often treated as one unitary phenomenon. However, pseudocoordinations with different first verbs have different properties (Lødrup 2002), and pseudocoordinations with *drive* are different from the others.

6.2 Pseudocoordination with *ta* 'take'

Pseudocoordination with *ta* 'take' represents a clear case of grammaticalization (Vannebo 2003), with parallels in other European languages (Coseriu 1966). An example is (47).

(47) Hun tok og kysset ham
she took and kissed him
'She (suddenly) kissed him.'

The first verbs *drive* and *ta* are the only verbs that are not used with the same meaning inside and outside of pseudocoordinations. The meaning of *ta* 'take' is clearly bleached, and the verb is used without an otherwise obligatory object. However, *ta* is syntactically very different from *drive*. Pseudocoordination with *ta* never shows equi or raising. It is a restructuring construction, as can be seen from the way syntactic processes apply. Syntactic processes that operate on predicates cannot involve one of the two verbs. It is impossible to passivize the second verb only, as in the ungrammatical (48). To the extent passivization is possible, it has to involve both verbs - the whole complex predicate - as in (49) (Lødrup 2002, 2014a).

(48) *Han tok og ble kysset
he took and became kissed
'He was (suddenly) kissed.' [intended]
(49) Alt styret (..) blir tatt og lagt lokk på av TV 2
all fuss.DEF becomes taken and put lid on by TV 2
'TV 2 puts a lid on all the fuss.'

6.3 Pseudocoordination with posture verbs

An important group of pseudocoordinations is those with posture verbs, as in (50).

(50) Da satt han og arbeidet
then sat he and worked
'Then he sat there working.'

These pseudocoordinations show syntactic similarities to pseudocoordinations with the equi verb *drive*. Both the posture verb and the second verb allow syntactic processes that do not involve the other verb (Lødrup 2002, 2014a), such as the passive and the presentational focus construction in (51)-(52).

(51) Der sitter Tone Damli Aaberge og blir stelt på håret
there sits Tone Damli Aaberge and becomes fixed on hair.DEF
'Tone Damli Aaberge is sitting there, getting her hair done.'
(52) Da satt det en mann der og arbeidet
then sat EXPL a man there and worked
'Then a man sat there working.'

Another similarity is that both pseudocoordinations with posture verbs and pseudocoordinations with *drive* can show signs of restructuring - somewhat marginally (see section 4.2 above). Sentence (53) must be analyzed as a long passive of a complex predicate with a posture verb as the first verb.

(53) Tegninger (...) skal (...) ikke sittes og mekkes på i etterkant
drawings shall not sit.PASS and fix.PASS on in retrospect
'One should not fix drawings after they are finished.'

An important difference between *drive* and posture verbs is that posture verbs do not allow subject-to-subject raising in pseudocoordination.

It was proposed above that the agentive *drive* takes a COMP with a PRO subject. This analysis can be transferred to posture verbs, and to some other pseudocoordination verbs, such as movement verbs like *gå* 'walk', and communication verbs like *ringe* 'phone'.[7] In Lødrup (2002), all these verbs were assumed to take an XCOMP with functional control (called VCOMP in Lødrup 2002).

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[7] The COMP analysis also solves a problem that was left unsolved in Lødrup (2016:397 note 12), concerning sentences such as (i).
(i) Det kom en mann styrtende og brølte
EXPL came a man rushing and roared
'A man came rushing and roared.'
Lødrup (2016) argued that the present participle *styrtende* 'rushing' is an XCOMP. However, this analysis was not compatible with his assumption that the second part of the pseudocoordination (*og brølte* 'and roared') was also an XCOMP. If the second part of the pseudocoordination is a COMP, as proposed here, this problem disappears.

An argument for the COMP analysis given above was the option of a passive *drive*. The same kind of argument can be given for posture verbs. Example (54) has the same structure as (23)-(24) above.

(54) Men det sittes og produseres
but EXPL sit.PASS and produce.PASS
'One sits producing.'

Many researchers see pseudocoordination with posture verbs as a progressive construction that is grammaticalized, or on its way to being grammaticalized (e.g. Kuteva 2001, Hilpert and Koops 2008, Hesse 2009, Hansen and Heltoft 2011:988). Others are more skeptical about the idea of grammaticalization (Tonne 2001, Behrens et al 2013, Lødrup 2014a, 2017, Ross and Lødrup 2017).

Posture verbs in pseudocoordinations do not show the bleached meaning that is typical of grammaticalization (Lødrup 2017). They are used with the same meanings as they have outside pseudocoordination - which in the Scandinavian languages include various transferred and metaphorical uses, with options for inanimate and abstract subjects (see e.g. Berthele et al. 2015). An important argument against grammaticalization is given by the fact that posture verbs in pseudocoordination keep their regular syntactic properties; for example, they allow the presentational focus and the passive construction (examples (51) and (54) above).

Blensenius (2014, 2015b) argues that pseudcoordinations with posture verbs (in Swedish) are not progressive. He compares the posture verbs with the progressive *hålla på* 'keep on' (which was mentioned in section 2.1). It is clear that *drive* (which does not exist in Swedish) patterns with the latter in relevant respects. The following is based upon Blensenius (2014), (2015b).

Scandinavian differs from English in that a simple verb form can have an imperfective interpretation. It has been observed that the second predicate in pseudcoordinations with posture verbs is normally atelic (Tonne 2001:77 on Norwegian, Blensenius 2015b:14, 44 on Swedish). These predicates would usually get a progressive interpretation even without the posture verb. On the other hand, the interpretation of a telic second predicate is not necessarily affected by the posture verb. An example is (55). This example could be compared to (11) with *drive*, reproduced as (56), which gets an iterative interpretation.

(55) Hun satt og sa hun veide 50 kg i fjor (constructed)
she sat and said she weighed 50 kilo in last.year
'She said that she weighed 50 kilo last year.'
(56) Hun drev og sa hun veide 50 kg i fjor
she carried.on and said she weighed 50 kilo in last.year
'She used to say that she weighed 50 kilo last year.'

This lack of a progressive effect can also be seen in that a posture verb can take a stative second verb (Tonne 2001:80-81). With progressives, stative verbs are not normally allowed.

(57) Nå står den og symboliserer at det ikke nytter å gi seg
now stands it and symbolizes that it not works to give REFL
'Now it [the sunflower] is standing there, symbolizing that you should not give up.'

It could also be mentioned that *drive* and posture verbs do not exclude each other, cf. (58).

(58) Sitter og driver og prøver å synce outlook 2003 med T630
sit and carry.on and try to syncronize Outlook 2003 with T630
'(I) sit here trying to syncronize Outlook 2003 with T630.'

We see, then, that the traditional analysis of pseudocoordinations with posture verbs as grammaticalized progressive constructions cannot be upheld. What has traditionally been said about them seems to be more apt for pseudocoordinations with *drive*.

7. Conclusion

Pseudocoordination is often discussed as if it were one unitary phenomenon. It turns out, however, that different types of pseudocoordinations have different grammatical properties. Pseudocoordination with *drive* has properties that are not shared by other pseudocoordinations. It was argued that *drive* shows similarities with aspectual verbs, and finds a place in their system. Especially interesting is the development of a subject-to-subject raising verb *drive* through grammaticalization. This is the only pseudocoordination verb that allows raising.

The syntactic analysis of pseudocoordination raises challenges. It was argued that pseudocoordination with the equi verb *drive* - as well as most other pseudocoordinations - takes anaphoric control. This is a revision of the analysis in Lødrup (2002).

CORPORA

NoTa-Oslo (Norsk talespråkskorpus - Oslodelen)
http://www.tekstlab.uio.no/nota/oslo/english.html
Nordic Dialect Corpus
http://www.tekstlab.uio.no/nota/scandiasyn/index.html

Leksikografisk bokmålskorpus
http://www.hf.uio.no/iln/tjenester/kunnskap/samlinger/bokmal/veiledningkorpus/
NoWaC (Norwegian Web as Corpus):
http://www.hf.uio.no/iln/om/organisasjon/tekstlab/prosjekter/nowac/index.html

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Minimal C-structure: Rethinking Projection in Phrase Structure

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Abstract

This paper addresses the formal properties of constituent structure (c-structure). We demonstrate inadequacies in the formalization of traditional X′ theory by Bresnan (2001) and Bresnan et al. (2016), and in the alternative proposal of Marcotte (2014). We propose "minimal c-structure" as a new approach to phrase structure within Lexical-Functional Grammar, which almost entirely eliminates non-branching nodes, and neatly captures the distinction between projecting and non-projecting words. Our proposal is fully formalized, and has been successfully tested by an XLE implementation.

1 Introduction

In Lexical-Functional Grammar (LFG), constraints on surface phrasal constituency are expressed in terms of phrase structure rules and represented by tree diagrams: "A commonly used representation of c-structure is the context-free phrase structure tree, defined by context-free phrase structure rules augmented by regular expressions" (Bresnan 2001: 44). The primitive elements in c-structure are nodes, labelled according to syntactic category and projection level. Our concern in this paper is the representation of projection level.[1] In this paper we show that existing formalizations of phrase structure in LFG are both inadequate and license superfluous structure. We propose a new formalization of phrase structure which eliminates redundancy while also capturing the full variety of phrase structures assumed in LFG.

Section 2 summarizes the formalization of X′-theoretic phrase structure proposed in Bresnan (2001), unmodified in Bresnan et al. (2016). Section 3 reviews a recent proposal by Marcotte (2014) to remove the notion of levels of structure from the formal properties of c-structure. Section 4 proposes a new formalization of phrase structure. Section 5 discusses further implications of our approach. A partial grammar for English based on our XLE (Crouch et al. 2011) implementation is provided in the appendix.

2 Current assumptions in LFG

We take Bresnan (2001; unmodified in Bresnan et al. 2016) as representative of standard assumptions regarding the formal properties of c-structure. Bresnan (2001: 100) describes the formal properties of c-structure nodes: "Formally, X′ categories

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[1] Syntactic category labels, such as N(oun), V(erb), P(reposition), D(eterminer), etc., can be treated as atomic or can be decomposed into features (Bresnan 2001, Dalrymple 2017); syntactic categories are not the focus of this paper, and we will assume an atomic approach for simplicity.

can be analyzed as triples consisting of a categorical feature matrix, a level of structure, and a third, privative feature F, which flags a category as 'function' (F) or unspecified as to function (lexical)." The "level of structure" feature, which we call BAR following Andrews & Manning (1999), has three values: 0, 1, 2. These digits each correspond to a level of structure which is represented notationally using the traditional X-bar symbols: X^0 for [BAR 0], X' for [BAR 1], and XP for [BAR 2]. The use of integers in this context implies that, in an endocentric projection, a mother must have a BAR value higher than its daughter.[2] The question of dominance is not discussed formally by Bresnan, but the familiar templatic description of X-bar principles (1) makes it clear that some additional mechanism is intended to enforce the dominance sequence.

(1) a. **Specifier phrase structure rule**
$XP \rightarrow X' , YP$

b. **Complement phrase structure rule**
$X' \rightarrow X^0 , ZP$

Marcotte (2014) criticizes this lack of formalization of dominance: "This dominance sequence is implied by the use of integers in the feature nomenclature, but does not constitute a formal requirement." That is, we intuitively know that 2 is above 1, but this does not come for free in the formal system.

The model put forward by Bresnan (2001) seems straightforward and intuitive, but it does not capture the diversity of structures used in descriptive analyses, and results in the postulation of unnecessary (and undesirable) structure, which can only be eliminated by the postulation of additional complications to the system. In the following subsections we discuss the main shortcomings of Bresnan's proposal.

2.1 Non-projecting words

Bresnan et al. (2016) differ in their theory of c-structure from Bresnan (2001) by incorporating the concept of non-projecting categories, as developed primarily by Toivonen (2003). Non-projecting categories differ from projecting categories in that they do not project any levels of structure, but are similar in being (potentially) preterminal nodes. They are technically not endocentric, and do not license any complement or specifier positions. In the current conception of non-projecting words, they only interact with the phrase structure through adjunction. Toivonen (2003) limits adjunction of non-projecting words to projecting heads (X^0). However, others have proposed allowing such adjunction to another non-projecting word or to a maximal phrase level (XP) (Spencer 2005, Arnold & Sadler 2013).

The close relation between non-projecting categories and zero-level projecting categories is evidenced by the notation: Toivonen (2003) proposes that X^0 be

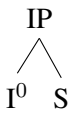
[2]The formal properties of exocentric structures are not discussed by Bresnan (2001). We provide a formal analysis of exocentric structures in §5.2.

used to represent a preterminal (i.e. BAR 0) projecting node, $\hat{X}$ to represent a non-projecting node, and X as a cover for all zero level categories. Bresnan et al. (2016) incorporate the concept and notation of non-projecting categories into the theory of c-structure, but do not revise the formal analysis of c-structure nodes to account for this new node type. What is the BAR value of a non-projecting node? Since non-projecting nodes are preterminal, they might be considered to have a BAR value of 0 (as implied by their grouping with X^0 under the cover X). But if the BAR of a non-projecting node is 0, how is it distinguished formally from a projecting head? Bresnan et al. (2016) provide no formal account.

2.2 One-level projections

Some versions of X-bar theory assume that all categories project the same number of levels of structure. Kornai & Pullum (1990) call this "Uniformity". Unless otherwise stated, it is normally assumed that all categories have two levels of projection.[3] In practice, Uniformity is not part of the LFG version of X-bar theory. For example, Bresnan (2001: 127) mentions in passing that the "specifier of IP is taken to be null (omitted) in Welsh, as a parametric choice." The structure given is represented in (2). In this structure, a head X^0 is immediately dominated by a maximal projection node, XP.[4]

(2) Single-level endocentric structure (Bresnan 2001: 127):



This "parametric choice" of allowing one or two levels of structure in an endocentric projection has not been formalized. The mother node of a one-level endocentric structure must share some property with the mother node of a two-level endocentric structure; this is represented, but not formalized, by the '-P' element of the node label. But in formal terms, what is the BAR of the XP in a one-level structure? If its BAR is 1, it would be formally impossible to select the class of maximal projections. Presumably, since it is represented by XP, its BAR is 2. But this would have interesting consequences in regard to the question of dominance sequence discussed above. In this system, a node whose BAR is 0 can apparently be immediately dominated by a node whose BAR is 2. So the dominance sequence implied by the integer values of BAR does not have to be sequential.[5] Just as there

[3]The assumption that all syntactic heads must project two levels of structure appears to have become the X-bar standard assumption with the publication of Chomsky (1986). There were a variety of earlier proposals, e.g., three levels (Jackendoff 1977) or one level for lexical categories and two levels for functional categories (Fukui 1986). See Muysken (1982) for an overview.

[4]In other places, Bresnan allows similar structures as an effect of Economy of Expression (§2.3). The case under discussion here involves a structure that will never have a mid-level node that could be subject to the constraints of Economy of Expression.

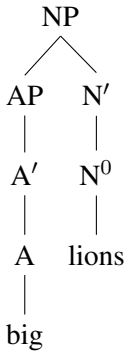
[5]Kornai & Pullum (1990: 28) note that many linguists have been inconsistent on this point violating what they call "Succession".

is a need for formal constraints on the dominance sequence (such that [BAR 1] cannot dominate [BAR 2]), there is also a need for formal constraints that allow the non-sequential dominance sequence (such that [BAR 2] can dominate [BAR 0]). No such constraints are proposed or formalized by Bresnan (2001).

2.3 Non-branching structures

In the standard approach to X′ theory, it is assumed that if a head can project structure, the spine of that structure is present even when non-head elements of the structure are not present. Kornai & Pullum (1990) call this assumption "Maximality". In LFG, Maximality is enforced by phrase structure rules that only select maximal phrases (XP) as non-head daughters. The result of Maximality is that when a head which can potentially co-occur with a complement and specifier appears alone in a constituent, its structure must be analyzed with at least two non-branching nodes, like the AP in (3). Note that the NP in (3) also has one non-branching node since there is no complement phrase.

(3) Non-branching nodes (Bresnan et al. 2016: 90):



Given the principled objection to empty categories in LFG,[6] Maximality requires the assumption that all complement and specifier positions can be optional. Dalrymple et al. (2015) call this type of optionality "Daughter Omission". Bresnan generalizes Daughter Omission over all phrase structure rules. Dalrymple et al. (2015: 386-388) point out that it is problematic to generalize Daughter Omission since there are cases when a daughter node is best analyzed as obligatory. In addition, Kornai & Pullum (1990: 31, 46) state that there is essentially no analytical value in assuming Maximality if those levels can have non-branching (or empty) nodes. The assumption of Maximality is satisfied with no corresponding empirically-observable content. In other words, it is a non-falsifiable assumption.

The non-branching nodes required by Maximality are in tension with a general principle of Economy of Expression. In the context of c-structure, Economy of Expression is a principle which states that, all else being equal, the smallest licit c-structure is the optimal one. This tension is noted by Jackendoff (1977: 36)

[6] Except perhaps as a "last resort" (Bresnan et al. 2016: 205).

who writes that Maximality comes "at the expense of some otherwise superfluous structure." The intuition is that the c-structure in (3) would be better if it did not have non-branching nodes that do not contain any unique grammatical information other than their BAR.

Bresnan (2001: 91) develops this intuition into what Dalrymple et al. (2015) call "X′ Elision". X′ Elision is a process of pruning all unnecessary nodes from a well-formed c-structure so that it is as small as possible. X′ Elision is therefore a complication of the grammar: it is a derivational process that, given an initial production of c-structures which are well-formed according to the phrase structure rules, then modifies those c-structures in ways that cannot be derived via the phrase structure rules. Given this complication, the position of Dalrymple et al. (2015) is that a general principle of Economy of Expression is not satisfactory motivation for incorporating X′ Elision in the grammar. Our proposed theory of c-structure improves on both of these positions by rejecting Maximality. It allows phrase structure rules to produce trees that satisfy the Economy of Expression principle without requiring a secondary operation like X′ Elision. It also removes the need to assume a generalized version of Daughter Omission. (See §6 for discussion of optionality in our approach.)

2.4 Conclusion

Some of the issues in the proposals of Bresnan (2001) could technically be resolved without fundamental changes to the system, e.g. by adding a feature to indicate whether a node is projecting or not, and adding a metaconstraint to allow non-sequential dominance sequences. However, such a solution would fail to capture the generalizations and subtleties that will be represented in the formal analysis proposed in §4. For example, a feature indicating non-projecting status would also occur on all nodes of level 2, without any explanation for why non-projecting words and XP nodes form this class. In addition to providing an elegant account of the issues in §2.1 and §2.2, the formal analysis of §4 also avoids the tension between Maximality and Economy of Expression highlighted in §2.3.

3 Marcotte (2014)

Marcotte (2014) reviews three formal approaches to c-structure and syntactic categories with a particular interest in the passing of information between nodes, such as the shared lexical (or functional) category features shared by a head and its mother. That particular problem is not addressed in this paper, but Marcotte's proposal is of interest because it also revises Bresnan's formal analysis of c-structure nodes. Marcotte attempts to simplify the formal properties of the system by removing the BAR feature and thus "allowing a reformulation of its insights with a reduced number of theoretical primitives…" (Marcotte 2014: 426). However, this simplification results in a system which cannot account for some basic syntactic

structures.

Marcotte's proposal is to remove the BAR feature, and to instead define the relationships between nodes in terms of dominance relations and shared category features, which he defines in terms of "x-structure". There are three basic definitions that define types of nodes in c-structure:

(4) a. PROJECTING NODE: A node projects iff its x-structure is identical with its mother's x-structure.
$Proj(*) \iff \chi(*) = \chi(\mathcal{M}(*))$

b. MAXIMAL PROJECTION: A node is a maximal projection iff it is not a projecting node.
$Max(*) \iff \neg Proj(*)$

c. TERMINAL: A node is a terminal iff no node has it as a mother.[7]
$Term(*) \iff \neg\exists n.\mathcal{M}(n) = *$

In (4), χ is a function from nodes to x-structures. $\mathcal{M}$ is the mother function from a node to its mother; $*$ represents the current node, and n represents any other node. In this system, there are four types of nodes, roughly equivalent to X^0, X', XP and $\hat{X}$. A projecting head ($\approx X^0$) is a node that meets the definitions of PROJECTING NODE (it has the same category as its mother) and TERMINAL (it is not the mother of any node).[8] A maximal projection ($\approx$ XP) meets the definition of MAXIMAL PROJECTION (it does not have a mother with identical features), and is not TERMINAL. Intermediate nodes ($\approx X'$) meet the definition of PROJECTING NODE, but not of TERMINAL. A non-projecting node ($\approx \hat{X}$) is both a MAXIMAL PROJECTION and a TERMINAL.[9]

Marcotte applies his approach to c-structure to the structure-function mapping principles, defining default positions for subjects, objects, heads, etc. For example (slightly simplified):

(5) **Marcotte (2014) "Endocentric c- to f-structure mappings"**

a. A projecting node shares the f-structure of its mother:
$Proj(*) \Longrightarrow \uparrow = \downarrow$

b. A SUBJ is a DP daughter of IP:
$$\begin{array}{ll} Max(*) & Max(\mathcal{M}(*)) \\ \chi = \mathrm{D} & \chi(\mathcal{M}(*)) = \mathrm{I} \end{array} \Longrightarrow (\uparrow \mathrm{SUBJ}) = \downarrow$$

[7] Presumably this is an accurate correction of a typographical error in the original which reads "A node is a terminal iff it [sic] node has it as a mother."

[8] Marcotte uses terminal to refer to what Bresnan calls a preterminal node. The lexical information at the bottom of the tree is not considered a node.

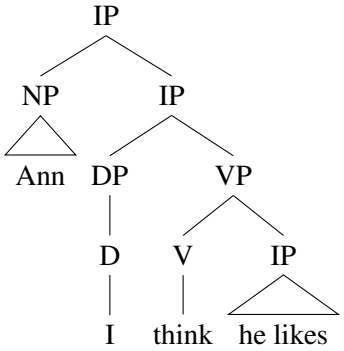
[9] This proposal is strikingly similar to that of Muysken (1982). Muyksen proposes eliminating bar levels and instead defines relationships in an endocentric projection in terms of two binary features: [±projection], [±maximal]. Muysken's [+maximal] is analogous to Marcotte's MAXIMAL PROJECTION, and [−maximal] parallels PROJECTING NODE. Muysken's [−projection] is analogous to TERMINAL, and [+projection] is similar to the non-Terminals. Muysken also discusses "non-projecting minor elements". He defines these in the same way as X^0: [−projection,+maximal].

Notably absent, however, is any definition of adjunction. In adjunction structures, the head and the mother have identical category features, just as in endocentric projection structures. The crucial difference between adjunction and projection is that in the former the head and its mother also share the same level of structure, while in the latter the mother has a higher level of structure. This distinction cannot be captured in Marcotte's (2014) proposal, because he has no equivalent to Bresnan's "level of structure" feature.

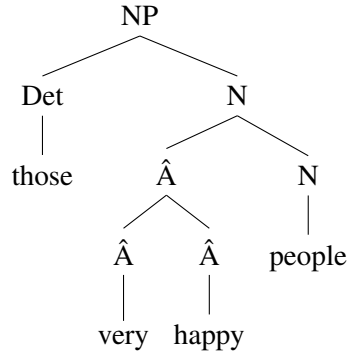
In addition, XP adjunction structures (as illustrated in (6)) pose a practical problem for Marcotte's definition of maximal phrases. In XP adjunction, a maximal phrase (XP) is the mother of another maximal phrase of the same category features. Such a structure is not possible in Marcotte's proposed system because, by definition, if a node's mother has the same category features, that node cannot be a MAXIMAL PROJECTION. It is a PROJECTING NODE.

The adjunction of non-projecting categories also poses difficulties for Marcotte's approach. For example, Arnold & Sadler (2013) propose that a non-projecting node can adjoin to another non-projecting node, a possibility which permits an insightful account of prenominal modification in English (7). However, in Marcotte's system, the modifiers *very* and *happy* would not count as non-projecting words. For Marcotte, a non-projecting word is both TERMINAL and MAXIMAL. A MAXIMAL PROJECTION is defined as a node that does not have the same category features as its mother, but in (7) both modifiers have the same category as their mother, so, by definition, they are PROJECTING, not MAXIMAL.[10] In addition, the mother of the two modifiers is a MAXIMAL PROJECTION in Marcotte's terms, but it is not TERMINAL since it has a daughter node that shares the same features. Thus this node does not meet the definition of a non-projecting node either.

(6)



(7)



These are just two examples of a number of analytical roadblocks that arise when applying Marcotte (2014)'s system to adjunction structures. It might be possible to address some of these issues by modifying his system, but it is hard to see how this could be done without compromising the formal elegance that motivates

[10]This example would not be a problem if, following e.g. Payne et al. (2010), adjectives and adverbs were treated as part of separate c-structure categories. But the point remains valid, e.g. in the phrase *those really very happy people* the same problem would apply to the relationship between *really* and *very*.

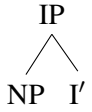
Marcotte's proposal. At the current time, it seems doubtful that any such attempt to entirely remove reference to levels of structure from the theory of projection is likely to be successful.

4 Minimal c-structure

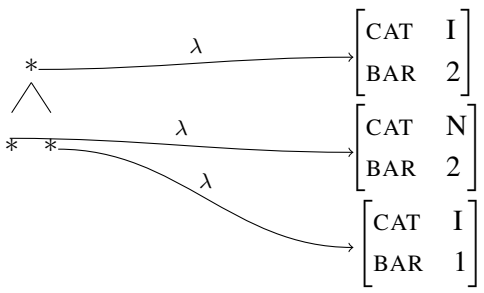
The facts and generalizations missed by both Bresnan's and Marcotte's approaches can be captured in relatively simple terms. Rather than abandoning reference to level of structure, as Marcotte (2014) does, we propose to split the "level of structure" feature of Bresnan (2001) into two features, the interaction of which permits us to provide an insightful and efficient model of c-structure. We call this approach "minimal c-structure" since it generates c-structures with the minimal number of levels of structure required to model constituency.

Following Kaplan (1989), syntactic category information and projection level are not directly encoded in c-structure, but are projected from c-structure nodes via a projection λ. That is, the traditional representation of Bresnan (2001) in (8) must be understood as a shorthand for something like (9).

(8)

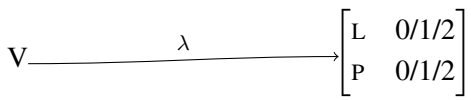


(9)



We refer to the projection of λ as the l-structure. Instead of one BAR feature, we assume two features: LEVEL or L, which represents the projection level of a particular node in a particular structure; and PROJECTION or P, which represents the total number of levels of structure in the projection of the node. The values of L and P are integers, i.e. 0, 1, 2 etc. The value 2 is a sufficient maximum for English, but higher values may be required for other languages. We distinguish non-projecting words from projecting words by defining the former as having no P feature.[11] We are not concerned with encoding category information via λ, only projection level information (see fn. 1). We therefore assume the following type of structures:

(10)



[11]Unlike previous works on non-projecting words, we do not restrict non-projecting words to adjunction structures. A node with no P value can either be adjoined or selected as the specifier complement of a phrase structure rule. In this way our analysis provides a systematic account of the c-structure of what are often called "minor categories".

Although we understand the features L and P as features within the 'l-structure' projected from a node, for ease of representation we utilize an alternative notation whereby L and P values are shown as superscripts on c-structure nodes, separated by a slash. For example, $V^{0/1}$ refers to a node of category V whose l-structure includes the features <L,0> and <P,1>.

4.1 Annotated phrase structure rules and templates

The L and P values for any node are determined by a combination of constraints which appear as annotations on c-structure nodes or in lexical entries. We assume that all words define their mother (preterminal node) as $L = 0$. P values are not (normally) determined lexically: it is not the case that a projecting head always projects the same number of levels of structure. Phrase structure rules can, but do not need to refer to L and P values directly. They can also refer to a relationship between L and P, for example by requiring that the L and P values for a particular node are identical (our definition of a maximal projection). They can also specify relations between mother and daughter nodes, for example that the P value for a particular node is identical to the mother node's P value (i.e. the head of an endocentric projection).

There are a fixed set of constraints required to model projection in c-structure, and for convenience we define these as templates, called as appropriate in the c-structure rules:

(11) Basic templates:

a.	LP	$\equiv$	$(*_\lambda\ L) = (*_\lambda\ P)$	g.	LO	$\equiv$	$(*_\lambda\ L) = 0$
b.	LPM	$\equiv$	$(\hat{*}_\lambda\ L) = (\hat{*}_\lambda\ P)$	h.	LOM	$\equiv$	$(\hat{*}_\lambda\ L) = 0$
c.	LUD	$\equiv$	$(\hat{*}_\lambda\ L) = (*_\lambda\ L)$	i.	PXM	$\equiv$	$(\hat{*}_\lambda\ P)$
d.	PUD	$\equiv$	$(\hat{*}_\lambda\ P) = (*_\lambda\ P)$	j.	PNX	$\equiv$	$\neg(*_\lambda\ P)$
e.	LIM	$\equiv$	$(\hat{*}_\lambda\ L) = 1$	k.	PNXM	$\equiv$	$\neg(\hat{*}_\lambda\ P)$

f. LDOWN $\equiv \{(*_\lambda\ L) = 0 \wedge (\hat{*}_\lambda\ L) = 1 \mid (*_\lambda\ L) = 1 \wedge (\hat{*}_\lambda\ L) = 2\ \}$

The constraint LP requires that the node in question have identical values for L and P. LPM states the same constraint of the mother of the current node. LUD and PUD ensure that a daughter and its mother have identical L or P values respectively. LIM specifies that the L value of the node's mother has the value 1. LDOWN models the change in projection level through an endocentric structure, ensuring that the L value of the node in question is one lower than the L value of its mother. LO and LOM specify the value 0 for the feature L respectively of a node or its mother. PXM is an existential constraint, requiring the mother of a node to have a P feature. PNX and PNXM are negative existential constraints, requiring that a node or its mother respectively do not have a P feature. These last three constraints are relevant to the analysis of non-projecting words, since we define non-projecting words as lacking P features.

The definition of LDOWN (11f) requires a brief comment. Intuitively, we treat L and P values as integers, with the expected ordering relation, such that the principle

to be captured by LDOWN is the following:

(12) $\text{LDOWN} \equiv (*_\lambda \text{ L}) = (\hat{*}_\lambda \text{ L}) - 1$

However, l-structures are feature structures, and values such as 0, 1 and 2 in a feature structure are symbols, not natural numbers. There are various possibilities for effecting ordering relations between symbols; for the purposes of our XLE implementation, however, we adopted the simplest approach, replicating the arithmetic in (12) by stipulation, assuming that there are only three possible values for L.[12]

We also intuitively want a system where the L value is never "greater than" the P value such as: $\forall *_\lambda$, $\text{P} \geq \text{L}$. Again, since our values are not natural numbers, this is not possible. Nor is it necessary: given the constraints in (11) and the assumption that the L value of all words is 0, our system will never create a c-structure that violates this intuitive general constraint.

Particular combinations of the constraints in (11) are associated with standard phrase structure notions, such as head or specifier positions. We therefore define further templates which call relevant combinations of templates from (11):

(13) Complex templates:

a.	HEADX	$\equiv$	@LDOWN $\wedge$ @PUD
b.	HEADA	$\equiv$	@LUD $\wedge$ @PUD
c.	EXT	$\equiv$	@LPM $\wedge$ @LP
d.	INT	$\equiv$	@LIM $\wedge$ @LP
e.	NONPRJ	$\equiv$	@LO $\wedge$ @PNX
f.	NONPRJM	$\equiv$	@LOM $\wedge$ @PNXM
g.	PRJM	$\equiv$	@LOM $\wedge$ @PXM
h.	NONPADJ	$\equiv$	@LOM $\wedge$ @NONPRJ

HEADX is the constraint set required for heads in traditional X′-theoretic structures, i.e. in specifier and complement structures: such a head has an L value one lower than that of its mother, and a P value identical to that of its mother. HEADA applies to heads in adjunction and coordination structures: such heads have the same L and P values as their mothers.[13] The constraints introduced by EXT apply to specifiers and adjuncts (unless nonprojecting): they are maximal projections (L=P) and are daughters of maximal projections (that this is true for adjuncts is discussed in §5.1). INT applies to complement positions (unless nonprojecting): they are maximal projections which are daughters of a node with an L value 1 (and therefore sisters of a head with <L,0>). NONPRJ requires that a node be nonprojecting: its L value is 0 and it has no P feature. NONPRJM states the same requirement

[12] It is of course unproblematic to license higher values for L by simply adding additional disjunctions to the definition of LDOWN. Given our formalism, licensing higher values for L and P does not mean those values necessarily occur, since values are determined bottom-up.

[13] The definition of HEADA in (13b) works unproblematically in XLE, but would need to be complicated to work within the formal description of LFG given by Kaplan & Bresnan (1982); this is discussed further in §5.2.

of the mother node; this is used in the lexical entries of nonprojecting words. PRJM states that the mother node has an L value of 0 and has a P feature; this is used in the lexical entries of projecting words. NONPADJ applies to nonprojecting adjuncts, which we assume can adjoin, in English, only to nodes with an L value of 0. We can therefore represent the major types of phrase structure in the following way:

(14) a. Specifier rule: X → Y (@EXT) X (@HEADX)

b. Complement rule: X → X (@HEADX) Y (@INT)

c. 'XP' adjunction: X → X (@HEADA) Y (@EXT)

d. Conjunction: X → X (@HEADA) Cnj (@NONPRJ) X (@HEADA)

e. Non-proj. adj.: X → Y (@NONPADJ) X (@HEADA)

These complex templates also provide a mechanism for retaining the structure-function association principles of Bresnan (2001). Nodes annotated with @HEADX and @HEADA are functional heads (↑=↓). Complements are annotated with @INT and can be associated with the appropriate grammatical functions. Specifier and adjunct nodes are annotated with @EXT, and can e.g. be associated with the grammaticalized discourse functions or adjunct functions.

4.2 Illustration

As an illustration of minimal c-structure, we give in (15) the necessary phrase structure rules to derive the English sentence *The small dog eats biscuits*. The lexical entries supply category information and the template call @PRJM, for projecting words, or @NONPRJM, for nonprojecting words (see the appendix). The result is the phrase structure in (16).

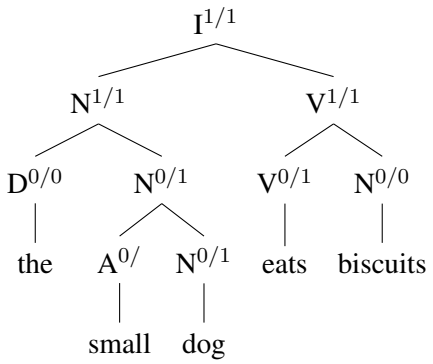
(15) a. I → N (↑ SUBJ) =↓ @EXT { I ↑=↓ @HEADX | V ↑=↓ @INT }

b. V → V ↑=↓ @HEADX N (↑OBJ)=↓ @INT

c. N → D ↑=↓ @EXT N ↑=↓ @HEADX

d. $\mathrm{N} \rightarrow$ A: $\downarrow \in (\uparrow \mathrm{ADJ})$, @NONPADJ; N: $\uparrow = \downarrow$, @HEADA

(16)



This tree has only nine nodes, and no non-branching nodes, compared with a standard X′-theoretic tree following the pattern in (3), which would have at least 14 nodes including at least 5 non-branching nodes.

The LEVEL value is determined from the bottom up, with all words specifying L=0 of their preterminal node. The PROJECTION value is determined by the number of projection levels in the phrase. A projecting head is permitted to have two, one or even zero levels of structure in any given c-structure. Here, *dog* is immediately dominated by a node $\mathrm{N}^{0/1}$, while biscuits is immediately dominated by a node $\mathrm{N}^{0/0}$: the difference is that *dog* heads a complex phrase which includes a specifier, while *biscuits* is the only word in its phrase. There are no superfluous levels of structure: the single node dominating *biscuits* is both the maximal projection and the preterminal node of this phrase.

Non-projecting words are distinguished from projecting words by not having a PROJECTION feature. The PROJECTION value for all other nodes is determined by annotations on phrase structure rules. The 'dominance constraint' (e.g., that a node with LEVEL value 1 cannot be the mother of a head with a value of 2) is formally constrained in the phrase structure rules.

The traditional notion of a 'maximal projection' remains, defined as L=P; the traditional notion of a (pre)terminal node remains, as L=0. As with *biscuits* in (16), these notions are not mutually exclusive. Note that despite our radically reduced structure, our proposal also retains the notions of specifier, complement and adjunct, licensing the standard structure-function mapping principles.

Interestingly, specifier, complement and adjunct structures are not necessarily mutually exclusive: the top node in (16) has both a specifier daughter and a complement daughter. Only maximal projections (L=P) can have specifier daughters; only nodes with the feature L = 1 can have complement daughters; the node $\mathrm{I}^{1/1}$ satisfies both constraints simultaneously.[14]

[14]Note that such possibilities have to be specifically licensed, as in (15a): they do not fall out directly from the phrase structure templates in (14).

4.3 Nonprojecting categories

A key requirement of our model is that it appropriately capture the difference between projecting and non-projecting categories, something which both Bresnan (2001) and Marcotte (2014) fail to achieve. We have modelled this with respect to adjectives, assuming that prenominal adjectives in English are non-projecting, but that in other positions adjectives can project phrases. We assume that adjectives which can appear in both prenominal and other positions have both projecting and non-projecting variants, but that adjectives such as *former* are non-projecting only (since they can only appear prenominally) and that adjectives such as *asleep* are projecting only (since they cannot appear prenominally). Our model correctly captures the grammaticality/ungrammaticality of the following examples:

(17) a. The small dog eats biscuits.
b. The dog is small.
c. The former president eats biscuits.
d. *The president is former.
e. *The asleep dog eats biscuits.
f. The dog is asleep.

Note that in our model, the inability of nonprojecting words to take specifiers, phrasal adjuncts and complements does not have to be stipulated, but falls out of the templates given in (13). Specifiers and phrasal adjuncts require their mother to have identical L and P values, while complements require their mother to have L=1; nonprojecting nodes are necessarily L=0 and lack a P value, so cannot take daughters with such requirements.

5 Two further implications of minimal c-structure

In addition to providing an improved formalization of issues that have been dealt with in previous work, minimal c-structure also provides a natural explanation of why X′ adjunction is not possible, and allows a formalization of the exocentric category S.

5.1 X′ adjunction

Adjunction is a perennial problem for X′ theoretic approaches to phrase structure. We can distinguish three different types of adjunction in traditional X′ notation: adjunction to XP, adjunction to X′, and adjunction to X^0. We assume adjunction to X^0 is restricted to non-projecting categories.

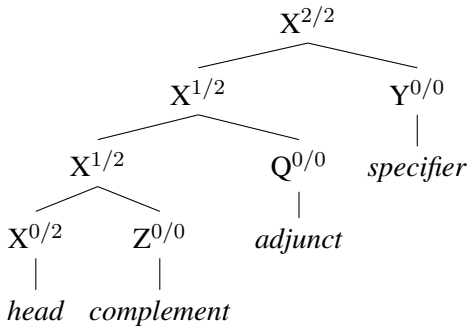
Let us see how to translate this three-way distinction into our model. XP adjunction means adjunction to nodes with the L/P values 2/2, 1/1 or 0/0, i.e. L=P.[15]

[15] And, of course, 3/3 etc., if more than two levels of projection are admitted.

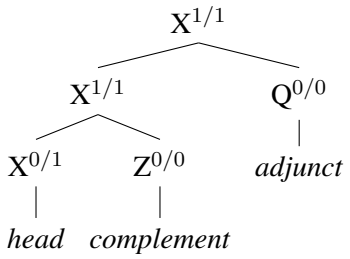
Adjunction of non-projecting categories to zero-level or non-projecting nodes is adjunction to 0/0, 0/1, 0/2 or 0/, i.e. L=0. Both of these are unproblematic, and are formalized in (14) above making use of independently required templates.

X′ adjunction, however, is impossible to formalize in minimal c-structure. Intuitively, X′ adjunction prevents an adjunct from occurring closer to the head than its complement, or further from the head than its specifier. It is impossible to select a set of L and P values which uniquely identifies such a position. In the tree in (18), the adjunct *Q* is adjoined in the equivalent of an X′ position; the node it is adjoined to has the projection features 1/2. However, this is not the only possibility. In (19), an adjunct *Q* is adjoined above the complement, but no specifier is present. Since the L and P values are not fixed, in this structure the adjunct is adjoined to a node with the features 1/1. The tree in (20) is also a type of X′ adjunction, only in this case there is no complement present; here the adjunct attaches to a node with the features 0/1. The problem is that adjunction to 1/1, which is required for (19), would be XP adjunction in (20), since the adjunct would appear higher than the specifier, and at the same time adjunction to 0/1, which is required for (20), would license adjunction between head and complement in (19). Thus it is not possible to define a set of L/P values which would capture the intuition of 'X′ adjunction'.

(18)



(19)



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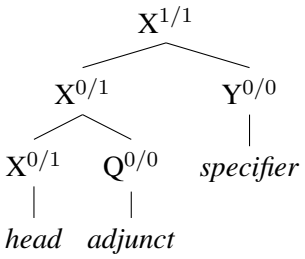


We take the impossibility of 'X′ adjunction' as a positive result, since a wealth of research in the last 30 years has shown that there is little or no evidence for processes which make specific reference to intermediate levels.[16] We therefore follow Toivonen (2003) in assuming the principle of "adjunction identity", that in adjunction "same adjoins to same".

[16]Early arguments in Travis (1984), see also Carnie (2000, 2010).

5.2 Exocentric 'S'

Thus far we have discussed only endocentric projections. However, exocentric categories such as S are widely utilized in LFG. Our proposal not only admits exocentric categories, but even provides an insightful account of them. For illustrative purposes, consider a language similar to Welsh (Sadler 1997), with top-level clausal structure as in (2). In our system, S can be introduced as a complement daughter, just like any other complement:

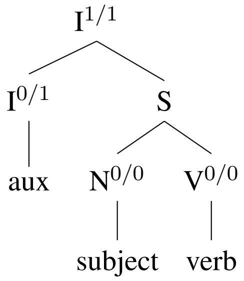
(21) I → I ($\uparrow$=$\downarrow$, @HEADX) S ($\uparrow$=$\downarrow$, @INT)

Since no daughter of S is the head, or a specifier, or a complement, or indeed an adjunct, none of the templates above apply to any of the daughter nodes. We can assume that daughters of S may be specified as necessarily projecting, for example, but the point is no daughter will make any specification about the L/P values of S.

(22) S → N (@LP) V (@LP) *or just* X* (@LP)

In XLE, the specification L=P is satisfied if $\neg$L $\wedge$ $\neg$P. This results in:

(23)



Thus as an exocentric category, S lacks L/P values. We take this to be the definition of an exocentric category in our system.[17] Since the features L and P are features to do with endocentric projection, this is intuitively satisfying.

This works in XLE, but given the definition of LP in (11a), it does not work in the theory. According to Kaplan & Bresnan (1982), a specification like L=P requires those features to exist, and if values for those features are not found, the derivation will fail. Under those assumptions, a practical solution is simply to redefine the template LP for languages which license exocentric structures as follows:[18]

(24) LP $\equiv$ {($*_\lambda$ L) = ($*_\lambda$ P) | $\neg$($*_\lambda$ L) $\wedge$ $\neg$($*_\lambda$ P) }

[17] Note that multiple exocentric categories are possible, distinguished by category label (cf. fn. 1).

[18] It is for the same reason that HEADA may have to be complicated, as discussed in fn. 13. Since HEADA calls PUD, and we want this to apply even if there is no P value, we would need: HEADA $\equiv$ @LUD $\wedge$ { @PUD | [@PNX $\wedge$ @PNXM]}.

6 Conclusion

Minimal c-structure is a more theoretically and formally precise approach to writing phrase structure rules in LFG. By writing l-structure templates below the nodes in phrase structure rules and the slash notation on nodes in c-structure trees, we can avoid the use of the outdated and formally ambiguous diacritics of previous versions of X-bar theory.

Further implementation of minimal c-structure will test the coverage of the templates that have been proposed in this paper. If certain templates turn out to be universal, while others are fairly rare or language-specific, this may give us more insight into the nature of c-structure cross-linguistically.

More study is still needed on the nature of optionality in minimal c-structure. Most optionality is trivial: if the complement of a verb is absent, for example, the phrase structure rule introducing it is simply not used; there is therefore no need for the complement to be optional in the rule itself. In a binary structure of a head and one sister, this is unproblematic. In a ternary (or larger) structure where each sister of the head can be omitted, it is still relatively simple to avoid a non-branching structure where a head has no sisters, by means of a disjunction (see fn. 19).

Optional heads and discontinuous constituents provide a further avenue for future investigation. One way to analyze optional heads is by means of disjunction, as in (15a) in §4.2. While this may work well in the case of extended projections, it cannot be used to account for the type of optional heads found in discontinuous constituents. For example, Snijders (2012) analyzes an adjective separated from the noun it modifies as the sole daughter of an N mother node. Here, the non-branching structure is necessary for indicating the category of the mother node, not for level of structure information. In such restricted cases, a non-branching node may be necessary, even under a minimal c-structure analysis.

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Appendix

To establish the viability of our "minimal" approach to c-structure, we implemented a mini-grammar of English in XLE. The implementation makes use of the ability to define additional projections in XLE: the projection $*_\lambda$ we define as `l::*`, with $\hat{*}_\lambda$ defined as `l::M*`. The implementation covers most of the basic grammatical structures of English, including embedded clauses, wh-question formation, copular clauses, coordination, and all kinds of modification. It is loosely based on the English grammar in Falk (2001), but assumes up to two levels of projection for lexical categories. We give here a brief grammar for English based on our XLE implementation, and two additional c-structures, for illustration.

Rules:

C →	N @EXT (↑UDF) = ↓ (↑UDF) = (↑UDFPATH)	C @HEADX ↑=↓			C →	C @HEADX ↑=↓	{I | V} @INT ↑=↓
I →	{N | C | P } @EXT (↑SUBJ) = ↓	{I @HEADX ↑=↓	|	V} @INT ↑=↓	I →	I @HEADX ↑=↓	V @INT ↑=↓
V →	V @HEADX ↑=↓	(N)[19] @INT (↑OBJ)=↓	(N) @INT (↑OBJ2)=↓	(P) @INT (↑OBL)=↓	(C) @INT (↑COMP)=↓		
V →	V @HEADX ↑=↓	{ N | A} @INT (↑PREDLINK)=↓			V →	V @HEADA ↑=↓	{ Adv | P} @EXT ↓ ∈ (↑ADJ)
V →	Adv @EXT ↓ ∈ (↑ADJ)	V @HEADA ↑=↓			N →	D @EXT ↑=↓	N @HEADX ↑=↓
N →	N @HEADA ↑=↓	P @EXT ↓ ∈ (↑ADJ)			N →	Adj @NONPADJ ↓ ∈ (↑ADJ)	N @HEADA ↑=↓
N →	N @HEADX ↑=↓	(P) @INT (↑OBL)=↓	(C) @INT (↑COMP)=↓		X →	X @HEADA ↓∈↑	Conj @NONPRJ ↑=↓	X @HEADA ↓∈↑
D →	N @INT (↑POSS) = ↓	D @HEADX ↑=↓ ¬(↑ SPEC)			Adj →	Adj @HEADX ↑=↓	P @INT (↑OBL) = ↓	

[19]Note that the optionality specified here is constrained in the XLE version so that at least one non-head daughter must appear. This is done by formulating this as a set of disjunctions: { V N (N) (P) (C) | V N (P) (C) | V P (C) | V C }.

Adj →	Adv @NONPADJ ↓∈ (↑ADJ)	Adj @HEADA ↑=↓	
P →	P @HEADX ↑=↓	N @INT (↑OBJ)=↓	

Adv →	Adv @NONPADJ ↓∈ (↑ADJ)	Adv @HEADA ↑=↓	

Lexicon (sample):

Verbs:

eat/eats	V	(↑ PRED)='eat<SUBJ,OBJ>' @PRJM
eating	V	(↑ PRED)='eat<SUBJ,OBJ>' (↑VFORM) = ING @PRJM

Copula:

is/are	I	(↑ TENSE) = PRES (↑ VFORM) =c ING @PRJM
	V	(↑ PRED) = 'be<SUBJ,PLINK>' @PRJM

Auxiliaries:

did	I	(↑ TENSE) = PAST @PRJM
	C	(↑ TENSE) = PAST (↑ QUEST) = + @PRJM

Prepositions:

to	P	(↑ PRED)='to<OBJ>' @PRJM

Conjunctions/complementizers:

and	Conj	(↑CONJFM) = AND @NONPRJM
that	C	(↑ COMPFM) = THAT @PRJM

Nouns:

dog	N	(↑ PRED) = 'dog' @PRJM

Determiners/pronouns:

the	D	(↑ EXT) = 'the' @PRJM
's	D	(↑ DEF) = + (↑ POSS) @PRJM.
what	N	(↑ PRED) = 'what' @PRJM
	D	(↑ EXT) = 'what' @PRJM

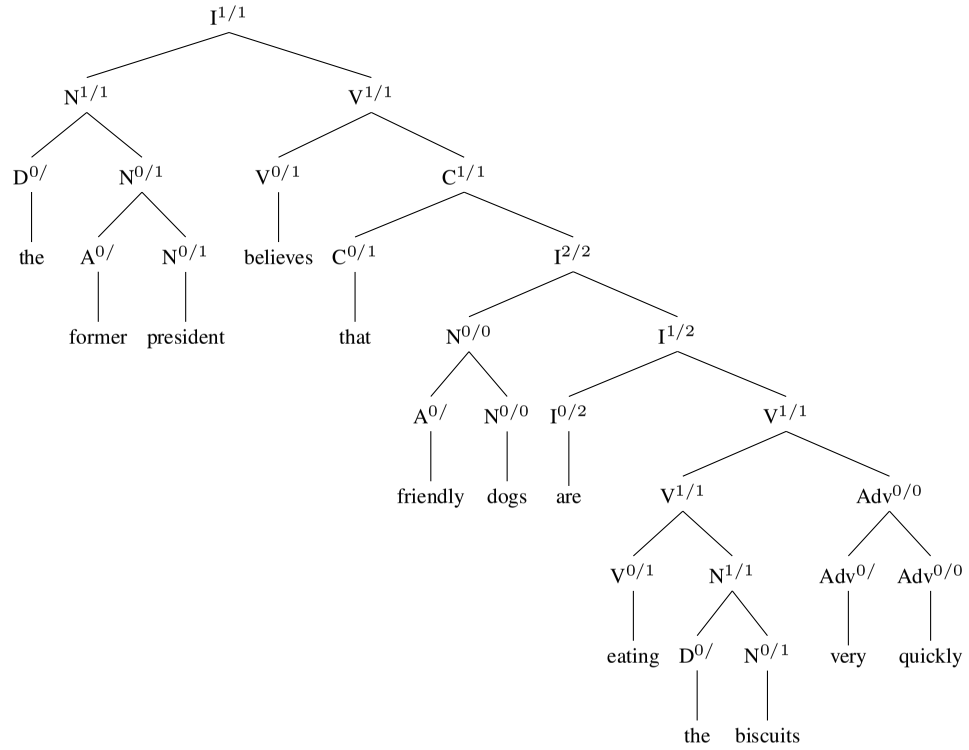
Adjectives:

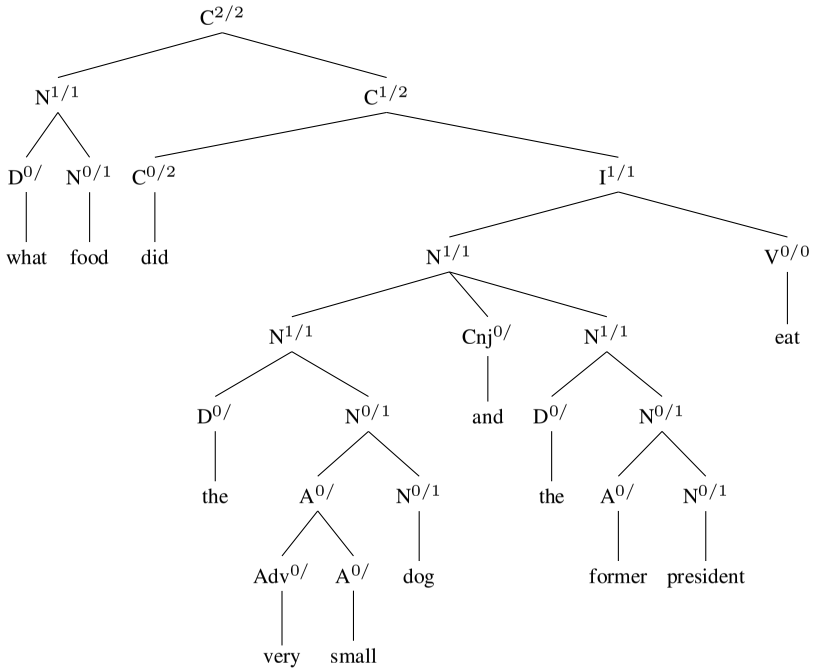
small	A	(↑ PRED) = 'small' @PRJM
	A	(↑ PRED) = 'small' @NONPRJM
asleep	A	(↑ PRED) = 'asleep' @PRJM
former	A	(↑PRED) = 'former' @NONPRJM

Adverbs:

very	Adv	(↑ PRED) = 'very' @NONPRJM
quickly	Adv	(↑ PRED) = 'quickly' @PRJM

Figure 1: C-structures for further illustration





A Gapping Analysis of Lexicalised Comparative Constructions

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Abstract

This paper is devoted to lexicalised comparative constructions as dependents of verbs in Polish. It discusses how such constructions can be analysed, offering a gapping-inspired analysis (formalised and implemented in XLE).

1 Introduction

Polish abounds in sentences containing lexicalised comparisons – lexicalised in the sense that the given predicate lexically requires certain forms to appear in the comparison if it is used (usually it is optional). In (1) the verb CHŁONĄĆ 'absorb' requires the nominal GĄBKA 'sponge' to appear in the comparison, while in (2) the comparison used with the verb PASOWAĆ 'fit' must involve the nominal KWIATEK 'flower' and the prepositional phrase featuring the nominal KOŻUCH 'fur coat':

(1) Chłonęła wszystko jak gąbka.
absorbed.F everything.ACC like sponge.NOM
'She absorbed everything like a sponge.' (http://nkjp.pl)

(2) Halloween pasuje do naszej kultury jak kwiatek do kożucha.
Halloween.NOM fits to our culture.GEN like flower.NOM to fur coat.GEN
'Halloween fits our culture like a flower (fits) a fur coat.' (literal)
= it is out of place (http://nkjp.pl)

It is worth noting that in these examples the phrases following the comparative element JAK correspond to respective dependents of the given verb: in (1) *gąbka* corresponds to the implicit subject of CHŁONĄĆ, while in (2) *kwiatek* corresponds to the subject of PASOWAĆ, *Halloween*, and *do kożucha* corresponds to its oblique dependent, *do naszej kultury*. Moreover, there is a morphosyntactic correspondence in these examples – the respective elements belong to the same syntactic categories (*Halloween* and *kwiatek* are nominal phrases, *do naszej kultury* and *do kożucha* are prepositional phrases) and have the same values of appropriate morphosyntactic features (case, preposition form).

The question is how such comparative elements should be analysed. One of the major issues is the categorial status of the word *jak* in examples such as (1) and (2): is it a preposition, a conjunction, a complementiser or something else?

1.1 PP analysis

The widely adopted view in Polish linguistics (Kallas 1986) is to assume that *jak gąbka* 'like a sponge' in (1) is a prepositional phrase involving the preposition JAK which takes a nominative complement, see the f-structure in (3).[1] Such an analysis is very elegant as it provides a minimal representation without positing any unmotivated elements (which are not represented overtly).

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[1]Is is perhaps worth mentioning that an analogous analysis was adopted in the English ParGram grammar for sentences such as *John swims like a fish*, where *like a fish* expresses a comparison.

(3)
$$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{absorb}\langle \boxed{1},\boxed{2}\rangle\text{'} \\ \textsc{subj} & \boxed{1}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{pro}\text{'} \\ \textsc{case} & \textsc{nom} \end{bmatrix} \\ \textsc{obj} & \boxed{2}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{everything}\text{'} \\ \textsc{case} & \textsc{acc} \end{bmatrix} \\ \textsc{adjunct} & \left\{ \begin{bmatrix} \textsc{pred} & \text{`}\textsc{like}\langle \boxed{3}\rangle\text{'} \\ \textsc{obj} & \boxed{3}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{sponge}\text{'} \\ \textsc{case} & \textsc{nom} \end{bmatrix} \end{bmatrix} \right\} \end{bmatrix}$$

However, it seems that such an analysis could not be used to account for examples such as (2), where the comparison involves 2 elements rather than one (a nominal phrase and a prepositional phrase) – normally, Polish prepositions take only one nominal complement marked for the case required by the preposition. In predicative constructions, the number of arguments of the preposition depends on whether the predicative complement is analysed as an open (XCOMP(-PRED)) or closed (PREDLINK, Butt et al. 1999) grammatical function – under the open analysis the preposition is assumed to have a subject. However, this aspect has no bearing on the issue discussed, because these comparative constructions are not predicative.

Therefore it seems unmotivated to introduce lexical entries for prepositions that would require two (or more) dependents, a nominal and a prepositional phrase in case of (2). Even if such entries were created, interpreting constructions with such special prepositions (taking 2 or more complements) would pose a problem (which grammatical functions should be assigned, on what grounds).

There exist analyses where the comparative element in certain comparative constructions (not lexicalised) is analysed as a preposition – this is the case in the copy raising analysis of English provided in Asudeh and Toivonen 2006. According to this analysis, *like he was upset* in (4) is analysed as an open predicative complement (XCOMP) of SEEM, as shown in the f-structure in (5). The word *like* is a predicative two-argument preposition which takes a subject (SUBJ, structure-shared with the subject of SEEM) and a closed complement (COMP) which contains the rest of the comparison – its subject is assumed to be co-referent with the subject of LIKE (structure-shared with SEEM, as described above).

(4) Frank seemed like he was upset.

(5)
$$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{seem}\langle \boxed{2}\rangle\boxed{1}\text{'} \\ \textsc{subj} & \boxed{1}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{Frank}\text{'} \end{bmatrix} \\ \textsc{xcomp} & \boxed{2}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{like}\langle \boxed{1},\boxed{3}\rangle\text{'} \\ \textsc{subj} & \boxed{1} \\ \textsc{comp} & \boxed{3}\begin{bmatrix} \text{``}\textsc{he was upset}\text{''} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Though such an analysis is a theoretical possibility, there seems to be no evidence that would support adopting it for Polish comparative constructions such as

in (1)–(2), because these do not have the properties of copy raising. Also, there are no Polish prepositions that would take the COMP grammatical function.

1.2 CP analysis

Due to the way comparative constructions such as in (1) and (2) are used and interpreted, the alternative is to treat JAK as a complementiser introducing a comparative clause whose dependents are the phrases following JAK. Though such an analysis is appealing from the perspective of representation (and semantics), the fundamental problem is the absence of an overt predicate in the comparison. A potential solution is to treat such comparative constructions as an instance of gapping (see Patejuk and Przepiórkowski 2017 and references there), where the predicate of the gapped comparative clause is reconstructed on the basis of the predicate from the main clause: see (6), which corresponds to (1), and (7), which is the f-structure for (2).[2]

(6)
$$\begin{bmatrix}
\text{PRED} & \text{`ABSORB}\langle\boxed{1},\boxed{2}\rangle\text{'} \\
\text{SUBJ} & \boxed{1}\begin{bmatrix}\text{PRED} & \text{`PRO'}\\ \text{CASE} & \text{NOM}\end{bmatrix} \\
\text{OBJ} & \boxed{2}\begin{bmatrix}\text{PRED} & \text{`EVERYTHING'}\\ \text{CASE} & \text{ACC}\end{bmatrix} \\
\text{ADJUNCT} & \left\{\begin{bmatrix}\text{PRED} & \text{`ABSORB}\langle\boxed{3}\rangle\text{'} \\ \text{SUBJ} & \boxed{3}\begin{bmatrix}\text{PRED} & \text{`SPONGE'}\\ \text{CASE} & \text{NOM}\end{bmatrix} \\ \text{COMP-FORM} & \text{LIKE}\end{bmatrix}\right\}
\end{bmatrix}$$

(7)
$$\begin{bmatrix}
\text{PRED} & \text{`FIT}\langle\boxed{1},\boxed{2}\rangle\text{'} \\
\text{SUBJ} & \boxed{1}\begin{bmatrix}\text{PRED} & \text{`HALLOWEEN'}\\ \text{CASE} & \text{NOM}\end{bmatrix} \\
\text{OBL} & \boxed{2}\begin{bmatrix}\text{PRED} & \text{`OUR CULTURE'}\\ \text{PFORM} & \text{TO}\\ \text{CASE} & \text{GEN}\end{bmatrix} \\
\text{ADJUNCT} & \left\{\begin{bmatrix}\text{PRED} & \text{`FIT}\langle\boxed{3},\boxed{4}\rangle\text{'} \\ \text{SUBJ} & \boxed{3}\begin{bmatrix}\text{PRED} & \text{`FLOWER'}\\ \text{CASE} & \text{NOM}\end{bmatrix} \\ \text{OBL} & \boxed{4}\begin{bmatrix}\text{PRED} & \text{`FUR COAT'}\\ \text{PFORM} & \text{TO}\\ \text{CASE} & \text{GEN}\end{bmatrix} \\ \text{COMP-FORM} & \text{LIKE}\end{bmatrix}\right\}
\end{bmatrix}$$

[2]For the sake of simplifying the representation, the f-structures presenting the CP gapping analysis uniformly assume that the complementiser is a co-head contributing the COMP-FORM attribute and that the entire comparative clause is an adjunct of the main predicate. However, these can be modified (CP as an argument, complementiser as the head) without affecting the general analysis.

Such an analysis seems to be supported by the fact that it is possible to use an overt instance of the predicate in the comparison (though it is typically omitted since it is the same as in the main clause), see (8) and (9).

(8) chłoniesz wiedzę jak gąbka chłonie wodę.
absorb.2.SG knowledge.ACC like sponge.NOM absorb.3.SG water.ACC
'You absorb knowledge like a sponge absorbs water.' (Google)

(9) tak pasuje do otoczenia jak kwiatek pasuje do kożucha.
so fit.3.SG to surrounding.GEN like flower.NOM fit.3.SG to fur coat.GEN
'He fits the surroundings like a flower fits a fur coat.' (literal)
= he does not fit (Google)

Note that the verb forms used in corresponding clauses do not need to be identical – they may have different agreement features: *chłoniesz* is a second person singular form, while *chłonie* is a third person singular form. The same holds in the case of typical instances of gapping in Polish (Patejuk and Przepiórkowski 2017).

2 More complex data and interactions

The following sections present data supporting the analysis which involves the use of a gapped predicate in the comparative clause.

2.1 Numeral phrases

While there seem to be good reasons to analyse comparative constructions in examples such as (2) as gapped clauses, it appears that comparisons such as in (1) could minimally be analysed as prepositional phrases. This would lead to a split analysis of comparative constructions, resulting in different, non-parallel syntactic representation. This is not a problem if making such a distinction is well-motivated, it seems, however, that examples such as (10) and (11) provide evidence that comparisons involving one argument should be treated as an instance of a clause rather than a prepositional phrase, arguing in favour of a unified gapping analysis.

(10) Kobieta wyglądała jak siedem nieszczęść.
woman.NOM looked like seven.ACC disasters.GEN
'Woman looked like seven disasters.' (literal)
= she looked miserable (http://nkjp.pl)

(11) wygląda jak pół dupy zza krzaka
looks like half.ACC arse.GEN behind bush
'It looks like a half of an arse from behind a bush.' (literal)
= it looks stupid, bad (http://nkjp.pl)

The clausal analysis, see (12) which corresponds to (10), is supported by the fact that the element inside the comparison is a non-agreeing numeral phrase, where the numeral head (*siedem* 'seven', *pół* 'half') takes accusative case and the accompanying nominal (*nieszczęść* 'disasters', *dupy* 'arse') is marked for genitive case.[3]

[3] See Przepiórkowski 2006 for discussion of PÓŁ as a non-agreeing numeral.

(12)
$$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{look}\langle\boxed{1}\rangle\text{'} \\ \textsc{subj} & \boxed{1}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{woman}\text{'} \\ \textsc{case} & \textsc{nom} \end{bmatrix} \\ \textsc{adjunct} & \left\{ \begin{bmatrix} \textsc{pred} & \text{`}\textsc{look}\langle\boxed{2}\rangle\text{'} \\ \textsc{subj} & \boxed{2}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{seven}\langle\boxed{3}\rangle\text{'} \\ \textsc{case} & \textsc{acc} \\ \textsc{obj} & \boxed{3}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{disaster}\text{'} \\ \textsc{case} & \textsc{gen} \end{bmatrix} \end{bmatrix} \\ \textsc{comp-form} & \textsc{like} \end{bmatrix} \right\} \end{bmatrix}$$

As discussed in the literature devoted to case assignment and agreement in Polish (e.g. Przepiórkowski 1999, Przepiórkowski and Patejuk 2012), such case marking is characteristic of non-agreeing numeral subjects in Polish – expected in clauses.

An alternative solution would be to allow, alongside nominative nominals, accusative non-agreeing (taking a genitive nominal object) numeral phrases with JAK as the preposition. As a result, the putative preposition would be required to allow as its complement (typically OBJ) nominative nominals and accusative non-agreeing numerals, both of which perfectly match subjecthood criteria in Polish, while disallowing non-numeral accusative nominals, which cannot act as a subject in Polish. Such a coincidence seems to strongly suggest that a generalisation is being missed, namely that the comparison should be analysed as a clause and the numeral as its subject – even in cases where there is only one dependent following JAK.

2.2 Passive

There are interesting interactions between comparative constructions and passive voice – it seems that the comparative dependent undergoes passivisation in the same way as the main predicate. In (13) the object of the verb WYDOIĆ 'milk', *nas* 'us', is marked for accusative case (structural case in the absence of negation) and the comparison includes the phrase *krowę* 'cow' – also an accusative form. When the verb is passivised, as in (14), the form of KROWA 'cow' inside the comparison is nominative, which is the same as the case of the implicit subject of the main verb.

(13) Gdy już nas wydoją jak krowę.
When already us.ACC milk like cow.ACC
'When they have already milked us like a cow.' (literal)
= they have milked us dry (http://nkjp.pl)

(14) Zostaniesz wydojony jak krowa.
become milk.PASS.NOM like cow.NOM
'You will be milked like a cow.' (literal)
= you will be milked dry (Google)

Another piece of evidence is provided by examples (15) and (16). This pair features the predicate PILNOWAĆ 'watch, keep an eye on somebody' which is different from

WYDOIĆ ‘milk’ discussed above in that its complement is not marked for structural case as in (13), but for lexical genitive case, see (15). Still, in Polish being marked for lexical case (not being accusative) does not preclude such an object from undergoing passivisation, as shown in (16).

(15) Pilnujcie jej jak oka w głowie.
watch she.GEN like eye.GEN in head
‘Watch her like an eye in the head.’ (literal)
= watch her closely (http://nkjp.pl)

(16) będzie pilnowany jak oko w głowie
will watch.PASS.NOM like eye.NOM in head
‘He will be watched like an eye in the head.’ (literal)
= he will be watched closely (http://nkjp.pl)

As in (13)–(14), the dependents in the comparisons in (15)–(16) seem to undergo passivisation in the same way as the corresponding dependents of the main clause – they are marked for case according to the same rules that apply to the dependents of the main predicate. The active predicate in (15) assigns lexical genitive case to its object and the dependent following JAK is also marked for genitive. Under passivisation the active object becomes the passive subject – in (16) the passive predicate assigns nominative case to its implicit subject and the dependent following JAK is also marked for nominative case.

It is worth highlighting that even if the resulting values of case are identical (as in the examples above), it would be wrong to assume that the respective values are copied from the main predicate to the comparison. Instead, they are assigned independently according to appropriate rules. As a result, the subject of (16) could be a non-agreeing accusative numeral, while the subject inside the comparison will remain nominative because it is a plain nominal:[4]

(17) pięciu zakładników było pilnowanych jak oko w głowie
five.ACC hostages.GEN were watch.PASS.ACC/GEN like eye.NOM in head
‘Five hostages were watched like an eye in the head.’ (literal)
= they were watched closely

These observations provide another argument supporting the clausal analysis of comparative constructions involving gapping – the f-structures in (18) and (19) correspond to (13) and (14), respectively.[5]

[4]The form *pilnowanych* ‘watched’ in (17) is glossed as ambiguous (accusative or genitive) because it may either agree with the accusative numeral head or its genitive nominal dependent (see Przepiórkowski and Patejuk 2012 for discussion and analysis).

[5]For the sake of brevity and simplicity of representation, a flat analysis of passive is used in this paper, where the lexical verb is the main verb (contributing PRED), while the auxiliary is a co-head (without PRED). However, as discussed in Patejuk and Przepiórkowski (2014a), a raising analysis of passive should be used for Polish (the auxiliary is the main verb, the lexical verb is its complement).

(18)
$$\begin{bmatrix}
\textsc{pred} & \text{`}\textsc{milk}\langle\boxed{1},\boxed{2}\rangle\text{'} \\
\textsc{subj} & \boxed{1}\begin{bmatrix}\textsc{pred} & \text{`}\textsc{pro}\text{'} \\ \textsc{case} & \textsc{nom}\end{bmatrix} \\
\textsc{obj} & \boxed{2}\begin{bmatrix}\textsc{pred} & \text{`}\textsc{we}\text{'} \\ \textsc{case} & \textsc{acc}\end{bmatrix} \\
\textsc{adjunct} & \left\{\begin{bmatrix}
\textsc{pred} & \text{`}\textsc{milk}\langle\boxed{3},\boxed{4}\rangle\text{'} \\
\textsc{subj} & \boxed{3}\begin{bmatrix}\textsc{pred} & \text{`}\textsc{pro}\text{'} \\ \textsc{case} & \textsc{nom}\end{bmatrix} \\
\textsc{obj} & \boxed{4}\begin{bmatrix}\textsc{pred} & \text{`}\textsc{cow}\text{'} \\ \textsc{case} & \textsc{acc}\end{bmatrix} \\
\textsc{comp-form} & \textsc{like}
\end{bmatrix}\right\}
\end{bmatrix}$$

(19)
$$\begin{bmatrix}
\textsc{pred} & \text{`}\textsc{milk}\langle\textsc{null},\boxed{1}\rangle\text{'} \\
\textsc{subj} & \boxed{1}\begin{bmatrix}\textsc{pred} & \text{`}\textsc{pro}\text{'} \\ \textsc{case} & \textsc{nom}\end{bmatrix} \\
\textsc{adjunct} & \left\{\begin{bmatrix}
\textsc{pred} & \text{`}\textsc{milk}\langle\textsc{null},\boxed{2}\rangle\text{'} \\
\textsc{subj} & \boxed{2}\begin{bmatrix}\textsc{pred} & \text{`}\textsc{cow}\text{'} \\ \textsc{case} & \textsc{nom}\end{bmatrix} \\
\textsc{comp-form} & \textsc{like} \\
\textsc{passive} & +
\end{bmatrix}\right\} \\
\textsc{passive} & +
\end{bmatrix}$$

The alternative analysis treating the comparison as a prepositional phrase would require introducing additional entries to allow for accusative case in (13) and genitive in (15) when the main verb is active and for nominative case in (14) and (16) when the main verb is passive – it seems this would be another case of a missed generalisation.

3 Potential mismatches

Most of the examples discussed so far featured a direct correspondence between the dependents of the main verb and the dependents of the comparative construction in terms of syntactic categories and grammatical functions – the lists of arguments in PRED in the main clause and the comparative clause in (7) and (12) are exactly the same. The following sections discuss examples of different kinds of mismatches and their consequences for the analysis.

3.1 Different number of dependents

The number of dependents in the main clause and the comparison is not the same in (6) since there is no overt object in the comparison in (1). However, an implicit object (marked for accusative case – see the discussion of (21)) could be introduced

in the comparative clause, making the relevant argument lists parallel: see the resulting alternative f-structure for (1) provided in (20).

(20)
$$\begin{bmatrix}
\textsc{pred} & \text{`}\textsc{absorb}\langle \boxed{1},\boxed{2}\rangle\text{'} \\
\textsc{subj} & \boxed{1}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{pro}\text{'} \\ \textsc{case} & \textsc{nom} \end{bmatrix} \\
\textsc{obj} & \boxed{2}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{everything}\text{'} \\ \textsc{case} & \textsc{acc} \end{bmatrix} \\
\textsc{adjunct} & \left\{ \begin{bmatrix}
\textsc{pred} & \text{`}\textsc{absorb}\langle \boxed{3},\boxed{4}\rangle\text{'} \\
\textsc{subj} & \boxed{3}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{sponge}\text{'} \\ \textsc{case} & \textsc{nom} \end{bmatrix} \\
\textsc{obj} & \boxed{4}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{pro}\text{'} \\ \textsc{case} & \textsc{acc} \end{bmatrix} \\
\textsc{comp-form} & \textsc{like}
\end{bmatrix} \right\}
\end{bmatrix}$$

Such an analysis could be supported by the fact that there are examples where the overt object is present in the comparison – it must be a form of WODA 'water' marked for accusative case (the value of structural case appropriate for the object in the absence of negation) – see (8) where the predicate inside the comparison is represented overtly and (21), with the f-structure in (22), where the predicate is missing:

(21) Chłonęli Zachód jak gąbka wodę.
absorbed West.ACC like sponge.NOM water.ACC
'They absorbed the West like a sponge (absorbs) water.' (http://nkjp.pl)

(22)
$$\begin{bmatrix}
\textsc{pred} & \text{`}\textsc{absorb}\langle \boxed{1},\boxed{2}\rangle\text{'} \\
\textsc{subj} & \boxed{1}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{pro}\text{'} \\ \textsc{case} & \textsc{nom} \end{bmatrix} \\
\textsc{obj} & \boxed{2}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{West}\text{'} \\ \textsc{case} & \textsc{acc} \end{bmatrix} \\
\textsc{adjunct} & \left\{ \begin{bmatrix}
\textsc{pred} & \text{`}\textsc{absorb}\langle \boxed{3},\boxed{4}\rangle\text{'} \\
\textsc{subj} & \boxed{3}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{sponge}\text{'} \\ \textsc{case} & \textsc{nom} \end{bmatrix} \\
\textsc{obj} & \boxed{4}\begin{bmatrix} \textsc{pred} & \text{`}\textsc{water}\text{'} \\ \textsc{case} & \textsc{acc} \end{bmatrix} \\
\textsc{comp-form} & \textsc{like}
\end{bmatrix} \right\}
\end{bmatrix}$$

Still, there are cases where it is difficult to argue for the presence of implicit arguments – consider (23), where the main verb (LATAĆ 'fly, run') takes a prepositional phrase consisting of the preposition ZA and a nominal marked for instrumental case. By contrast, the comparison does not include such an argument in any way – neither lexical nor implicit.

(23) latał za nią jak kot z pęcherzem
ran after she.INST like cat.NOM with bladder
'He ran after her like a cat with a bladder (attached to it as a prank).' (literal)
= he was always chasing after her like mad (http://nkjp.pl)

It seems that *z pęcherzem* in (23) can be analysed in three ways – as a dependent of *kot*, as an adjunct in the comparison or as its argument. In the first two cases, the argument lists of the predicates in the main clause and in the comparison would be distinct – see (24) where *z pęcherzem* is as an adjunct in the comparison. This suggests that the phenomenon that is being discussed is not a typical instance of gapping, because the predicates in the two clauses, the main clause and the comparison, may take a different number of arguments.

(24)
$$\begin{bmatrix} \text{PRED} & \text{'RUN}\langle \boxed{1},\boxed{2}\rangle\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBL} & \boxed{2}\begin{bmatrix} \text{PRED} & \text{'SHE'} \\ \text{PFORM} & \text{AFTER} \\ \text{CASE} & \text{INST} \end{bmatrix} \\ \text{ADJUNCT} & \left\{ \begin{bmatrix} \text{PRED} & \text{'RUN}\langle \boxed{3}\rangle\text{'} \\ \text{SUBJ} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{'CAT'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{ADJUNCT} & \left\{ \begin{bmatrix} \text{PRED} & \text{'WITH}\langle \boxed{4}\rangle\text{'} \\ \text{OBJ} & \boxed{4}\begin{bmatrix} \text{PRED} & \text{'BLADDER'} \\ \text{CASE} & \text{INST} \end{bmatrix} \end{bmatrix} \right\} \\ \text{COMP-FORM} & \text{LIKE} \end{bmatrix} \right\} \end{bmatrix}$$

In the case where the prepositional phrase *z pęcherzem* is analysed as an argument in the comparison, it would be assigned the OBL grammatical function. Even though it happens to be the same grammatical function as the one assigned to *za nią*, these dependents clearly do not correspond to each other – they are not compared to each other as in other pairs discussed so far. Moreover, distinct constraints apply to these prepositional phrases: the main clause predicate requires the preposition ZA, while the comparison requires the preposition Z. So, even if the number of arguments is assumed to be the same (by assuming that *z pęcherzem* is an argument), there is still the issue of different morphosyntactic requirements imposed on dependents of the predicates in the main clause and in the comparison. Again, this could not be accounted for under a standard gapping analysis whereby both predicates would be required to have the same requirements (possibly disjunctive).

3.2 Different constraints in dependents

Since in (23) the obliques in the main clause (*za nią*) and in the comparison (*z pęcherzem*) do not correspond to each other, let us discuss (25) and (26) where

such a correspondence exists (corresponding phrases are compared to each other), but there are differences in mophosyntactic constraints imposed on them:

(25) wszyscy na mnie patrzyli jak sroka w kość.
everybody at I.ACC looked like magpie.NOM in bone.ACC
'Everybody looked at me like a magpie at a bone.' (literal)
= they stared at me (http://nkjp.pl)

(26) na premiera to on sie nadawał jak wół do karety.
for PM.ACC FOC he.NOM REFL fit like OX.NOM to carriage/coach.GEN
'He was fit to be a Prime Minister as an ox fits a carriage/coach.' (literal)
= he was not fit to be a PM (http://nkjp.pl)

In both examples all prepositional phrases (in the main clause and in the comparison) would be analysed as obliques. However, different prepositions are used in corresponding prepositional phrases. In (25) the main verb uses NA as the preposition, while the comparison must use W as the preposition – see the f-structure in (27).[6] Similarly, in (26) the main predicate features the preposition NA, while DO must be used in the comparison.

(27)
$$\begin{bmatrix} \text{PRED} & \text{'LOOK}\langle \boxed{1}, \boxed{2} \rangle\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix} \text{PRED} & \text{'EVERYBODY'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBL} & \boxed{2}\begin{bmatrix} \text{PRED} & \text{'I'} \\ \text{PFORM} & \text{NA} \\ \text{CASE} & \text{ACC} \end{bmatrix} \\ \text{ADJUNCT} & \left\{ \begin{bmatrix} \text{PRED} & \text{'LOOK}\langle \boxed{3}, \boxed{4} \rangle\text{'} \\ \text{SUBJ} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{'MAGPIE'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBL} & \boxed{4}\begin{bmatrix} \text{PRED} & \text{'BONE'} \\ \text{PFORM} & \text{W} \\ \text{CASE} & \text{ACC} \end{bmatrix} \\ \text{COMP-FORM} & \text{LIKE} \end{bmatrix} \right\} \end{bmatrix}$$

The situation here is complicated by the fact that the main predicates in (25)–(26) have disjunctive subcategorisation requirements – the comparison in (25) can be used with NA or W as the preposition in the main predicate, or their coordination (phrases are coordinated). The possibility of coordination suggests that there is one valency schema for the verb PATRZYĆ 'look' which disjunctively specifies its oblique argument in the main clause (Patejuk and Przepiórkowski 2012).

This would pose a problem for the standard gapping account, whereby the predicates in the main clause and in the gapped clause are expected to be subject to the

[6] In (27) the values of PFORM are in Polish to show that they are distinct (unlike their translation).

same constraints. This is because the comparison is more restricted – it must use only one of the options allowed by the main predicate: in (25) only w is appropriate as the preposition in the comparison, it must not be NA (which is possible in the main clause). The case of (26) is analogous – the main predicate allows either NA or DO as the preposition, while only the latter can be used in the comparison.

Note that while a standard gapping analysis cannot account for such restrictions, the problem could easily be solved by stating such constraints in the lexicon – by requiring the appropriate preposition forms (and cases) to appear in the comparison.

3.3 Different grammatical functions of dependents

There is another type of mismatch between dependents of the main clause and the comparison – this is the mismatch in the assignment of grammatical functions to these dependents, which seems to pose another problem to typical gapping analyses.

(28) Pasuje on do reszty jak świni siodło.
fits he.NOM to rest.GEN like pig.DAT saddle.NOM
'He fits the rest like a saddle (fits) a pig.' (literal)
= he is out of place (http://nkjp.pl)

In (28) the main clause contains a nominative subject (*on* 'he') and a prepositional (*do reszty* 'to rest') oblique (OBL), while the comparison contains the corresponding nominative subject (*siodło* 'saddle') and a dative nominal phrase (*świni* 'pig'), typically analysed as an oblique object (OBJ_θ) in Polish, see (29).

(29)
$$\begin{bmatrix}
\text{PRED} & \text{`FIT}\langle\boxed{1},\boxed{2}\rangle\text{'} \\
\text{SUBJ} & \boxed{1}\begin{bmatrix}\text{PRED} & \text{`PRO'} \\ \text{CASE} & \text{NOM}\end{bmatrix} \\
\text{OBL} & \boxed{2}\begin{bmatrix}\text{PRED} & \text{`REST'} \\ \text{PFORM} & \text{TO} \\ \text{CASE} & \text{GEN}\end{bmatrix} \\
\text{ADJUNCT} & \left\{\begin{bmatrix}
\text{PRED} & \text{`FIT}\langle\boxed{3},\boxed{4}\rangle\text{'} \\
\text{SUBJ} & \boxed{3}\begin{bmatrix}\text{PRED} & \text{`SADDLE'} \\ \text{CASE} & \text{NOM}\end{bmatrix} \\
\text{OBJ}_\theta & \boxed{4}\begin{bmatrix}\text{PRED} & \text{`PIG'} \\ \text{CASE} & \text{DAT}\end{bmatrix} \\
\text{COMP-FORM} & \text{LIKE}
\end{bmatrix}\right\}
\end{bmatrix}$$

Unlike in (25)–(26), where the main predicate has disjunctive subcategorisation requirements (the given argument can be filled by category A, category B or their coordination), this is not the case with the verb PASOWAĆ 'fit' – it can either take the prepositional phrase (with DO as the preposition, requiring a genitive nominal) or a dative nominal phrase, but not their coordination. This is why there must be four valency schemata for this verb – two where the categories in the main clause and

in the comparison match and two where these do not match (oblique in the main clause as opposed to dative indirect object in the comparison, as in (29), or the other way round; subjects are assumed to match in both cases).

Unlike in (23), where under the analysis which treats *z pęcherzem* as an oblique (rather than an adjunct) the dependents have the same grammatical function (but different morphosyntactic properties) yet they do not correspond to one another (they are not compared), in (28) such mismatched dependents (different grammatical function, different morphosyntactic constraints) do correspond to each other and are comparable. While in (23) there is no way to express the fact that these phrases do not correspond to one another, in (28) there is no way to express the opposite – that such mismatched phrases do correspond to each other.

A potential solution to this problem would be to introduce an explicit representation of the correspondence between the respective dependents of the main predicate and the comparison. This can be achieved by introducing a dedicated attribute, for instance REF, in the f-structure of the relevant dependent inside the comparison – its value would be structure-shared with the f-structure of the corresponding dependent from the main clause. If the REF attribute is absent, such a dependent does not have a counterpart in the main clause. The equations in (30),[7] placed in the lexical entry of the main verb, represent the correspondences in (28): between the subjects and between the main clause oblique and the OBJ$_\theta$ inside the comparison. The resulting extended f-structure representation of (28) is provided in (31).

(30) (↑ SUBJ)= (%C SUBJ REF)
(↑ OBL)= (%C OBJ$_\theta$ REF)

(31)
$$\begin{bmatrix}
\text{PRED} & \text{`FIT}\langle\boxed{1},\boxed{2}\rangle\text{'} \\
\text{SUBJ} & \boxed{1}\begin{bmatrix}\text{PRED} & \text{`PRO'}\\ \text{CASE} & \text{NOM}\end{bmatrix} \\
\text{OBL} & \boxed{2}\begin{bmatrix}\text{PRED} & \text{`REST'}\\ \text{PFORM} & \text{TO}\\ \text{CASE} & \text{GEN}\end{bmatrix} \\
\text{ADJUNCT} & \left\{\begin{bmatrix}
\text{PRED} & \text{`FIT}\langle\boxed{3},\boxed{4}\rangle\text{'} \\
\text{SUBJ} & \boxed{3}\begin{bmatrix}\text{PRED} & \text{`SADDLE'}\\ \text{CASE} & \text{NOM}\\ \text{REF} & \boxed{1}\end{bmatrix} \\
\text{OBJ}_\theta & \boxed{4}\begin{bmatrix}\text{PRED} & \text{`PIG'}\\ \text{CASE} & \text{DAT}\\ \text{REF} & \boxed{2}\end{bmatrix} \\
\text{COMP-FORM} & \text{LIKE}
\end{bmatrix}\right\}
\end{bmatrix}$$

[7] %C is a variable which corresponds to an element of the ADJUNCT set, (↑ ADJUNCT ∈)= %C, as defined in (35). See §4 for a detailed discussion of the formalisation.

3.4 Voice mismatch

Let us consider the following pair of examples. (33) seems to show that, unlike in examples discussed in §2.2, the comparative construction does not passivise when the main verb does – *jak kura pazurem* used in active (32) remains in passive (33).

(32) Nawet małe dzieci potrafią nabazgrolić jak (pijana) kura
even small children.NOM can scribble.INF like drunk.NOM hen.NOM
pazurem.
claw.INST
'Even small children can scribble like a drunk hen with a claw.' (literal)
= they can write in a spidery scrawl (Google)

(33) Na karteczce było coś nabazgrolone jak (*pijana)
on card was something.NOM scribble.PPAS.NOM like drunk.NOM
kura pazurem.
hen.NOM claw.INST
'Something was scribbled on the card like a hen with a claw.' (literal)
= it was written in a spidery scrawl (Google)

Such voice mismatch could be approached using the mechanism for representing the correspondence between the dependents of the main predicate and the comparison proposed in §3.3. In (32) the active main clause subject (*małe dzieci* 'small children') corresponds to the active subject in the comparison (*pijana kura* 'drunk hen'), while in (33) the active subject *kura* would correspond to NULL in the passive main clause (there is no oblique agent) – see the f-structure in (34).

(34)
$$\begin{bmatrix} \text{PRED} & \text{'SCRIBBLE}\langle \text{NULL}, \boxed{1} \rangle\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix} \text{PRED} & \text{'SOMETHING'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{ADJUNCT} & \left\{ \begin{bmatrix} \text{PRED} & \text{'SCRIBBLE}\langle \boxed{2}, \boxed{3} \rangle\text{'} \\ \text{SUBJ} & \boxed{2}\begin{bmatrix} \text{PRED} & \text{'HEN'} \\ \text{CASE} & \text{NOM} \\ \text{REF} & \text{NULL} \end{bmatrix} \\ \text{OBL}_{inst} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{'CLAW'} \\ \text{CASE} & \text{INST} \end{bmatrix} \\ \text{COMP-FORM} & \text{LIKE} \end{bmatrix} \right\} \\ \text{PASSIVE} & + \end{bmatrix}$$

The other solution is to assume that the phrase *jak kura pazurem* 'like hen with a claw' in (33) is a lexicalised fixed expression roughly meaning *in an ugly way* (of writing) – a multiword expression functioning as one unit and thus not having internal structure. This approach could be supported by the difference in modification patterns – in (32), where the predicate is active, the comparative dependent

may be modified with *pijana* 'drunk', which suggests that it has internal structure and therefore it could be analysed under the gapping analysis. By contrast, such modification is not possible in (33) under passive voice in the main clause.

4 Formalisation

Since the comparative constructions discussed in this paper are lexicalised, the relevant requirements are formalised in the lexicon – in the lexical entry of the relevant predicate taking a comparative dependent.[8]

First, (35) assigns the path to the comparative construction to the variable %C: it is an element of the verb's adjunct set (due to the assumption stated in fn. 2, which, as explained there, could be changed).

(35) (↑ ADJUNCT ∈)= %C

Subsequently, this variable is used in the specification of the PRED of the gapped comparative clause – the constraint in (37) states that the comparison includes the subject and an oblique (it corresponds to (2), repeated in (39)), while in (38) it has a subject and an indirect object OBJ_θ (it covers (28), repeated in (40)).[9] (36) states the PRED value of the main verb (it takes a subject and an oblique in both examples).

(36) (↑ PRED)='FIT<(↑ SUBJ),(↑ OBL)>'

(37) (%C PRED)='FIT<(%C SUBJ),(%C OBL)>'

(38) (%C PRED)='FIT<(%C SUBJ),(%C OBJ_θ)>'

(39) Halloween pasuje do naszej kultury jak kwiatek do kożucha.
Halloween.NOM fits to our culture.GEN like flower.NOM to fur coat.GEN
'Halloween fits our culture like a flower (fits) a fur coat.' (literal)
= it is out of place (http://nkjp.pl)

(40) Pasuje on do reszty jak świni siodło.
fits he.NOM to rest.GEN like pig.DAT saddle.NOM
'He fits the rest like a saddle (fits) a pig.' (literal)
= he is out of place (http://nkjp.pl)

Next, the %C variable is used when imposing lexicalised constraints such as the form of the relevant argument inside the comparison. (41) states constraints on (37) – it requires that the subject must be a form of FLOWER, while the oblique must be a form of FUR COAT (inside a prepositional phrase). The constraints in (42) match

[8] As mentioned in §1, in most cases the comparison is optional. The formalisation presented here models cases where the lexicalised comparison is used – as a result, the comparison is required and its dependents must satisfy all the constraints specified in the lexicon. However, unless the comparison is required (as in §5), the relevant lexical entry contains additional constraints making it possible to use a given predicate without such a comparison (not presented here for reasons of space).

[9] The constraints in (37) and (38) use the explicit lemma (FIT) for clarity, but the %STEM variable can be used in XLE – it supplies the stem of the lexical entry.

the PRED in (38): the subject must be a form of SADDLE, the indirect object must be a form of PIG. The constraints in (38) and (42) are accompanied by the constraint in (30), repeated in (43), which provides the mapping between the dependents of the comparison and the main clause using the REF attribute (as explained in §3.3).

(41) (%C SUBJ PRED)$=_c$ FLOWER
(%C OBL PRED)$=_c$ FUR COAT

(42) (%C SUBJ PRED)$=_c$ SADDLE
(%C OBJ$_\theta$ PRED)$=_c$ PIG

(43) (↑ SUBJ)= (%C SUBJ REF)
(↑ OBL)= (%C OBJ$_\theta$ REF)

The %C variable is also used for imposing appropriate morphosyntactic constraints on the relevant dependents in the comparison – these include restricting the number of the dependent and, more importantly, imposing appropriate valency requirements such as the appropriate preposition form or case, especially structural case.

(44) (%C OBL PFORM)$=_c$ TO

(45) (%C OBL CASE)$=_c$ GEN

(46) (%C OBJ$_\theta$ CASE)$=_c$ DAT

(47) @(STRCS (%C SUBJ))

The constraints in (44)–(45) apply to the oblique (OBL) inside the comparison – see the corresponding PRED in (37) and the example in (39). (44) makes sure that the preposition form is TO, while (45) ensures that the nominal in the prepositional phrase is marked for genitive case.

The constraint in (46) is a simple constraint on case, which corresponds to the PRED in (38) and example (40) – the indirect object (OBJ$_\theta$) inside the comparison is required to bear dative case – it is a lexical case, as opposed to structural case.

The template STRCS handles structural case assignment to the subject in the grammar – if the element in the path given as its argument is a noun, nominative case is required, if it is a non-agreeing numeral, accusative case is required (see §2.1 and references therein). Since the template call in (47) contains the path which points to the subject of the comparison, it will impose relevant constraints there, independently of the case of the main clause subject (see the discussion of (17) in §2.2). Since in both examples considered above the subject is a noun (FLOWER, SADDLE), it must be marked for nominative case. However, accusative case will be required in (10) because the subject there is a non-agreeing numeral (SEVEN).

Let us consider the formalisation of examples involving passivisation discussed in §2.2. (50) is the the full lexical entry of the verb WYDOIĆ 'milk' – it contains all the constraints[10] needed to account for examples (13)–(14), repeated as (48)–(49).

(48) Gdy już nas wydoją jak krowę.
When already us.ACC milk like cow.ACC
'When they have already milked us like a cow.' (literal)
= they have milked us dry (http://nkjp.pl)

[10] In (50) STRCO is a template handling structural case assignment to the object – it takes the path to the object as its argument and assigns an appropriate case (see Patejuk and Przepiórkowski 2014b).

(49) Zostaniesz wydojony jak krowa.
become milk.PASS.NOM like cow.NOM
'You will be milked like a cow.' (literal)
= you will be milked dry (Google)

The first disjunct of (50) handles active voice, see (48), while the second one handles the passive, see (49). Both disjuncts provide an appropriate mapping between dependents of the main clause and the comparison using the REF attribute.

(50) *wydoić* V (↑ ADJUNCT ∈)= %C
[¬(↑ PASSIVE) ¬(%C PASSIVE)
(↑ PRED)='MILK<(↑ SUBJ),(↑ OBJ)>'
@(STRCS (↑ SUBJ))
@(STRCO (↑ OBJ))
(%C PRED)='MILK<(%C SUBJ),(%C OBJ)>'
@(STRCS (%C SUBJ))
@(STRCO (%C OBJ))
(%C OBJ PRED)=$_c$ COW
(↑ SUBJ)= (%C SUBJ REF)
(↑ OBJ)= (%C OBJ REF)]
∨
[(↑ PASSIVE)=$_c$ + (%C PASSIVE)= +
(↑ PRED)='MILK<NULL,(↑ SUBJ)>'[11]
(%C PRED)='MILK<NULL,(%C SUBJ)>'
(%C SUBJ PRED)=$_c$ COW
@(STRCS (↑ SUBJ))
@(STRCS (%C SUBJ))
(↑ SUBJ)= (%C SUBJ REF)]

Note that (50) is a fully expanded lexical entry for the verb WYDOIĆ in the use which uses a lexicalised comparison. In principle, it should be possible to equivalently use the active part of (50) in conjunction with a lexical rule for handling passive voice.[12]

Finally, the second part of the formalisation of the proposed analysis is creating c-structure rules necessary to build the relevant structures. (51) is a rule which builds the gapped clause – it consists of the co-head JAK, analysed as the complementiser, followed by a non-zero sequence of the DEP co-head, defined in (52).

(51) CP_{compar} → COMP DEP$^+$
↑=↓ ↑=↓
(↑ COMP-FORM)=$_c$ JAK

[11] If the oblique expressing the agent (OBL_{ag}) may be used with the passivised main predicate (it seems to be a possibility), the following disjunctive specification of PRED should be used instead: [(↑ PRED)='MILK<NULL,(↑ SUBJ)>' ∨ (↑ PRED)='MILK<(↑ OBL_{ag}),(↑ SUBJ)>']. If it is possible, it would not be a problem that the main predicate takes an OBL_{ag} while the comparison does not (it uses NULL).

[12] However, the statements related to the PASSIVE attribute would need to be added on top of this.

(52) DEP ≡ { NP (↑ {SUBJ|OBJ|OBJ$_\theta$|...})=↓ | PP (↑ OBL)=↓ | ... }

According to (52), DEP corresponds[13] to various dependents used in the grammar – the annotation of each right hand side disjunct builds the partial f-structure, for instance it states that an NP is a subject, an object or an indirect object (this is restricted using case constraints imposed by lexical entries – see (46), (47) and (50)). Because of the co-head annotation of DEP in (51), partial structures of relevant DEPs are merged into one f-structure in (51) and matched against the constraints in the lexical entry of the verb (constraints of appropriate lemmata, morphosyntactic constraints).

5 Potential alternative analysis of JAK

Upon closer scrutiny the representation of (10) provided in (12) seems to pose an interesting potential problem to the current analysis. Unlike in most other cases discussed so far, *jak siedem nieszczęść* is a required dependent of the main verb – without it the sentence becomes ungrammatical, as shown in (53):

(53) Kobieta wyglądała *(jak siedem nieszczęść).
woman.NOM looked like seven.ACC disasters.GEN

In Polish, there are predicates such as WYGLĄDAĆ 'look', ZACHOWYWAĆ SIĘ 'behave' or CZUĆ SIĘ 'feel' that obligatorily take a dependent which expresses manner – in some approaches these are modelled as arguments (listed in PRED), see (54),[14] while in other approaches these are treated as obligatory adjuncts (which, according to the most prominent definition of adjuncts, is a contradiction of terms), see (12). Whichever analysis is adopted, such a dependent expressing manner must be present since its absence results in ungrammaticality.

(54)
$$\begin{bmatrix} \text{PRED} & \text{'LOOK}\langle \boxed{1}, \boxed{2} \rangle\text{'} \\ \text{SUBJ} & \boxed{1}\begin{bmatrix} \text{PRED} & \text{'WOMAN'} \\ \text{CASE} & \text{NOM} \end{bmatrix} \\ \text{OBL}_{mod} & \boxed{2}\begin{bmatrix} \text{PRED} & \text{'LOOK}\langle \boxed{3} \rangle\text{'} \\ \text{SUBJ} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{'SEVEN}\langle \boxed{3} \rangle\text{'} \\ \text{CASE} & \text{ACC} \end{bmatrix} \\ \text{OBJ} & \boxed{3}\begin{bmatrix} \text{PRED} & \text{'DISASTER'} \\ \text{CASE} & \text{GEN} \end{bmatrix} \\ \text{COMP-FORM} & \text{LIKE} \end{bmatrix} \end{bmatrix}$$

[13] Since ≡ is used in (52) instead of →, DEP is a metacategory – the left-hand side of this rule, DEP, does not appear in the c-structure, the relevant right-hand side category is used instead. While this is equivalent to having the right-hand side of (52) instead of DEP in (51), it makes rules more readable and less complicated.

[14] The OBL$_{mod}$ grammatical function is used in Polish for arguments expressing manner.

This is precisely the problem with alternative representations of (10) given in (12) and (54): in both cases the dependent expressing manner (analysed as an adjunct or an argument, respectively) is only present in the main clause – realised as a comparison (*jak siedem nieszczęść*).[15] However, there is no such dependent in the comparison itself, though it has the same predicate as the main clause and it has the same requirements (presence of a manner dependent, be it an argument or an adjunct).

There seems to be a potential solution to this problem, though it involves changing the treatment of JAK – so far it has been analysed as a complementiser. Such comparative constructions could instead be analysed as relative clauses, where the entire clause is the manner dependent of the main verb, while JAK is the relative element inside the relative clause, filling its manner dependent position, see (55). Alternatively, a free relative-like analysis could be adopted, where JAK is at the same time a dependent of the main clause predicate and a dependent of the comparative clause – see (56), inspired by the account of free relatives in Dalrymple and Kaplan 2000. Under both variants of the relative clause solution the requirements of both predicates taking a manner dependent are satisfied.

(55)
$$\begin{bmatrix}
\text{PRED} & \text{`LOOK}\langle\boxed{1},\boxed{2}\rangle\text{'} \\
\text{SUBJ} & \boxed{1}\begin{bmatrix}\text{PRED} & \text{`WOMAN'}\\ \text{CASE} & \text{NOM}\end{bmatrix} \\
\text{OBL}_{mod} & \boxed{2}\begin{bmatrix}
\text{PRED} & \text{`LOOK}\langle\boxed{3},\boxed{4}\rangle\text{'} \\
\text{SUBJ} & \boxed{3}\begin{bmatrix}\text{PRED} & \text{`SEVEN}\langle\boxed{5}\rangle\text{'}\\ \text{CASE} & \text{ACC}\\ \text{OBJ} & \boxed{5}\begin{bmatrix}\text{PRED} & \text{`DISASTER'}\\ \text{CASE} & \text{GEN}\end{bmatrix}\end{bmatrix} \\
\text{OBL}_{mod} & \boxed{4}\begin{bmatrix}\text{PRED} & \text{`JAK'}\end{bmatrix} \\
\text{CLAUSE-TYPE} & \text{REL}
\end{bmatrix}
\end{bmatrix}$$

(56)
$$\begin{bmatrix}
\text{PRED} & \text{`LOOK}\langle\boxed{1},\boxed{2}\rangle\text{'} \\
\text{SUBJ} & \boxed{1}\begin{bmatrix}\text{PRED} & \text{`WOMAN'}\\ \text{CASE} & \text{NOM}\end{bmatrix} \\
\text{OBL}_{mod} & \boxed{2}\begin{bmatrix}
\text{PRED} & \text{`JAK'} \\
\text{ADJUNCT} & \left\{\begin{bmatrix}
\text{PRED} & \text{`LOOK}\langle\boxed{3},\boxed{2}\rangle\text{'} \\
\text{SUBJ} & \boxed{3}\begin{bmatrix}\text{PRED} & \text{`SEVEN}\langle\boxed{4}\rangle\text{'}\\ \text{CASE} & \text{ACC}\\ \text{OBJ} & \boxed{4}\begin{bmatrix}\text{PRED} & \text{`DISASTER'}\\ \text{CASE} & \text{GEN}\end{bmatrix}\end{bmatrix} \\
\text{OBL}_{mod} & \boxed{2} \\
\text{CLAUSE-TYPE} & \text{REL}
\end{bmatrix}\right\}
\end{bmatrix}
\end{bmatrix}$$

[15] I am very grateful to the audience of LFG17 for pointing out this problem with the analysis.

6 Conclusion

This paper presented an analysis of Polish data involving lexicalised comparative constructions with JAK. It presented arguments supporting a unified clausal, gapping-like analysis of lexicalised comparative dependents of verbs based on attested data from Polish. On the basis of the discussion of possible mismatches between the main clause and the comparison, it argued that a standard gapping analysis where the gapped comparative clause uses the same predicate and imposes the same requirements is not capable of accounting for all the data presented in this paper. For this reason it proposes a gapping-inspired formalisation of the analysis of gapped comparisons, which relies on the use of appropriate constraints in the lexicon. Adopting such an approach makes it possible to account for mismatches that could not be handled by a standard gapping analysis or would be problematic. The formalisation of the analysis proposed in this paper was successfully implemented and tested in XLE as a part of a general grammar of Polish.

However, it must be noted that the examples of mismatch between the main verb and the comparison are very rare. This paper is based on the analysis of 147 valency schemata[16] in which the comparison involves more than one lexicalised dependent. In the vast majority of inspected schemata there is a perfect match between the dependents of the main verb and the comparison – it might therefore be worth exploring the possibility of adapting the analysis of gapping described in Patejuk and Przepiórkowski 2017 to such comparisons, hoping for a unified account of gapping (perhaps leaving out the extremely rare genuine mismatches). While the current paper does not investigate instances of non-lexicalised comparisons with JAK (which are very productive), these could be taken into account under such a unified account.

Furthermore, it seems that the current account of lexicalised comparisons could be extended so as to use Optimality Theory marks to account for instances of word play where some of the constraints imposed on the lexicalised comparison are deliberately violated – it seems that such violations do not simply result in ungrammaticality, which would call for a more refined solution.

Finally, though Polish abounds in other types of comparative constructions, for instance featuring NICZYM 'like' (which is sometimes treated as a high-register variant of JAK) or NIŻ 'than', these are outside of the scope of this paper – it is focused exclusively on lexicalised comparisons involving JAK.

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[16]The schemata were taken from Walenty (Przepiórkowski et al. 2014), a valency dictionary of Polish. It is freely available online at http://walenty.ipipan.waw.pl/. At the time of writing, the schemata containing comparisons are not analysed in Walenty as described in this paper (no grammatical functions such as SUBJ or OBJ, no mapping between corresponding dependents).

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Filling the Gap

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Abstract

The paper presents an LFG account of Gapping based on data from English and Polish. The analysis accounts for the requirement that the elided verb be understood as having the same semantic – but not necessarily agreement – features as the overt verb, and for the possibility of mismatches between arguments of the overt and the elided verb.

1 Introduction

There is no worked-out LFG analysis of Gapping. It is – by design – not dealt with in Maxwell and Manning 1996, which provides an analysis of some other kinds of non-constituent coordination (using mechanisms which go beyond standard LFG), and just a very general basic idea is suggested in Kaplan 1987, 1995 based on a new operator – priority union. The aim of this paper is to fill this gap. The proposed analysis does not assume any non-standard mechanisms and it uniformly deals with standard cases of Gapping (as in (1)–(2)), as well as other phenomena sometimes analysed as subspecies of Gapping, including Conjunction Reduction (as in (3)).

(1) Marge gave an apple to Lisa, and Homer a donut to Bart.
(2) Marge gave an apple to Lisa, and Homer to Bart.
(3) Marge gave an apple to Lisa and a banana to Bart.

The main analysis is developed on the basis of English, but more complex interactions are illustrated on the basis of Polish, a free word order language with interesting valency and case assignment phenomena.

2 Basics

2.1 Data

A property distinguishing Gapping from many other ellipsis-like phenomena is that a verb is completely elided, rather than being replaced by a verbal pro-form like *do (so)*. This property also sets apart the examples in (1)–(3) above from, e.g., Right Node Raising (cf. (4)) and VP Ellipsis (cf. (5)):

(4) Marge gave an apple, and Homer wanted to give a donut, to their daughter Lisa. (RNR)
(5) Marge has just given Lisa a kiss, and Homer will, too. (VPE)

Another property of Gapping is that the elided verb must be understood as having the same semantic and information-structural features as the overt verb, including tense and voice. No such constraints hold, e.g., in the case of VP Ellipsis: (5) above involves different tense values, and (6) below (cited as attested in Dalrymple et al. 1991: 440) – different voice values.

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(6) A lot of this material can be presented in a fairly informal and accessible fashion, and often I do.

Attempts to violate these constraints on Gapping result in ungrammaticality:[1]

(7) Marge gave an apple to Lisa yesterday, and Homer *(will give) a banana to Bart tomorrow.

(8) Lisa was given an apple by Marge and Homer *(gave) a banana to Bart.

This does not, however, mean that the elided verb, if present, must have the same form as the overt verb – they may differ in agreement features, as in the following example from Johnson 2014: 4:

(9) He likes beans and you (like) rice.

More examples of this kind will be given in §4 below, in the context of Polish.

2.2 Analysis

A rule like (10) is usually assumed for sentential coordination in LFG (Kaplan and Maxwell 1988: 304, Dalrymple 2001: 362, Peterson 2004: 652, etc.).

(10) IP → IP Conj IP
$\downarrow \in \uparrow$ $\downarrow \in \uparrow$

At the functional level it creates a set with two f-structures corresponding to the two conjoined sentences. Given that in the second IP on the right hand side of this rule the verb is missing in Gapping constructions, the pleasing symmetry between the two IP constituents in (10) cannot be maintained: the value of PRED in the second f-structure must originate in the first f-structure.

The analysis proposed here generalises and appropriately encodes the intuition that functional annotations pertaining to the first conjunct may optionally hold for the whole set and, hence, spread to other conjuncts. A coordination rule that handles Gapping is given in (11).

(11) IP → IP1 [Comma IP]* Conj IP
$\uparrow = \downarrow$ $\downarrow \in \uparrow$ $\downarrow \in \uparrow$
$(\downarrow \text{LOCAL}) \in \uparrow$

This rule trivially extends the previous version to the case of possibly more than two conjuncts and – less trivially – treats the first of these (IP1) in a special way to be explained briefly.

As more complex interactions will be illustrated with Polish, we assume here the following c-structure rules which are a part of a large implemented grammar of Polish (Patejuk and Przepiórkowski 2012b, 2014c, 2017).

(12) IP → DEP*, (I)

(13) DEP ≡ NP | InfP | PP | ...
$(\uparrow \text{SUBJ}) = \downarrow$ $(\uparrow \text{XCOMP}) = \downarrow$ $\downarrow \in (\uparrow \text{ADJ})$
$(\downarrow \text{CASE}) =_c \text{NOM}$ ... ...

[1] As usual, an asterisk in front of parentheses means that optionality is ruled out, i.e., that only a version of the sentence with the material in the parentheses is grammatical.

As usual, the lack of any functional schemata below a right hand side (RHS) category is understood as a shorthand for the single "head equation" $\uparrow{=}\downarrow$. This means that all constituents in (12) are co-heads of the IP: this holds for the optional verb, I, and any number of dependents. Note also the comma in the RHS of (12), which signals an arbitrary order of the constituents. Since Polish is a so-called free word order language, i.e., a language where word order is to a large extent determined by information structure, the subject is treated just like any other dependent – there is no need to split an IP first into the subject and an I′, and then the I′ into an I and any postverbal dependents, as is normally done in English. But nothing in the basic analysis depends on the flat structure of clauses produced by (12), and the proposed analysis is compatible with a more hierarchical structure and strict linearisation, as usually assumed for English (but see §5.1 for an aspect of Gapping where the flat structure becomes crucial).

Possible dependents are specified in (13) in the usual way: a nominative NP is a possible subject, an infinitival phrase is a candidate for an XCOMP value, etc. What is perhaps slightly unusual is the splitting of the IP rule into the two rules (12)–(13), which jointly have the same effect as the following single rule:

(14) $\begin{array}{lcccccc} \text{IP} & \rightarrow & \text{NP}, & \text{InfP}, & \text{PP*}, & \ldots, & \text{(I)} \\ & & (\uparrow \textsc{subj}) = \downarrow & (\uparrow \textsc{xcomp}) = \downarrow & \downarrow \in (\uparrow \textsc{adj}) & & \\ & & (\downarrow \textsc{case}) =_c \textsc{nom} & \ldots & \ldots & & \end{array}$

The advantage of splitting this rule into two is that the definition of possible dependents in (13) may be reused, in particular in the following rule for IP1:

(15) $\begin{array}{lcll} \text{IP1} & \rightarrow & \text{DEP*}, & \text{I} \\ & & (\uparrow (\textsc{local})) = \downarrow & \end{array}$

One simple difference between the rule for the initial IP1 in (15) and the rule for any non-initial IP in (12) is that the I, i.e., the finite verb, is obligatory in IP1, while it is optional in further IPs, which may be gapped. The other difference is the presence of the optional attribute LOCAL in the functional annotation on DEP. The effect of this optional attribute in (15) is that each dependent either contributes to the top f-structure of IP1 (if the annotation $(\uparrow (\textsc{local})) = \downarrow$ is resolved to $\uparrow{=}\downarrow$) or to the value of LOCAL, assumed to be a non-distributive feature (if the annotation is resolved to $(\uparrow \textsc{local}) = \downarrow$). The procedural intuition is that LOCAL at this stage contains exactly those pieces of the first conjunct which do not distribute to other conjuncts. If this analysis were to be applied to example (1), repeated below, the f-structure for the first conjunct would at this stage look as in (16), on the assumption that the functional annotation resolves to $(\uparrow \textsc{local}) = \downarrow$ for each of the three dependents.[2]

(1) Marge gave an apple to Lisa, and Homer a donut to Bart.

[2] In all AVMs corresponding to the running example, the values of LOCAL are marked as $\boxed{0}$.

(16)
$$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{give}\text{<}\textsc{subj},\textsc{obj},\textsc{obl}\text{>'} \\ \textsc{tense} & \textsc{past} \\ \textsc{voice} & \textsc{active} \\ \textsc{local} & \boxed{0}\begin{bmatrix} \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{Marge}\text{'} \end{bmatrix} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{apple}\text{'} \end{bmatrix} \\ \textsc{obl} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{Lisa}\text{'} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Given the three dependents, there are $2^3 = 8$ possibilities of resolving the three $(\uparrow\ (\textsc{local})) = \downarrow$ functional equations, of which (16) is just one. Another one could potentially be (17), but it would not lead to a successful analysis of (1).

(17)
$$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{give}\text{<}\textsc{subj},\textsc{obj},\textsc{obl}\text{>'} \\ \textsc{tense} & \textsc{past} \\ \textsc{voice} & \textsc{active} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{apple}\text{'} \end{bmatrix} \\ \textsc{local} & \begin{bmatrix} \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{Marge}\text{'} \end{bmatrix} \\ \textsc{obl} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{Lisa}\text{'} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

What is important is that only the DEP constituents may have their f-structures put into the value of LOCAL, while the verb in I is implicitly annotated with the head equation $\uparrow = \downarrow$, i.e., necessarily contributes to the top level of the structure. Moreover, it contributes all the features – not just PRED, but also other attributes defined in the lexical entry of the verb, including TENSE and VOICE (or similar attributes). This naturally accounts for the fact mentioned above that the elided verb not only takes over the basic meaning of the overt verb (i.e., its PRED), but also any other semantic and information-structural features of a given verb form, including its tense and voice.

Let us now consider the coordination rule (11), repeated below:

(11) IP → IP1 [Comma IP]* Conj IP
$\uparrow = \downarrow$ $\downarrow \in \uparrow$ $\downarrow \in \uparrow$
$(\downarrow \textsc{local}) \in \uparrow$

While all non-initial IPs contribute their f-structures to the resulting set, as standard in LFG, in the case of IP1 it is the LOCAL value which is defined as the member of the whole set, via the $(\downarrow \textsc{local}) \in \uparrow$ functional annotation.

In the case of the running example (1), speaking procedurally again, this results in the set in (18), where the first element is the value of LOCAL of the first conjunct (cf. (16) above) and the second element is the f-structure of the second conjunct.

(18)
$$\left\{ \boxed{0}\begin{bmatrix} \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{Marge}\text{'} \end{bmatrix} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{apple}\text{'} \end{bmatrix} \\ \textsc{obl} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{Lisa}\text{'} \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{Homer}\text{'} \end{bmatrix} \\ \textsc{obj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{donut}\text{'} \end{bmatrix} \\ \textsc{obl} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{Bart}\text{'} \end{bmatrix} \end{bmatrix} \right\}$$

Further, according to the other annotation on IP1, ↑=↓, this set is unified with the whole f-structure of IP1, in effect distributing all distributable features of IP1 to all elements of the set. In the case of the running example, the unification of the set in (18) with the top f-structure for the first conjunct in (16) results in the final hybrid f-structure for the coordinated IP shown in (19).

(19)
$$\left[\begin{array}{l}\left\{\left(\boxed{0}\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{give}\langle\boxed{1},\boxed{2},\boxed{3}\rangle\text{'}\\ \textsc{subj} & \boxed{1}\left[\textsc{pred}\quad \text{`}\textsc{Marge}\text{'}\right]\\ \textsc{obj} & \boxed{2}\left[\textsc{pred}\quad \text{`}\textsc{apple}\text{'}\right]\\ \textsc{obl} & \boxed{3}\left[\textsc{pred}\quad \text{`}\textsc{Lisa}\text{'}\right]\\ \textsc{tense} & \textsc{past}\\ \textsc{voice} & \textsc{active}\end{array}\right],\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{give}\langle\boxed{4},\boxed{5},\boxed{6}\rangle\text{'}\\ \textsc{subj} & \boxed{4}\left[\textsc{pred}\quad \text{`}\textsc{Homer}\text{'}\right]\\ \textsc{obj} & \boxed{5}\left[\textsc{pred}\quad \text{`}\textsc{banana}\text{'}\right]\\ \textsc{obl} & \boxed{6}\left[\textsc{pred}\quad \text{`}\textsc{Bart}\text{'}\right]\\ \textsc{tense} & \textsc{past}\\ \textsc{voice} & \textsc{active}\end{array}\right]\right)\right\}\\ \textsc{local}\ \boxed{0}\end{array}\right]$$

Apart from the presence of the technical attribute LOCAL, this is the desired representation of (1). It would be easy to get rid of this attribute by using the restriction operator and replacing the functional equation ↑=↓ under IP1 in (11) with ↑=↓/LOCAL, but this attribute will play a role in the analysis of agreement, so we leave it there.

An important aspect of this analysis is that the information introduced by the verb in the first conjunct is distributed to all conjuncts simultaneously. For this reason, different values of PRED in particular conjuncts – namely, values differing in what arguments fill particular argument positions – are fine, as long as they are all subsumed (see, e.g., Maxwell and Manning 1996: 11) by the value specified in the lexical entry of the verb (e.g., by (↑ PRED) = 'GIVE<SUBJ,OBJ,OBL>').

Out of the 8 possibilities of analysing the first conjunct of (1), where each of SUBJ, OBJ and OBL is present either at the top level or within the value of LOCAL, only the analysis illustrated in (16), where all of them are put within LOCAL, guarantees the successful analysis of the whole sentence. If any of these three attributes were instead present at the top level, as is OBJ in (17), they would distribute to the other conjunct, which would result in a feature clash, as the other conjunct already contains the values of all three attributes (see the second element of the set in (18)). However, (17) is exactly the right analysis of the first conjunct in the case of example (2), repeated below, where not only the verb is elided, but also the direct object:

(2) Marge gave an apple to Lisa, and Homer to Bart.

In this case, the following two elements will initially be contributed to the coordination set by the membership (∈) statements in the coordination rule (11):

(20)
$$\left\{\boxed{0}\left[\begin{array}{ll}\textsc{subj} & \left[\textsc{pred}\quad \text{`}\textsc{Marge}\text{'}\right]\\ \textsc{obl} & \left[\textsc{pred}\quad \text{`}\textsc{Lisa}\text{'}\right]\end{array}\right],\left[\begin{array}{ll}\textsc{subj} & \left[\textsc{pred}\quad \text{`}\textsc{Homer}\text{'}\right]\\ \textsc{obl} & \left[\textsc{pred}\quad \text{`}\textsc{Bart}\text{'}\right]\end{array}\right]\right\}$$

The effect of the unification of this set with the full f-structure for IP1 in (17) will then have the result of distributing not only the values of PRED, TENSE and VOICE, but also the value of OBJ:

(21)
$$\left[\left\{\left(\boxed{0}\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{give}\text{<}\boxed{1},\boxed{2},\boxed{3}\text{>'}\\ \textsc{subj} & \boxed{1}\left[\textsc{pred}\quad \text{`}\textsc{Marge}\text{'}\right]\\ \textsc{obj} & \boxed{2}\left[\textsc{pred}\quad \text{`}\textsc{apple}\text{'}\right]\\ \textsc{obl} & \boxed{3}\left[\textsc{pred}\quad \text{`}\textsc{Lisa}\text{'}\right]\\ \textsc{tense} & \textsc{past}\\ \textsc{voice} & \textsc{active}\end{array}\right),\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{give}\text{<}\boxed{4},\boxed{2},\boxed{5}\text{>'}\\ \textsc{subj} & \boxed{4}\left[\textsc{pred}\quad \text{`}\textsc{Homer}\text{'}\right]\\ \textsc{obj} & \boxed{2}\\ \textsc{obl} & \boxed{5}\left[\textsc{pred}\quad \text{`}\textsc{Bart}\text{'}\right]\\ \textsc{tense} & \textsc{past}\\ \textsc{voice} & \textsc{active}\end{array}\right)\right\}\right]$$
$$\textsc{local}\ \boxed{0}$$

In a similar fashion, the analysis also deals with Conjunction Reduction, as in (3), repeated below.

(3) Marge gave an apple to Lisa and a banana to Bart.

In this case, the annotation on the DEP corresponding to *Marge* will resolve to ↑=↓, with the effect of the SUBJ value spreading to other conjuncts. This will result in a structure like (22).

(22)
$$\left[\left\{\left(\boxed{0}\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{give}\text{<}\boxed{1},\boxed{2},\boxed{3}\text{>'}\\ \textsc{subj} & \boxed{1}\left[\textsc{pred}\quad \text{`}\textsc{Marge}\text{'}\right]\\ \textsc{obj} & \boxed{2}\left[\textsc{pred}\quad \text{`}\textsc{apple}\text{'}\right]\\ \textsc{obl} & \boxed{3}\left[\textsc{pred}\quad \text{`}\textsc{Lisa}\text{'}\right]\\ \textsc{tense} & \textsc{past}\\ \textsc{voice} & \textsc{active}\end{array}\right),\left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{give}\text{<}\boxed{1},\boxed{4},\boxed{5}\text{>'}\\ \textsc{subj} & \boxed{1}\\ \textsc{obj} & \boxed{4}\left[\textsc{pred}\quad \text{`}\textsc{banana}\text{'}\right]\\ \textsc{obl} & \boxed{5}\left[\textsc{pred}\quad \text{`}\textsc{Bart}\text{'}\right]\\ \textsc{tense} & \textsc{past}\\ \textsc{voice} & \textsc{active}\end{array}\right)\right\}\right]$$
$$\textsc{local}\ \boxed{0}$$

3 Delimiting Gapping

As demonstrated above, the analysis proposed here does not only deal with the most typical cases of Gapping, such as (1)–(2) above, but also with Conjunction Reduction, sometimes analysed as a special case of Gapping (Neijt 1979, Johnson 2014). On the other hand, Right Node Raising and VP Ellipsis have properties which set them apart from Gapping, including the lack of any constraints on the identity – across conjuncts – of semantic features such as tense and voice. One property encoded in the proposed analysis which distinguishes standard Gapping and Conjunction Reduction on one hand and RNR and VP Ellipsis on the other is that the former – but not the latter – require the absence of the main verb in the non-initial conjunct(s). This follows from the rule (15) for IP1, repeated below, namely, from the fact that the verb, I, is implicitly annotated with the head equation ↑=↓ and, hence, must distribute to other conjuncts. This is only possible when the other conjuncts do not contain their own main verbs.

(15) IP1 → DEP*, I
$(\uparrow (\textsc{local})) = \downarrow$

If the constituent I in (15) were annotated just like DEP, i.e., with the equation $(\uparrow (\textsc{local})) = \downarrow$, the same rule (15) could be used for ordinary sentential coordination: all constituents within IP1 (also the verb) could be analysed as elements of LOCAL, i.e., none would distribute to other conjuncts. However, this positive aspect of this more general analysis would be marred by the fact that the analysis would severely overgenerate. For example, if the verb and almost all dependents were analysed as local to the first conjunct, and only, say, the object were to be distributed across the coordinate structure, the result would be unacceptable:

(23) Marge gave an apple to Lisa and Homer took *(an apple) from Bart.

Hence, as it stands, the IP coordination rule (11) only deals with Gapping, etc., but not with ordinary sentential coordination. However, it is not necessary to formulate a completely separate rule for ordinary coordination; rather, what is needed is an extension of (11) which makes it possible to have an ordinary IP as the first constituent, rather than the Gapping-specific IP1:

(24) IP → (IP | IP1) [Comma IP]* Conj IP
$\downarrow \in \uparrow$ $\downarrow = \uparrow$ $\downarrow \in \uparrow$ $\downarrow \in \uparrow$
$(\downarrow \textsc{local}) \in \uparrow$

Despite the fact that the proposed analysis makes a clear distinction between Gapping (now also including Conjunction Reduction) and other superficially similar phenomena, there are cases where it seems to introduce spurious ambiguities, as in the following example:

(25) Betsy has read a book or a magazine.

The obvious analysis of (25) is as involving a coordination of nominal phrases within the object position of *read*. However, a Gapping analysis of this sentence is also available, on which what is elided is both the verbal material (*has read*) and the subject (*Betsy*).

Johnson (2014) – citing Schwarz 1999 – argues that a Gapping analysis of such an apparent NP-coordination should be made available by the grammar. This claim is based on examples like the following (Johnson 2014: 6):

(26) Either Betsy wanted to read a book or a magazine.

Accepting the analysis of Schwarz 1999, on which *either* marks the start of the first conjunct rather than being displaced from its original location (as previously analysed in Larson 1985), Johnson (2014) concludes that (26) involves sentential coordination, so the second conjunct, *a magazine*, represents the sentence *Betsy wanted to read a magazine*, with the subject and the verbal material elided. If so, also the following sentence, which differs from (26) only in not marking the beginning of the first conjunct, should also have a Gapping analysis in addition to the NP-coordination one (and similarly for (25)):

(27) Betsy wanted to read a book or a magazine.

According to Johnson (2014: 6), there is a semantic reflex of the structural ambiguity of (27). On the NP-coordination analysis, the sentence "describes a particular desire that Betsy has: she desires to read something that is either a book or a magazine". But on the Gapping analysis, (27) is synonymous with the unambiguous (26), "which claims that Betsy has one or the other of two desires… Betsy wanted to read a book or Betsy wanted to read a magazine".

In summary, the proposed account seems to properly delineate Gapping: it only deals with cases where non-initial conjuncts lack the main verb and it includes Conjunction Reduction and – although it may be surprising that this is an advantage of the analysis – also cases which superficially look like instances of coordination within a dependent of the main verb, as in (25).

4 Interactions and extensions

4.1 Agreement

The analysis proposed above naturally accounts for the fact that the elided verb must be understood as having the same semantic features – such as tense – as the overt verb, but it also seems to require that it have the same agreement features, i.e., it seems to exclude examples such as (9), repeated below, where the overt verb occurs in the singular and the elided verb, if present, would occur in the plural:

(9) Maggie only drinks milk, while Carl and Lennie (only drink) beer.

In languages in which subject–verb agreement involves grammatical gender, this morphosyntactic feature also does not have to be shared in Gapping, as illustrated by the Polish example (28) and its intended f-structure (29):

(28) Lisa lubiła Nelsona, a Nelson (lubił) Lisę.
Lisa.NOM.F liked.F Nelson.ACC.M and Nelson.NOM.M liked.M Lisa.ACC.F
'Lisa liked Nelson and Nelson (liked) Lisa.' (Polish)

(29)
$$\left[\begin{array}{l}\left\{\left[\begin{array}{ll}\text{PRED} & \text{'LIKE<}\boxed{1}\text{,}\boxed{2}\text{>'}\\ \text{SUBJ} & \boxed{1}\left[\begin{array}{ll}\text{PRED} & \text{'LISA'}\\ \text{CASE} & \text{NOM}\\ \text{NUMB} & \text{SG}\\ \text{GEND} & \text{F}\end{array}\right]\\ \text{OBJ} & \boxed{2}\left[\begin{array}{ll}\text{PRED} & \text{'NELSON'}\\ \text{CASE} & \text{ACC}\\ \text{NUMB} & \text{SG}\\ \text{GEND} & \text{M}\end{array}\right]\\ \text{TENSE} & \text{PAST}\\ \text{VOICE} & \text{ACTIVE}\end{array}\right]\boxed{0}, \left[\begin{array}{ll}\text{PRED} & \text{'LIKE<}\boxed{3}\text{,}\boxed{4}\text{>'}\\ \text{SUBJ} & \boxed{3}\left[\begin{array}{ll}\text{PRED} & \text{'NELSON'}\\ \text{CASE} & \text{NOM}\\ \text{NUMB} & \text{SG}\\ \text{GEND} & \text{M}\end{array}\right]\\ \text{OBJ} & \boxed{4}\left[\begin{array}{ll}\text{PRED} & \text{'LISA'}\\ \text{CASE} & \text{ACC}\\ \text{NUMB} & \text{SG}\\ \text{GEND} & \text{F}\end{array}\right]\\ \text{TENSE} & \text{PAST}\\ \text{VOICE} & \text{ACTIVE}\end{array}\right]\right\}\\ \text{LOCAL}\ \boxed{0}\end{array}\right]$$

In the usual LFG analysis of subject–verb agreement, only the subject bears explicit morphosyntactic features such as NUMB(er) or GEND(er), while the verb is, say,

singular and masculine only in the sense that it requires its subject to have appropriate values of NUMB (say, SG) and GEND (say, F(eminine)). So, in this approach, lexical entries of nouns will include defining equations such as (30), while lexical entries of verbs will include constraining equations such as (31).

(30) a. $(\uparrow \text{NUMB}) = \text{SG}$
b. $(\uparrow \text{GEND}) = \text{F}$

(31) a. $(\uparrow \text{SUBJ NUMB}) =_c \text{SG}$
b. $(\uparrow \text{SUBJ GEND}) =_c \text{F}$

In the case of many languages, the above constraining equations are not sufficient, as the verb does not necessarily agree with the subject as a whole, but may agree with just one – usually the closest – conjunct within the subject, when the subject is a coordinate structure (cf., e.g., Sadler 1999, Kuhn and Sadler 2007 and Dalrymple and Hristov 2010). This means that, at least in such languages, the constraining equations in (31) could be replaced with more general equations in (32), where the local name %s, representing the agreement target, is resolved either to the value of SUBJ, in effect giving the equations in (31), or to the value of an appropriate conjunct within SUBJ (cf., e.g., Falk 2006: 198–199 and Patejuk 2015: §3.1.3).

(32) a. $(\uparrow \%\text{S NUMB}) =_c \text{SG}$
b. $(\uparrow \%\text{S GEND}) =_c \text{F}$

An extension of such an analysis of subject–verb agreement to Gapping is immediate: a third – or second, in the case of languages which do not display single conjunct agreement – possible agreement target needs to be added, namely, the subject within LOCAL.[3] In the case of English, where single conjunct agreement is not observed, subject–verb agreement would then boil down to the following statements in the lexical entries of finite verbs:[4]

(33) a. $\%\text{S} = (\uparrow \text{SUBJ}) \mid \%\text{S} = (\uparrow \text{LOCAL SUBJ})$
b. $(\uparrow \%\text{S NUMB}) =_c \text{SG}$
c. $(\uparrow \%\text{S GEND}) =_c \text{F}$

Since such statements are effectively parts of lexical entries of overt finite verbs, the $\uparrow$ metavariable points to the f-structure corresponding to the verb. According to the current analysis of Gapping, the f-structure of the overt verb is at the same time the f-structure of IP1 and, hence, the f-structure of the whole coordinate structure. As the whole structure contains the attribute LOCAL, whose value is the first conjunct, $(\uparrow \text{LOCAL SUBJ})$ exists and the second disjunct in (33) may be selected as defining the target of agreement.[5] This means that there is no sense in which the elided verb

[3] In the case of languages allowing for single conjunct agreement, one more target must be specified, namely, a distinguished conjunct of the LOCAL subject.

[4] Appropriate sets of such statements can be defined as templates, called from lexical entries (Dalrymple et al. 2004).

[5] Given that SUBJ is a distributive feature, this simplified analysis produces spurious ambiguities when two subjects in a Gapping construction bear the same morphosyntactic features. The XLE implementation of this analysis avoids such ambiguities by making sure that the first option, $\%\text{S} = (\uparrow \text{SUBJ})$, is realised only in the absence of Gapping (i.e., in the absence of the LOCAL feature). This

in the second conjunct agrees with the subject within this second conjunct. The only subject–verb agreement in Gapping is that between the overt verb and its (i.e., LOCAL) subject.

4.2 Case assignment

Consider the following slightly more complex Polish sentence and its intended f-structure:

(34) Lisa lubiła Nelsona, a Nelson Lisy nie.
Lisa.NOM.F liked.F Nelson.ACC.M but Nelson.NOM.M Lisa.GEN.F NEG
'Lisa liked Nelson, but Nelson didn't like Lisa.' (Polish)

(35)
$$\left[\begin{array}{l} \left\{ \boxed{0} \left[\begin{array}{ll} \text{PRED} & \text{`LIKE<}\boxed{1},\boxed{2}\text{>'} \\ \text{SUBJ} & \boxed{1}\left[\begin{array}{ll} \text{PRED} & \text{`LISA'} \\ \text{CASE} & \text{NOM} \\ \text{NUMB} & \text{SG} \\ \text{GEND} & \text{F} \end{array}\right] \\ \text{OBJ} & \boxed{2}\left[\begin{array}{ll} \text{PRED} & \text{`NELSON'} \\ \text{CASE} & \text{ACC} \\ \text{NUMB} & \text{SG} \\ \text{GEND} & \text{M} \end{array}\right] \\ \text{TENSE} & \text{PAST} \\ \text{VOICE} & \text{ACTIVE} \end{array}\right], \left[\begin{array}{ll} \text{PRED} & \text{`LIKE<}\boxed{3},\boxed{4}\text{>'} \\ \text{SUBJ} & \boxed{3}\left[\begin{array}{ll} \text{PRED} & \text{`NELSON'} \\ \text{CASE} & \text{NOM} \\ \text{NUMB} & \text{SG} \\ \text{GEND} & \text{M} \end{array}\right] \\ \text{OBJ} & \boxed{4}\left[\begin{array}{ll} \text{PRED} & \text{`LISA'} \\ \text{CASE} & \text{GEN} \\ \text{NUMB} & \text{SG} \\ \text{GEND} & \text{F} \end{array}\right] \\ \text{NEG} & + \\ \text{TENSE} & \text{PAST} \\ \text{VOICE} & \text{ACTIVE} \end{array}\right] \right\} \\ \text{LOCAL}\ \boxed{0} \end{array}\right]$$

Apart from the issue of different agreement features, dealt with in the previous subsection, this example also illustrates a potential problem of different case assignment properties of the overt and the elided verb: while the direct object, *Nelsona*, of the affirmative overt verb occurs in the accusative case, the direct object in the second conjunct, *Lisy*, must occur in the genitive case, due to the presence of the verbal negation marker, *nie*.

Interestingly, to account for different case assignment to the objects in the two conjuncts of (34), no modification is needed to the account of structural case assignment to objects presented in Patejuk and Przepiórkowski 2014b. Simplifying, whether the structurally-cased object receives the accusative or the genitive depends on the presence of a $+$-valued NEG feature, supplied by the negative marker *nie*, which must occur in the final position when stranded from the verb; cf. the extended rule for IP in (36), which should replace the previous version in (12).

(36) IP $\rightarrow$ [DEP*, (I)] (NEG)

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analysis of agreement in Gapping bears a striking resemblance to Ash Asudeh's unpublished analysis of closest conjunct agreement, as described in Kuhn and Sadler 2007: 314–315; this fact has come to our attention only after developing our analysis in the first version of this paper.

Such a [NEG +] feature is absent on the first conjunct but it is contributed by the final *nie* in the second conjunct, so only the second conjunct is understood as negated.

Crucially, case assignment possibilities are formulated in Patejuk and Przepiórkowski 2014b using off-path constraints, in such a way that they are evaluated separately for each conjunct. More specifically, lexical entries of forms of verbs such as LUBIĆ 'like' call a template whose effect is the same as the following existential constraint:

(37) $(\uparrow \textsc{obj} \quad \textsc{pred} \quad)$
$[\neg((\textsc{obj} \leftarrow) \textsc{neg}) \wedge (\leftarrow \textsc{case}) =_c \textsc{acc}] \quad \vee$
$[((\textsc{xcomp}^* \textsc{obj} \leftarrow) \textsc{neg}) =_c + \wedge (\leftarrow \textsc{case}) =_c \textsc{gen}]$

The basic constraint, stating that there is an object which has a PRED value, is trivially true, but what is less trivial are the off-path specifications attached to this PRED. What they are saying is that either there is no NEG feature on the verb and the object bears the accusative case, or there is a $+$-valued NEG feature on this or a higher (but only across XCOMP boundaries) verb and the object bears the genitive case. Since these off-path constraints are attached to PRED, they are distributed with it in coordinate structures and they are evaluated independently in each conjunct. So, in the case there is no NEG in one conjunct, the object must bear the accusative case (cf. the first conjunct in (35)), and in the case there is NEG and its value is +, the object must occur in the genitive (cf. the second conjunct in (35)).

This rather complex analysis of structural case assignment is needed independently of Gapping cases such as (34), namely, to account for unlike category coordination, where perhaps only some of the conjuncts receive case at all (Przepiórkowski and Patejuk 2012, Patejuk 2015), as in:

(38) Lisa chciała książkę i żeby ktoś ją przytulił.
Lisa.NOM wanted book.ACC and that somebody.NOM she.ACC hug
'Lisa wanted a book and that somebody hug her.' (Polish)

Hence, the only extension of the basic analysis that is required to handle case assignment facts such as those illustrated by (34) consists in adding the possibility of the final stranded negation to the main IP rule, as done in (36).

4.3 Unlike categories

Similarly, an account of subcategorisation and coordination in Patejuk and Przepiórkowski 2012a and Patejuk 2015, in which alternative ways of categorial realisation of a given grammatical function are evaluated separately for each conjunct (thus making unlike category coordination possible), allows for Gapping examples such as (39), where the object of the gapped verb is realised as different categories in different conjuncts, by analogy to the unlike coordination example in (38):

(39) Lisa chciała książkę, a Maggie żeby ktoś ją
Lisa.NOM wanted book.ACC and Maggie.NOM that somebody.NOM she.ACC
przytulił.
hug
'Lisa wanted a book and Maggie wanted someone to hug her.' (Polish)

Verbs which allow different categories (and hence also their coordination) in a single position specify the range of possibilities in a way analogous to the specification of case possibilities in (37) above. In the specific case of CHCIEĆ 'want' the object is specified as either case-bearing (with case resolved to accusative or genitive as above) or sentential, with the complementiser ŻEBY 'that' (among other possibilities):

(40) $(\uparrow \text{OBJ} \quad \text{PRED} \quad)$
$[\neg((\text{OBJ} \leftarrow) \text{ NEG}) \wedge (\leftarrow \text{CASE}) =_c \text{ ACC}] \quad \vee$
$[((\text{XCOMP}^* \text{ OBJ} \leftarrow) \text{ NEG}) =_c + \wedge (\leftarrow \text{CASE}) =_c \text{ GEN}] \quad \vee$
$(\leftarrow \text{COMP-FORM}) =_c \text{ŻEBY}$

Again, this kind of specification is needed – and was proposed – independently of Gapping examples such as (39), namely, in order to account for unlike category coordination cases such as (38) above. In the case of the Gapping example (39), the effect of the interaction of the above specification with the analysis of Gapping proposed in the previous section is the following f-structure:

(41)
$$\left[\begin{array}{l} \left\{\left(\begin{array}{l} \boxed{0}\left[\begin{array}{ll} \text{PRED} & \text{'WANT<}\boxed{1}\text{,}\boxed{2}\text{>'} \\ \text{SUBJ} & \boxed{1}\left[\begin{array}{ll} \text{PRED} & \text{'LISA'} \\ \text{CASE} & \text{NOM} \end{array}\right] \\ \text{OBJ} & \boxed{2}\left[\begin{array}{ll} \text{PRED} & \text{'BOOK'} \\ \text{CASE} & \text{ACC} \end{array}\right] \\ \text{TENSE} & \text{PAST} \\ \text{VOICE} & \text{ACTIVE} \end{array}\right], \\ \left[\begin{array}{ll} \text{PRED} & \text{'WANT<}\boxed{3}\text{,}\boxed{4}\text{>'} \\ \text{SUBJ} & \boxed{3}\left[\begin{array}{ll} \text{PRED} & \text{'MAGGIE'} \\ \text{CASE} & \text{NOM} \end{array}\right] \\ \text{OBJ} & \boxed{4}\left[\begin{array}{ll} \text{PRED} & \text{'HUG<}\boxed{5}\text{,}\boxed{6}\text{>'} \\ \text{SUBJ} & \boxed{5}\left[\begin{array}{ll} \text{PRED} & \text{'SB'} \\ \text{CASE} & \text{NOM} \end{array}\right] \\ \text{OBJ} & \boxed{6}\left[\begin{array}{ll} \text{PRED} & \text{'SHE'} \\ \text{CASE} & \text{ACC} \end{array}\right] \\ \text{COMP-FORM} & \text{THAT} \end{array}\right] \\ \text{TENSE} & \text{PAST} \\ \text{VOICE} & \text{ACTIVE} \end{array}\right] \end{array}\right)\right\} \\ \text{LOCAL} \quad \boxed{0} \end{array}\right]$$

5 Limitations

5.1 Verb clusters

Let us examine the following sentences, similar to those given in §3:

(42) Lisa has read a book and Marge a magazine.

(43) Lisa wanted to read a book and Marge a magazine.

In both cases, there is more than just a single verb form which is elided in the gapped sentence: in the case of (42) it is *has* and *read*, and in the case of (43) it is *wanted*, *to* and *read*. On standard LFG assumptions, the first sentence is not problematic for our analysis, as *has* and *read* would be treated as co-heads within the I constituent and would share a single f-structure. However, the second sentence involves two contentful verbs which are elided, each projecting a separate f-structure: *wanted*

and *(to) read*.

Such examples belong to the core cases of Gapping and were systematically discussed in Ross 1970. On the basis of examples adduced there, Johnson (2014: 2) provides the following examples illustrating the possibility of eliding a varying amount of verbal material:

(44) I want to try to begin to write a novel, and Mary (wants) to get ready to set out to review a play.

(45) I want to try to begin to write a novel, and Mary (wants to try) to set out to review a play.

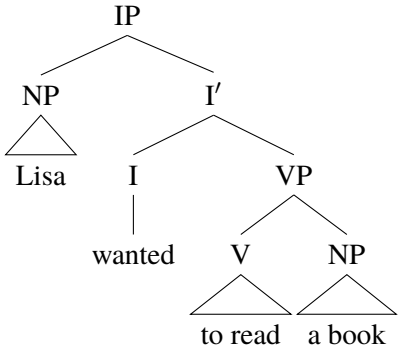
(46) I want to try to begin to write a novel, and Mary (wants to try to begin) to review a play.

(47) I want to try to begin to write a novel, and Mary (wants to try to begin to review) a play.

He notes that the more material is elided, the easier it is to process such sentences, probably due to the fact that fewer constituents are contrasted then.

Given the standard assumption – supported by constituency tests – that infinitival phrases form constituents, i.e., that a sentence like the first conjunct in (43) should have a c-structure like that given schematically in (48), it is not clear to us how to extend the account proposed here to deal with such cases.

(48)



On the other hand, the current account may be straightforwardly extended to deal with similar facts in Polish. The crucial property of Polish which differentiates it from English is its free word order, also in such 'verb cluster' environments. For example, while the most obvious translation of the first conjunct of (43) is given in (49), other word orders are also possible, given the right information structure requirements, including (50)–(53):

(49) Lisa chciała przeczytać książkę.
Lisa.NOM wanted read.INF book.ACC
'Lisa wanted to read a book.' (Polish)

(50) Przeczytać książkę chciała Lisa.
read.INF book.ACC wanted Lisa.NOM

(51) Lisa książkę chciała przeczytać.
Lisa.NOM book.ACC wanted read.INF

(52) Książkę chciała przeczytać Lisa.
book.ACC wanted read.INF Lisa.NOM

(53) Przeczytać chciała Lisa książkę.
read.INF wanted Lisa.NOM book.ACC

This word order freedom suggests a sentential rule which does not treat infinitival dependents as single constituents but rather separates infinitival verbs from their dependents. That means that, in the case of Polish, rule (13), repeated below, which defines possible dependents of verbs, should be replaced with a rule like (54), where single infinitival verbs – rather than whole infinitival phrases – may be (possibly indirect) dependents, and where other constituents – apart from subjects – are interpreted as dependents of either the main verb or one of the infinitival verbs:[6]

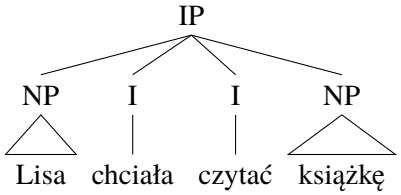
(13) DEP ≡ NP | InfP | PP | …
$(\uparrow \textsc{subj}) = \downarrow$ $(\uparrow \textsc{xcomp}) = \downarrow$ $\downarrow \in (\uparrow \textsc{adj})$
$(\downarrow \textsc{case}) =_c \textsc{nom}$ … …

(54) DEP ≡ NP | I | PP |
$(\uparrow \textsc{subj}) = \downarrow$ $(\uparrow \textsc{xcomp}^+) = \downarrow$ $\downarrow \in (\uparrow \textsc{xcomp}^* \textsc{adj})$
$(\downarrow \textsc{case}) =_c \textsc{nom}$ $(\downarrow \textsc{vform}) =_c \textsc{inf}$ …

NP | …
$(\uparrow \textsc{xcomp}^* \textsc{obj}) = \downarrow$
$(\downarrow \textsc{case}) =_c \textsc{acc}$

According to this rule, (49) receives the c-structure in (55).

(55)



Now, given the above c-structure rule independently motivated by word order facts, it is easy to analyse sentences such as (56) (a Polish translation of (43)) in a way that assigns them an f-structure such as (57).[7]

(56) Lisa chciała przeczytać książkę, a Marge czasopismo.
Lisa.NOM wanted read.INF book.ACC and Marge.NOM magazine.ACC
'Lisa wanted to read a book and Marge a magazine.' (Polish)

For such an analysis to work, out of the three dependents in the first conjunct, namely, the subject of the main verb *Lisa*, the lower verb *czytać* 'read' and the object of the lower verb *książkę* 'book', the subject and the object are put into LOCAL and, hence, will not distribute to other conjuncts, while the lower verb, providing

[6] See Zaenen and Kaplan 1995 for a similar use of functional uncertainty in an analysis of West Germanic verb clusters.

[7] The actual account is a little more complicated as the infinitival argument of CHCIEĆ 'want' is, arguably, its OBJECT rather than XCOMP (Patejuk and Przepiórkowski 2014a).

the value of XCOMP, will contribute to the top level of IP1 and, hence, will distribute to other conjuncts, cf. (58).

(57)
$$\left[\begin{array}{l}\text{LOCAL}\ \boxed{0}\\ \left\{\begin{array}{l}\boxed{0}\left[\begin{array}{ll}\text{PRED} & \text{`WANT<}\boxed{1}\text{,}\boxed{2}\text{>'}\\ \text{SUBJ} & \boxed{1}\left[\begin{array}{ll}\text{PRED} & \text{`LISA'}\\ \text{CASE} & \text{NOM}\end{array}\right]\\ \text{XCOMP} & \boxed{2}\left[\begin{array}{ll}\text{PRED} & \text{`READ<}\boxed{1}\text{,}\boxed{3}\text{>'}\\ \text{SUBJ} & \boxed{1}\\ \text{OBJ} & \boxed{3}\left[\begin{array}{ll}\text{PRED} & \text{`BOOK'}\\ \text{CASE} & \text{ACC}\end{array}\right]\end{array}\right]\\ \text{TENSE} & \text{PAST}\\ \text{VOICE} & \text{ACTIVE}\end{array}\right],\\ \left[\begin{array}{ll}\text{PRED} & \text{`WANT<}\boxed{4}\text{,}\boxed{5}\text{>'}\\ \text{SUBJ} & \boxed{4}\left[\begin{array}{ll}\text{PRED} & \text{`MARGE'}\\ \text{CASE} & \text{NOM}\end{array}\right]\\ \text{XCOMP} & \boxed{5}\left[\begin{array}{ll}\text{PRED} & \text{`READ<}\boxed{4}\text{,}\boxed{6}\text{>'}\\ \text{SUBJ} & \boxed{4}\\ \text{OBJ} & \boxed{6}\left[\begin{array}{ll}\text{PRED} & \text{`MAGAZINE'}\\ \text{CASE} & \text{ACC}\end{array}\right]\end{array}\right]\\ \text{TENSE} & \text{PAST}\\ \text{VOICE} & \text{ACTIVE}\end{array}\right]\end{array}\right\}\end{array}\right]$$

(58)
$$\left[\begin{array}{ll}\text{PRED} & \text{`WANT<SUBJ,XCOMP>'}\\ \text{TENSE} & \text{PAST}\\ \text{VOICE} & \text{ACTIVE}\\ \text{XCOMP} & \left[\text{PRED}\quad \text{`READ<SUBJ,OBJ>'}\right]\\ \text{LOCAL} & \left[\begin{array}{ll}\text{SUBJ} & \left[\text{PRED}\quad \text{`LISA'}\right]\\ \text{XCOMP} & \left[\text{OBJ}\quad \left[\text{PRED}\quad \text{`BOOK'}\right]\right]\end{array}\right]\end{array}\right]$$

While this analysis also successfully handles the more complex Polish facts analogous to those in (44)–(47), it crucially relies on the fact that Polish is a free word language and that infinitival environments display 'clause union' properties in this language, so it is unfortunately not directly applicable to languages such as English, where similar environments have a more hierarchical c-structure.

5.2 Other loose ends

Apart from the possibility of eliding more verbal material, which is problematic for the current account (and many other accounts) in the case of languages such as English, there are other issues left for future research, which may or may not turn out to be problematic.

First of all, the analysis is currently limited to coordinate constructions, with the first conjunct providing interpretation for the constituents elided in subsequent conjuncts. But, as is well known, at least two other constructions are similar to Gapping, namely, list-like answers to questions and comparative constructions (Johnson 2014: 1):

(59) Q. Who met who?
A. Jerry, Sarah; Sally, Mark; Trish, Betsy

(60) Sally met more parents than Tom, kids.

We believe that the analysis proposed here may be extended to such cases by defin-

ing other sources of material to be distributed than just IP1 in coordinate structures, but we have not yet attempted to do so.

What is potentially more problematic for the current analysis are examples like the following:

(61) Homer and Bart like donuts, Maggie likes yogurt and Lisa apples.

(62) Either Homer likes donuts and Bart bananas, or Bart donuts and Homer bananas.

The analysis fails in the case of (61) because the verbal information from the first (or the second) conjunct that must be distributed to the last conjunct is distributed to all conjuncts, including to the second (or the first) conjunct, which already contains such information. This problem could perhaps be avoided on the assumption that (61) involves two binary coordinate structures: asyndetic, with *Homer and Bart like donuts* as the first conjunct and the rest of the sentence as the second, and syndetic, with *Maggie likes yogurt* as the first conjunct and *Lisa apples* as the second. But in the case of (62) it is exactly the recursive structure of coordination that is problematic: the material contributed by *likes* in the first conjunct only spreads to other elements of the same inner set, i.e., to the second conjunct, but not to the third or fourth conjuncts, which form their own set. To the best of our knowledge, such examples, to the extent that they are grammatical, represent a challenge to all theories of Gapping. In any case, the issues discussed in this section, as well as interactions of the proposed analysis with extraction, scope of negation, etc., have to be postponed to future research.

6 Previous LFG work

As mentioned in the introduction, there is no previous comprehensive LFG analysis of Gapping, but there are at least two suggestions. One is made in passing in Kaplan 1987, 1995: 365–366, where a new operator is proposed, called 'priority union' (see also Dalrymple 2001: 175–177). Given two f-structures, f and g, their priority union f/g is that feature structure which contains all attribute–value pairs which constitute f (i.e., all information present in f), as well as those attribute–value pairs $\langle a, v\rangle$ in g for which a does not have a value in f. The intuition is that, if f is the f-structure corresponding directly to a gapped conjunct and g is the first conjunct, then f/g is the full f-structure of the gapped conjunct, with information missing in f filled by g.

To the best of our knowledge, this intuitive idea has never been turned into a worked-out analysis of Gapping. While it is possible that a successful account of Gapping may be based on this priority union operator, the current paper proposes an analysis which does not assume any non-standard machinery, one that can be directly implemented in XLE.[8]

[8] XLE (Crouch et al. 2011) is a comprehensive platform for turning LFG grammars into parsers, which implements various mechanisms proposed throughout the history of LFG (including off-path constraints, hybrid feature structures and the restriction operator), but which lacks an implementation of priority union.

Another idea is presented in Alzaidi 2010 and is based on an earlier analysis of Frank 2002, which also inspired the current account. The target of Frank's analysis is the so-called SGF coordination in German, illustrated by (63) (Höhle 1983), where the subject within the first conjunct is shared with the second conjunct; the simplified intended f-structure for this example is given in (64).

(63) In den Wald ging der Jäger und fing einen Hasen.
into the forest went the.NOM hunter.NOM and caught a.ACC rabbit.ACC
'The hunter went into the forest and caught a rabbit.' (German)

(64) $\left\{ \begin{bmatrix} \textsc{pred} & \text{`GO<}\boxed{1}\text{,}\boxed{2}\text{>'} \\ \textsc{subj} & \boxed{1}\begin{bmatrix} \textsc{pred} & \text{`HUNTER'} \end{bmatrix} \\ \textsc{obl} & \boxed{2}\text{``INTO THE FOREST''} \end{bmatrix}, \begin{bmatrix} \textsc{pred} & \text{`CATCH<}\boxed{1}\text{,}\boxed{3}\text{>'} \\ \textsc{subj} & \boxed{1} \\ \textsc{obj} & \boxed{3}\begin{bmatrix} \textsc{pred} & \text{`RABBIT'} \end{bmatrix} \end{bmatrix} \right\}$

Since the subject does not occur in the sentence-initial position in the first conjunct, the sharing of the subject cannot be interpreted as resulting from VP-coordination (as it could in the case of the English translation).

In order to account for SGF coordination, Frank 2002: 188 breaks the symmetry of the basic coordination rule (10), repeated below, and replaces it with (65).

(10) $\text{IP} \rightarrow \underset{\downarrow\in\uparrow}{\text{IP}}\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{IP}}$

(65) $\text{IP} \rightarrow \underset{\substack{\downarrow\in\uparrow \\ ((\uparrow \textsc{gdf}) = (\downarrow \textsc{gdf}))}}{\text{IP}}\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{IP}}$

GDF stands here for a grammatical discourse function, i.e., TOPIC, FOCUS or – crucially for the example (63) – SUBJ. The effect of this additional annotation is that the subject of the first conjunct (i.e., *der Jäger* 'the hunter') optionally becomes the subject of the whole set and, hence, if it does, it distributes to both conjuncts: spuriously to the first conjunct and crucially to the second.

Alzaidi 2010: 81 proposes applying the same idea to Gapping (in Hejazi Arabic), where what is distributed is not a grammatical function, but PRED and TENSE:

(66) $\text{IP} \rightarrow \underset{\substack{\downarrow\in\uparrow \\ (\uparrow \textsc{pred}) = (\downarrow \textsc{pred}) \\ (\uparrow \textsc{tense}) = (\downarrow \textsc{tense})}}{\text{IP}}\ \text{Conj}\ \underset{\downarrow\in\uparrow}{\text{IP}}$

There are various problems with this idea. The main formal problem is that the explicit equation $(\uparrow \textsc{pred}) = (\downarrow \textsc{pred})$ in (66) works differently than the distribution of PRED proposed above. In (66), the value of $(\downarrow \textsc{pred})$ is the specific value of this feature as instantiated in the first conjunct, i.e., together with specific values of any arguments mentioned in the semantic form. This means that the same first-conjunct arguments are present in the PRED value of the second conjunct, i.e., that these arguments cannot be instantiated to whatever values of SUBJ, OBJ, etc., are introduced in the second conjunct. For this reason the analysis crashes (as verified in an attempt at implementing it in XLE). This differs from the analysis proposed

here, where the information introduced by the verb in the first conjunct is distributed to all conjuncts simultaneously.

There is also a conceptual problem with the analysis proposed in Alzaidi 2010, namely, that the identity of semantic features must be stipulated by explicit statements such as $(\uparrow \textsc{tense}) = (\downarrow \textsc{tense})$. So it is conceivable that there are languages where only some such identities hold, but not all – say only voice must be equal, but not tense. As we are not aware of languages in which Gapping would not involve the same conditions on the identity of all semantic features, an analysis like the one proposed in the current paper – one where all features defined in verbal lexical entries go together – should be preferred. Note also that – since not only the verb but also various dependents may be elided in Gapping – the first conjunct in (66) would also have to be annotated with optional equations such as $((\uparrow \textsc{gf}) = (\downarrow \textsc{gf}))$, for any non-adjunct grammatical function, and an equation such as $((\uparrow \textsc{adj} \in) = (\downarrow \textsc{adj} \in))*$ (and similarly for $\textsc{xadj}$), to account for the possibility of eliding any number (hence the Kleene star) of adjuncts introduced in the first conjunct.

Finally, it is not clear how the proposal of Alzaidi 2010 could be extended to deal with different case values or different syntactic categories of the same grammatical functions (see §§4.2–4.3). We conclude, then, that the current proposal is the first working analysis of a reasonable subset of Gapping phenomena in LFG.

7 Summary

Several types of non-constituent coordinations, including Conjunction Reduction and Right Node Raising, received an interesting uniform LFG(ish) account in Maxwell and Manning 1996. Unfortunately, Gapping falls outside of the scope of that analysis. In general, Kaplan 1987, 1995 and Alzaidi 2010 notwithstanding, no working analysis of gapping has been proposed in LFG. We hope to have just bridged this gap. The account proposed here does not use any non-standard mechanism and it correctly interacts with agreement, case assignment and diverse morpho-syntactic realisations of arguments; all these interactions were verified in the implementation of the current analysis within the large-scale XLE grammar of Polish mentioned above. The analysis naturally captures the observation that the elided verb must be understood as bearing the same semantic and information-structural features as the overt verb, and – given the independently motivated flat structure approach to 'verb clusters' in Polish – accounts for the possibility of eliding larger chunks of verbal material in this language.

One of the already known limitations of this analysis, however, is that it is not clear how to extend the analysis of this last aspect of Gapping – the possibility to elide more verbal material – to languages such as English, with more hierarchical c-structure. It is also not immediately clear how to extend the analysis to coordinate structures in which more than one conjunct contains the overt main verb or to cases of recursively embedded coordination. Such cases, and various interactions of the proposed analysis with other phenomena, should be a matter of future research.

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Hierarchical Lexicon and the Argument/Adjunct Distinction

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Abstract

The first aim of this paper is to propose a fully hierarchical organisation of valency information in LFG, inspired by FrameNet and by recent LFG work on using templates to encode valency. The second aim is to demonstrate that this proposal meshes particularly well with a recent proposal *not* to distinguish arguments from adjuncts.

1 Introduction

In many constraint-based linguistic theories, as well as in some lexicographic projects, lexical information is organised hierarchically. In such a hierarchy, internal nodes represent generalisations pertaining to various portions of the lexicon. These generalisations are inherited by 'lower' nodes. The 'lowest' nodes – the 'leaves' in the hierarchy – typically correspond to specific lexical items, which inherit generalisations from all the nodes on the way up to the root of the hierarchy, and only add truly idiosyncratic information such as the orthographic form. This approach to the lexicon is an important aspect of Head-driven Phrase Structure Grammar (cf., e.g., Flickinger 1987 and Davis 2001), but similar proposals have also been made within Lexicalized Tree-Adjoining Grammar (Vijay-Shanker and Schabes 1992) and within Categorial Grammar (van der Linden 1992), *inter alia*. Hierarchical organisation is also an important feature of WordNet (Miller et al. 1990, Fellbaum 1998) and FrameNet (Fillmore et al. 2003, Fillmore and Baker 2015, Ruppenhofer et al. 2016). While in all these approaches hierarchies represent mainly syntactic and semantic generalisations, Network Morphology (Corbett and Fraser 1993), based on the lexical representation language DATR (Evans and Gazdar 1996), is concerned with morphological and morphosyntactic generalisations.

The possibility of adopting such a comprehensive taxonomic approach to the lexicon has never been seriously entertained within Lexical Functional Grammar. The first aim of this paper is to propose an organisation of the LFG lexicon that is close to that of FrameNet. The technical side of this proposal is relatively straightforward, assumes the Glue approach to LFG semantics (Dalrymple 1999, 2001), makes heavy use of templates (Dalrymple et al. 2004, Asudeh et al. 2008, 2013), and does not require any formal extensions to the underlying LFG machinery, but does require some care to avoid the spurious multiple introduction of meaning constructors. An accompanying paper, Przepiórkowski 2017a, which shares with the current paper most of the material of the initial three sections, demonstrates the feasibility of this FrameNet-inspired approach within the standard LFG.

The second aim of this paper is to argue that such a hierarchical organisation of lexical information fills a gap in the recent proposal *not* to distinguish arguments from adjuncts in LFG, made in Przepiórkowski 2016. That proposal follows the conservative assumption that typical arguments are introduced in the lexicon and

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typical adjuncts are introduced by syntactic rules (with the proviso that some arguments may be introduced constructionally in the syntax and the so-called 'obligatory adjuncts' may be introduced in the lexicon). Importantly, together with other approaches to adjunction, that approach assumes that typical adjuncts may in principle modify any head (of an appropriate grammatical category), subject to some vague 'semantic compatibility' requirement. Here, we show that the hierarchical lexicon approach makes it possible to encode the distribution of adjuncts more precisely. As a by-product, the last vestige of the argument/adjunct distinction is removed from the analysis of Przepiórkowski 2016: according to the analysis proposed here, both types of dependents are normally introduced lexically (which does not preclude the possibility of some being introduced constructionally, pace Asudeh et al. 2013).

2 Inheritance in FrameNet

FrameNet organises lexical knowledge with reference to cognitive structures called *frames*. Various lexical items may evoke the same frame. For instance, the Apply_heat frame is evoked by verbs such as BAKE, FRY, GRILL, STEW, etc. Frames also define *frame elements*, i.e. – simplifying a little – semantic roles which are normally expressed by dependents of lexical items evoking the frame. In the case of Apply_heat, typical frame elements are the Cook and the Food, but also the Container that holds the Food to which heat is applied, the Medium through which heat is applied to Food, etc. In the following examples, verbs evoking the Apply_heat frame are in bold:[1]

(1) **Boil** [the potatoes]$_{\text{Food}}$ [in a medium-sized pan]$_{\text{Container}}$.

(2) [Drew]$_{\text{Cook}}$ **sauteed** [the garlic]$_{\text{Food}}$ [in butter]$_{\text{Medium}}$.

Frames are linked via a number of relations, including the hierarchical multiple-inheritance relation. For example, Apply_heat inherits semantic roles from both Activity and Intentionally_affect frames, the latter inherits from Intentionally_act, which in turn inherits from Event (see Figure 1). It is not clear whether this is a design feature of FrameNet or just a reflection of its work-in-progress status, but it happens in current versions of FrameNet (including the latest at the time of writing this paper, 1.7) that the same role is introduced multiple times in the hierarchy. For example, within the fragment of the inheritance hierarchy in Figure 1, the Agent role is introduced independently at Activity, at Objective_influence (where it is called Influencing_entity; see below) and at Intentionally_act.

Another feature of FrameNet is that inherited roles, as they acquire more specialised meanings, may change names.[2] For example, the agentive role introduced at Objective_influence is called Influencing_entity there, but gets renamed to Agent

[1] These made up examples are taken from the description of the Apply_heat frame at the FrameNet web interface, at https://framenet2.icsi.berkeley.edu/.

[2] This correspondence between frame elements of different frames is currently not shown in the web interface to FrameNet, but it is explicitly defined in the distributed version of the lexicon, in the file `frRelation.xml`.

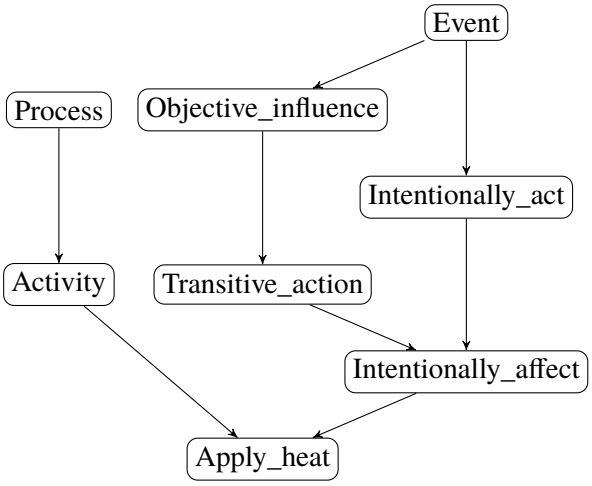


Figure 1: A fragment of the FrameNet 1.7 inheritance hierarchy – all frames from which Apply_heat inherits

when it is inherited by Transitive_action. The Agent roles of both Transitive_action and Intentionally_act correspond to the (single) Agent role of Intentionally_affect, but the role of Apply_heat corresponding to the Agent roles of both Activity and Intentionally_affect is renamed to Cook. Similarly, the Food role of Apply_heat corresponds to the Patient role of Intentionally_affect and Transitive_action above it (where it is renamed from the Dependent_entity role of Objective_influence). Below, we will simplify by adopting single names for roles related via inheritance hierarchy. For example, instead of Cook and Food, the respective roles of Apply_heat will be called Agent and Patient, as on the superordinate frames. But, as always, it should be borne in mind that a role on a subordinate frame will usually carry more entailments than the homonymous role on a superordinate frame.

An important aspect of FrameNet is that frame elements correspond to both arguments and adjuncts. For example, among the roles associated with Apply_heat are roles realised by typical adjuncts, such as Manner, Time and Place. A FrameNet reflex of the argument/adjunct dichotomy is its categorisation of roles into core (corresponding to arguments) and non-core (corresponding to adjuncts), but the criteria used for deciding whether a role is core or not suffer from the usual problems of providing only partial tests or being pairwise incompatible. In particular, Fillmore and Baker 2015: 801, admitting that "there are clear cases and unclear cases in trying to draw this distinction", propose the following partial criteria for coreness:

- if a role is obligatorily expressed, it is core,
- roles realised as subjects and direct objects are core (but there are exceptions),
- roles "expressed by phrases with lexically specific morphological marking" are core.

As discussed in Przepiórkowski 2016: 562–563, dependents may be obligatory in various ways and for different reasons, some of them pragmatic in nature. For example, the apparently obligatory adjuncts (Grimshaw and Vikner 1993) occurring after *The house was built* (see below) are arguably (Goldberg and Ackerman 2001) obligatory only in a rather weak sense of being often – but not always – needed to satisfy Grice's maxim of quantity:

(3) #This house was built.

(4) This house was built {yesterday / in ten days / in a bad part of town / only with great difficulty / by a French architect}.

Probably the same very weak notion of obligatoriness is invoked in FrameNet in the case of the core roles Time and Place of the Event frame (neither of the other two criteria for coreness applies here). This frame is directly evoked by verbs such as HAPPEN or OCCUR, which might seem to require the presence of Time or Place: #*This event occurred*. However, just as in the case of the "obligatory adjuncts" combining with *The house was built*, it is easy to find fully acceptable occurrences of HAPPEN and OCCUR without any realisation of Time or Place, e.g.:

(5) If it's not on Facebook it didn't happen.[3]

(6) Scientists manipulate brains of mice to make them think fake event really occurred.[4]

Hence, obligatoriness is not a fully operational criterion for distinguishing core from non-core, even when treated as just a unidirectional test (*if* it is obligatory, *then* it is core).

Also the second criterion above, referring to subjects and direct objects, is not reliable even when construed as unidirectional. Fillmore and Baker 2015: 801 (fn. 4) exempt from this criterion direct objects in dative constructions such as *you* in *I'll bake you a cake*, as well as direct objects in resultative constructions such as *my plate* in *I ate my plate clean*. Since no meta-criteria are given for the applicability of this criterion, it is – again – not operational even as a partial test.

Finally, the third unidirectional criterion, referring to the possibility to express a role with "lexically specific morphological marking", is also difficult to apply in practice, as specific morphological marking on dependents is rarely a feature of single lexemes, but usually a matter of smaller or larger classes of lexemes. Ruppenhofer et al. 2016: 24 illustrate this criterion with the verb DEPEND and its lexically specified dependent introduced by the preposition ON, but even in this case this kind of dependent is a feature of a coherent class of verbs, which includes RELY, COUNT, LEAN, etc. What seems to matter here is the *size* of the class of verbs or frames with which a given morphosyntactic type of dependent occurs bearing a specific meaning. This is made clear in the following quote (Ruppenhofer et al. 2016: 24): "The preposition ON does not occur as a marker of the same meaning [i.e. the same as in the case of DEPEND – AP] with predicates in many other frames. In its basic spatial

[3] http://www.wordyard.com/2016/01/19/if-its-not-on-facebook-it-didnt-happen/

[4] http://www.independent.co.uk/news/science/is-it-inception-total-recall-no-science-fact-false-implanted-in-mice-brains-8732466.html; this is a headline, hence the lack of articles.

sense of 'in contact with and supported by', ON occurs in many different frames; as a marker of Place or Location frame elements it is totally unremarkable and does not suggest core status for these [frame element]s." But without any specification of the minimal size of the class of verbs or frames which justifies the assignment of the non-core status to a role with a specific morphosyntactic realisation, this criterion is again not operational.

It is clear, then, that the core/non-core dichotomy in FrameNet is as ill-understood as the infamous argument/adjunct distinction. For this reason we will mostly ignore this dichotomy below, but we will still model it by making core roles obligatory and non-core roles optional. It should be borne in mind, though, that this is a vast oversimplification, since – as discussed above – there is no strong assumption in FrameNet that all core roles are syntactically obligatory. Moreover, semantic obligatoriness cuts across the class of non-core roles and is the basis of the distinction within this class between peripheral roles (semantically obligatory but – unlike core roles – not central to the meaning of the frame) and extra-thematic roles (semantically optional). Again, the issue of the proper modelling of these various aspects of obligatoriness requires substantial research.

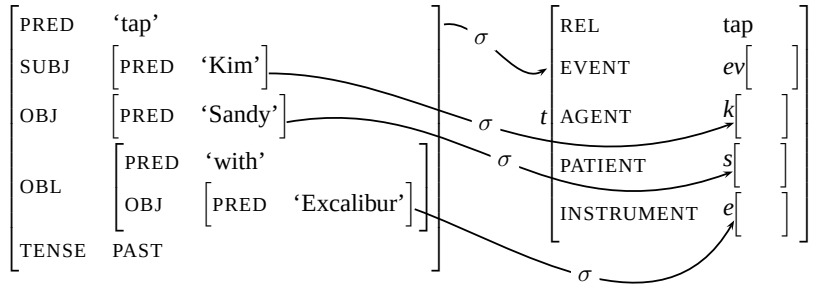
What is interesting is that inheritance may change the coreness status of a role. For example, as discussed above, at the Event frame the roles Time and Place are marked as core, but the same roles are treated as non-core on almost all of the 27 frames directly subordinate to Event.[5] Obviously, the Event frame pertains to situations which normally occur at some time and at some place, so in this sense Time and Place are semantically obligatory, but the same can be said about all frames inheriting from Event, on which, however, Time and Place are not marked as core. The reverse situation happens in case of the Existence frame, where Time and Place are non-core, but become core on its directly subordinate frame, Circumbscribed_existence. Such changes of coreness seem to bring non-monotonicity to the otherwise monotonic inheritence relation in FrameNet. Below, we will see how such apparently non-monotonic behaviour can be modelled via the monotonic means of Lexical Functional Grammar.

3 Valency in LFG

As is common in LFG, we assume the existence of a level of representation which encodes the semantic argument structure, i.e., which contains information about semantic (or thematic) roles such as Agent or Goal. Traditionally, semantic forms – values of PRED – served this purpose in Lexical Functional Grammar (Kaplan and Bresnan 1982). Alternatively, we could employ the distinct level of argument structure of Butt et al. 1997. Instead, we build here on more recent work and assume the formalisation of argument structure within the semantic structure (Asudeh and Giorgolo 2012, Asudeh et al. 2014, Findlay 2016). For example, Asudeh and Giorgolo 2012: 78, propose the following f-structure and s-structure for the sentence *Kim tapped Sandy with Excalibur*:

[5] The only exception is the Emergency frame, which treats Time as core.

(7)



Much of the work in this thread assumes that some of the semantic attributes – those which correspond to arguments in the scope of the (Lexical) Mapping Theory (Bresnan and Kanerva 1989) as formalised in Findlay 2016 – are called ARG$_1$, ARG$_2$, etc., instead of the more mnemonic names such as AGENT and PATIENT, but – as we are not concerned with LMT in this paper – we will continue to use these more intuitive names.

What kind of lexical entries give rise to such f- and s-structures? Let us consider a simpler case, that of the transitive verb *devoured*:

(8) lexical entry for *devoured*, 1st version:

$$
\begin{aligned}
\textit{devoured}\ \ \mathrm{V}\quad & (\uparrow \textsc{pred}) = \text{`}\textsc{devour}\text{'} \\
& (\uparrow_\sigma \textsc{rel}) = \textsc{devour} \\
& \lambda e.\ devour(e) : (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma \\
& (\uparrow \textsc{subj})_\sigma = (\uparrow_\sigma \textsc{agent}) \\
& \lambda P \lambda x \lambda e.\ P(e) \wedge agent(e, x) : \\
& \quad [(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \textsc{agent}) \multimap (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma \\
& (\uparrow \textsc{obj})_\sigma = (\uparrow_\sigma \textsc{patient}) \\
& \lambda P \lambda x \lambda e.\ P(e) \wedge patient(e, x) : \\
& \quad [(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \textsc{patient}) \multimap (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma \\
& (\uparrow \textsc{tense}) = \textsc{past} \\
& \lambda P.\ \exists e\ P(e) \wedge past(e) : [(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap \uparrow_\sigma
\end{aligned}
$$

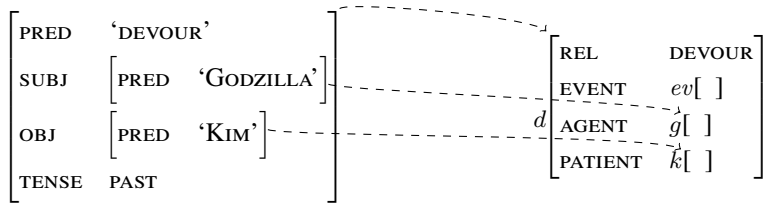
There are four natural parts of this lexical entry: 1) the idiosyncratic part, defining PRED,[6] as well as the corresponding s-structure attribute REL,[7] and introducing the basic meaning constructor containing the $devour$ relation in its meaning representation; 2) the part saying that the subject grammatical function realises the agent semantic relation: 3) the analogous part defining the correspondence between the object and the patient; 4) the part adding tense information to the f-structure and to the meaning representation, as well as defining the existential closure over the event

[6] As noted already in Dalrymple et al. 1993: 13–14, and Kuhn 2001: § 1.3.3, Glue makes PRED largely superfluous. Here I follow Asudeh and Giorgolo 2012 and retain PRED, but with values reflecting the predicate *sans* its valency – hence, the value of PRED in (8) is defined as 'DEVOUR' rather than 'DEVOUR⟨SUBJ, OBJ⟩'.

[7] The existence of the semantic attribute REL is assumed – but not formally introduced – in a number of recent papers, including Asudeh and Giorgolo 2012, Asudeh et al. 2008, 2013, 2014 and Findlay 2016; the following lexical entries make the introduction of this attribute explicit.

variable. In the case of the sentence *Godzilla devoured Kim*, this lexical entry gives rise to the f- and s-structures in (9) below, as well as to the instantiated meaning constructors in (10).

(9)



(10) 1. $\lambda e.\ devour(e) : ev \multimap d$

2. $\lambda P \lambda x \lambda e.\ P(e) \wedge agent(e, x) : [ev \multimap d] \multimap g \multimap ev \multimap d$

3. $\lambda P \lambda x \lambda e.\ P(e) \wedge patient(e, x) : [ev \multimap d] \multimap k \multimap ev \multimap d$

4. $\lambda P.\ \exists e\ P(e) \wedge past(e) : [ev \multimap d] \multimap d$

These instantiated meaning constructors, together with the following instantiated meaning constructors introduced by the lexical entries of *Godzilla* and *Kim*, may be used to derive the expected meaning representation for the whole sentence: $\exists e\ devour(e) \wedge agent(e, godzilla) \wedge patient(e, kim) \wedge past(e)$.

(11) 5. $godzilla : g$

6. $kim : k$

Here is one possible proof:

(12) 7. $\lambda x \lambda e.\ devour(e) \wedge agent(e, x) : g \multimap ev \multimap d$ (from 2 and 1)

8. $\lambda e.\ devour(e) \wedge agent(e, godzilla) : ev \multimap d$ (from 7 and 5)

9. $\lambda x \lambda e.\ devour(e) \wedge agent(e, godzilla) \wedge patient(e, x) : k \multimap ev \multimap d$ (from 3 and 8)

10. $\lambda e.\ devour(e) \wedge agent(e, godzilla) \wedge patient(e, kim) : ev \multimap d$ (from 9 and 6)

11. $\exists e\ devour(e) \wedge agent(e, godzilla) \wedge patient(e, kim) \wedge past(e) : d$ (from 4 and 10)

Obviously, apart from the first – idiosyncratic – part of the lexical entry (8), the other three parts will also occur in many other lexical entries, so it makes sense to encode them as templates (Dalrymple et al. 2004):[8]

(13) $\textsc{agent} := (\uparrow \textsc{subj})_\sigma = (\uparrow_\sigma \textsc{agent})$
$\lambda P \lambda x \lambda e.\ P(e) \wedge agent(e, x) :$
$[(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \textsc{agent}) \multimap (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma$

(14) $\textsc{patient} := (\uparrow \textsc{obj})_\sigma = (\uparrow_\sigma \textsc{patient})$
$\lambda P \lambda x \lambda e.\ P(e) \wedge patient(e, x) :$
$[(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \textsc{patient}) \multimap (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma$

[8] In the actual templates, the parts defining the correspondence between a semantic argument and a grammatical function will be more complex, to allow for diathesis; see Asudeh et al. 2014 and Findlay 2016.

(15) PAST := $(\uparrow \text{TENSE}) = \text{PAST}$
$\lambda P.\, \exists e\; P(e) \wedge past(e) : [(\uparrow_\sigma \text{ EVENT}) \multimap \uparrow_\sigma] \multimap \uparrow_\sigma$

With these templates in hand, the lexical entry for *devoured* simplifies to:

(16) lexical entry for *devoured*, 2nd version:

devoured V $(\uparrow \text{PRED}) = \text{'DEVOUR'}$
$(\uparrow_\sigma \text{ REL}) = \text{DEVOUR}$
$\lambda e.\, devour(e) : (\uparrow_\sigma \text{ EVENT}) \multimap \uparrow_\sigma$
@AGENT @PATIENT @PAST

LFG templates may call other templates, and in this sense they form a kind of hierarchy. In the context of valency, this possibility was explored by Asudeh et al. (2008, 2013) in their account of English and Swedish *way*-constructions, as in: ***Bill elbowed his way through the crowd***. Similarly, Asudeh et al. (2014) make use of such embedded template calls for example when defining a prototypical transitive argument structure:

(17) AGENT-PATIENT := @AGENT @PATIENT

The proposal presented below may be seen as taking the approach summarised above to its logical conclusion.

4 Lexically introduced adjuncts in LFG

4.1 Frame elements via templates

As shown in Przepiórkowski 2017a, the main gist of the current proposal is compatible with standard LFG and the traditional feature architecture of f-structures, but here we assume the approach of Patejuk and Przepiórkowski 2016 (inspired by Alsina 1996 and work within HPSG), on which all syntactically realised dependents of a predicate are members of the DEPS set,[9] with just a couple of grammatical functions – typically SUBJECT and OBJECT – additionally singled out via separate attributes. This is illustrated in Figure 2, which contains the desired f- and s-structures

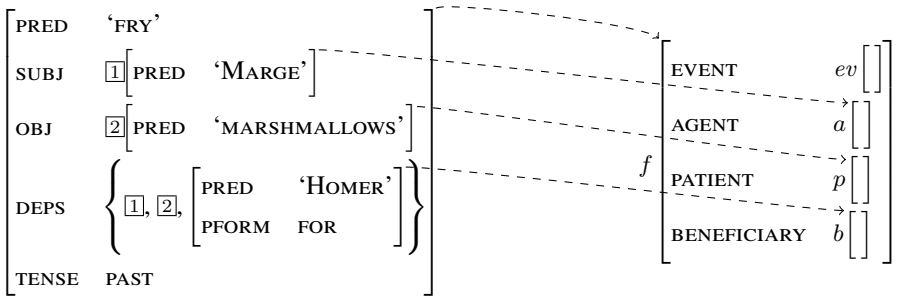


Figure 2: Functional and semantic structures for *Marge fried marshmallows for Homer*

[9] In Patejuk and Przepiórkowski 2016 and Przepiórkowski 2016, DEPS is list-valued and encodes the functional hierarchy, but here we assume for simplicity that it is set-valued.

for the sentence *Marge fried marshmallows for Homer*. In this setup, parts of the lexical entry for *fried* may look as in (18):

(18) lexical entry for *fried*, 1st version:

fried I $(\uparrow \textsc{pred}) = \text{`}\textsc{fry}\text{'}$
$\lambda e.fry(e) : (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma$
$(\uparrow_\sigma \textsc{agent}) = (\uparrow \textsc{subj})_\sigma \quad (\uparrow \textsc{subj}) \in (\uparrow \textsc{deps})$
$\lambda P \lambda x \lambda e.\ P(e) \wedge agent(e,x) :$
$[(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \textsc{agent}) \multimap (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma$
$(\uparrow_\sigma \textsc{patient}) = (\uparrow \textsc{obj})_\sigma \quad (\uparrow \textsc{obj}) \in (\uparrow \textsc{deps})$
$\lambda P \lambda x \lambda e.\ P(e) \wedge patient(e,x) :$
$[(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \textsc{patient}) \multimap (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma$
$((\uparrow_\sigma \textsc{beneficiary}) = (\uparrow \textsc{deps}\ \in)_\sigma$
$\lambda P \lambda x \lambda e.\ P(e) \wedge beneficiary(e,x) :$
$[(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \textsc{beneficiary}) \multimap (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma)$
$\ldots$
$\lambda P.\exists e\, P(e) \wedge past(e)\ :\ [(\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma] \multimap \uparrow_\sigma$
$(\uparrow \textsc{tense}) = \textsc{past}$

How do we know that various pointers to elements of DEPS, e.g., $(\uparrow \textsc{subj}) \in (\uparrow \textsc{deps})$ and $(\uparrow_\sigma \textsc{beneficiary}) = (\uparrow \textsc{deps}\ \in)_\sigma$ pick out different elements of this set? This follows directly from the resource sensitivity of Glue: if, say, the above two references to elements of DEPS picked out the same element, then also $(\uparrow_\sigma \textsc{agent})$ and $(\uparrow_\sigma \textsc{beneficiary})$ would be the same semantic object, so the two corresponding meaning constructors above, referring to $(\uparrow_\sigma \textsc{agent})$ and $(\uparrow_\sigma \textsc{beneficiary})$ in the linear formulae, would ultimately require the consumption of two linear resources corresponding to this semantic object. But only one such resource is introduced by the phrase which gave rise to the DEPS element which was selected twice. Hence, if two references to elements of DEPS accidentally pick out the same element, the linear logic proof will fail.

Obviously, just as above, such extended valency specifications may again be made concise via the use of template calls such as @AGENT, @PATIENT and @BENEFICIARY:

(19) lexical entry for *fried*, 2nd version:

fried V $(\uparrow \textsc{pred}) = \text{`}\textsc{fry}\text{'}$
$\lambda e.fry(e) : (\uparrow_\sigma \textsc{event}) \multimap \uparrow_\sigma$
@AGENT @PATIENT (@BENEFICIARY) ...
@PAST

The definitions of the templates AGENT and PATIENT in (13)–(14) must be trivially modified, by adding the functional schemata $(\uparrow \textsc{subj}) \in (\uparrow \textsc{deps})$ and $(\uparrow \textsc{obj}) \in (\uparrow \textsc{deps})$, respectively.[10] The basic definition of BENEFICIARY is similar:

[10] Again, this should be a part of a more general analysis of diathesis.

(20) BENEFICIARY := $(\uparrow_\sigma \text{BENEFICIARY}) = (\uparrow \text{DEPS} \in)_\sigma$
$\lambda P \lambda x \lambda e.\ P(e) \wedge \mathit{beneficiary}(e, x)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{BENEFICIARY}) \multimap$
$(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

In order to ensure that only prepositional phrases headed by *for* play the role of a Beneficiary, an additional constraint should make sure that the value of PFORM is FOR; this can be done with the use of a local name (Dalrymple 2001: 146–148):[11]

(21) BENEFICIARY := $\%\text{B} = (\uparrow \text{DEPS} \in)$
$(\%\text{B PFORM}) =_c \text{FOR}$
$(\uparrow_\sigma \text{BENEFICIARY}) = \%\text{B}_\sigma$
$\lambda P \lambda x \lambda e.\ P(e) \wedge \mathit{beneficiary}(e, x)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{BENEFICIARY}) \multimap$
$(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

On this analysis, *for* is assumed to be an asemantic (PRED-less) preposition, with the lexical entry in (22), and combining with the following NP as a co-head via a rule such as (23).

(22) *for* P $(\uparrow \text{PFORM}) = \text{FOR}$

(23) PP → P NP
$\downarrow = \uparrow$ $\downarrow = (\uparrow \text{OBJ}) \mid \downarrow = \uparrow$

The above analysis assumes that, in the case of the verb FRY, the Beneficiary is optional, but it does not say anything about its status as an argument or adjunct – on the approach assumed here (i.e. that of Przepiórkowski 2016), which rejects the argument/adjunct distinction, this issue simply does not arise. For this reason the single BENEFICIARY template in (21) may be used whenever a Beneficiary combines with a predicate, whatever the perceived argument/adjunct status of the Beneficiary. As discussed in Przepiórkowski 2017a, two different templates (or at least a more complex definition of this single template) would be needed on the standard assumption of the argument/adjunct distinction, one for an element of ADJ, and another for OBL_{BEN} (for the benefit of those predicates which require a *for*-beneficiary).

Each of the above templates for Agent, Patient and Beneficiary contributes the same predicate to the meaning representation (agent, $\mathit{patient}$ and $\mathit{beneficiary}$, respectively), regardless of the lexical nature of the dependent (*Marge*, *marshmallows* and *Homer*, in the example above). We assume here that in the case of many other semantic roles the predicate will depend on the head of the phrase realising the role. For example, in the case of the manner adverb *slowly*, the corresponding con-

[11] The external reviewer proposes to simplify the treatment of some adjuncts, including Beneficiary, by removing them from the template system and instead specifying relevant constraints in appropriate lexical entries, e.g., in the lexical entry of *for*, with the help of inside-out functional uncertainty. This simplified treatment would lead to the same representations as those proposed in this paper. Since – as noted in the review – only some adjuncts could be treated outside of the template system this way, we retain here the more uniform system where all dependents are added via hierarchically organised templates, and leave more detailed investigation of this suggestion for future research.

junct in the meaning representation will be something like $slowly(e)$ (rather than $manner(e, slowly)$), and in the case of the locative *in Springfield* the corresponding conjunct will be $in(e, springfield)$ (rather than $place(e, in, springfield)$). So, for the example sentence *Marge slowly fried marshmallows for Homer in Springfield*, we expect the final meaning representation to be as in (24) (simplifying the analysis of *marshmallows*), with f- and s-structures as in Figure 3.

(24) $\exists e\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) \wedge$
$beneficiary(e, homer) \wedge slowly(e) \wedge in(e, springfield) \wedge past(e)$

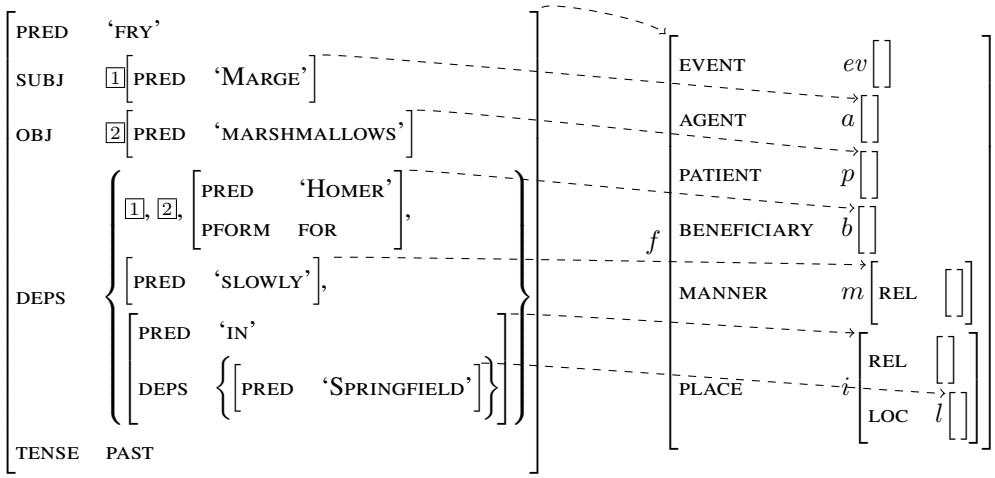


Figure 3: Functional and semantic structures for *Marge slowly fried marshmallows for Homer in Springfield*

The following MANNER and PLACE templates take care of the appropriate inclusion of dependents such as *slowly* and *in Springfield* into the analysis:[12]

(25) MANNER := $(\uparrow_\sigma \text{MANNER}) = (\uparrow \text{DEPS} \in)_\sigma$
$\lambda P \lambda Q \lambda e.\ P(e) \wedge Q(e)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma] \multimap$
$[(\uparrow_\sigma \text{MANNER REL}) \multimap (\uparrow_\sigma \text{MANNER})] \multimap$
$(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

(26) PLACE := $(\uparrow_\sigma \text{PLACE}) = (\uparrow \text{DEPS} \in)_\sigma$
$\lambda P \lambda Q \lambda e.\ P(e) \wedge Q(e)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma] \multimap$
$[(\uparrow_\sigma \text{PLACE REL}) \multimap (\uparrow_\sigma \text{PLACE})] \multimap$
$(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$

The property Q in the above templates is provided by specific lexemes, such as the following:

[12] A more general parameterised template could be defined instead which would take semantic attribute names such as MANNER and PLACE as arguments.

(27) *slowly* Adv $(\uparrow \textsc{pred}) = \text{`}\textsc{slowly}\text{'}$
$\lambda e.\ slowly(e)\ :\ (\uparrow_\sigma \textsc{rel}) \multimap \uparrow_\sigma$

(28) *in* P $(\uparrow \textsc{pred}) = \text{`}\textsc{in}\text{'}$
$(\uparrow_\sigma \textsc{loc}) = (\uparrow \textsc{deps} \in)_\sigma$
$\lambda x \lambda e.\ in(e, x)\ :\ (\uparrow_\sigma \textsc{loc}) \multimap (\uparrow_\sigma \textsc{rel}) \multimap \uparrow_\sigma$

In the case of the manner adverb, the property in question is $\lambda e.\ slowly(e)$. In the case of the locative preposition *in*, the complete property will be specified once the preposition combines with the following NP, e.g., *Springfield*, yielding $\lambda e.\ in(e, springfield)$.

In both (and other similar) cases additional constraints may be added to lexical entries to the effect that, say, *slowly* always expresses Manner and the locative *in* always realises the role Place. The following respective constraints would do the trick: $(\textsc{manner} \uparrow_\sigma)$ and $(\textsc{place} \uparrow_\sigma)$. Such constraints would encode the intuition that typical adjuncts determine their semantic role in the sentence (while the semantic role of typical arguments is determined by the predicate). However, at least in the case of locative and temporal PPs this seems to be too strong, as such phrases do not necessarily express the place or time of the event denoted by the verb, as the following examples (from Jaworska 1986: 355–356) illustrate:

(29) The campaigners planned *until Christmas* in detail.

(30) The new tenants are reclaiming *behind the garage*.

Clearly, the planning activity of the time from now until Christmas does not have to last the whole time until Christmas, and similarly reclaiming some location can be performed at a different location. For this reason we do not include such constraints in the above lexical entries, until this matter is further investigated.

Let us now illustrate this analysis with a simple derivation of the desired meaning representation (24), assuming the analysis of *Marge slowly fried marshmallows for Homer in Springfield* which results in the functional and semantic representations in Figure 3. The following instantiated meaning constructors are initially in the set of premises:

(31)
1. $marge : a$
2. $marshmallows : p$
3. $homer : b$
4. $springfield : l$
5. $\lambda e.\ fry(e) : ev \multimap f$
6. $\lambda P.\ \exists e\ P(e) \wedge past(e) : [ev \multimap f] \multimap f$
7. $\lambda P \lambda x \lambda e.\ P(e) \wedge agent(e, x) : [ev \multimap f] \multimap a \multimap ev \multimap f$
8. $\lambda P \lambda x \lambda e.\ P(e) \wedge patient(e, x) : [ev \multimap f] \multimap p \multimap ev \multimap f$
9. $\lambda P \lambda x \lambda e.\ P(e) \wedge beneficiary(e, x) : [ev \multimap f] \multimap b \multimap ev \multimap f$
10. $\lambda P \lambda Q \lambda e.\ P(e) \wedge Q(e) : [ev \multimap f] \multimap [(m\ \textsc{rel}) \multimap m] \multimap ev \multimap f$
11. $\lambda P \lambda Q \lambda e.\ P(e) \wedge Q(e) : [ev \multimap f] \multimap [(i\ \textsc{rel}) \multimap i] \multimap ev \multimap f$

12. $\lambda e.\ slowly(e)\ :\ (m\ \textsc{rel}) \multimap m$

13. $\lambda x \lambda e.\ in(e, x)\ :\ l \multimap (i\ \textsc{rel}) \multimap i$

Meaning constructors 1–4 come from the lexical entries of nouns (with the simplified treatment of *marshmallows* as a proper name), 5 comes directly from the lexical entry of *fried*, 6 – from the PAST template called there, 7–11 – from the AGENT, PATIENT, BENEFICIARY, MANNER and PLACE templates called there, 12 – from the lexical entry of *slowly* and 13 – from the lexical entry of *in*.

It is easy to see that these constructors give rise to the expected meaning representation for this sentence:

(32) 14. $\lambda e.\ in(e, springfield)\ :\ (i\ \textsc{rel}) \multimap i$ (from 13 and 4)

15. $\lambda x \lambda e.\ fry(e) \wedge agent(e, x) : a \multimap ev \multimap f$ (from 7 and 5)

16. $\lambda e.\ fry(e) \wedge agent(e, marge) : ev \multimap f$ (from 15 and 1)

17. $\lambda x \lambda e.\ fry(e) \wedge agent(e, marge) \wedge patient(e, x) : p \multimap ev \multimap f$ (from 8 and 16)

18. $\lambda e.\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) : ev \multimap f$ (from 17 and 2)

19. $\lambda x \lambda e.\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) \wedge beneficiary(e, x) : b \multimap ev \multimap f$ (from 9 and 18)

20. $\lambda e.\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) \wedge beneficiary(e, homer) : ev \multimap f$ (from 19 and 3)

21. $\lambda Q \lambda e.\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) \wedge beneficiary(e, homer) \wedge Q(e) : [(m\ \textsc{rel}) \multimap m] \multimap ev \multimap f$ (from 10 and 20)

22. $\lambda e.\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) \wedge beneficiary(e, homer) \wedge slowly(e) : ev \multimap f$ (from 21 and 12)

23. $\lambda Q \lambda e.\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) \wedge beneficiary(e, homer) \wedge slowly(e) \wedge Q(e) : [(i\ \textsc{rel}) \multimap i] \multimap ev \multimap f$ (from 11 and 22)

24. $\lambda e.\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) \wedge beneficiary(e, homer) \wedge slowly(e) \wedge in(e, springfield) : ev \multimap f$ (from 23 and 14)

25. $\exists e\ fry(e) \wedge agent(e, marge) \wedge patient(e, marshmallows) \wedge beneficiary(e, homer) \wedge slowly(e) \wedge in(e, springfield) \wedge past(e) : f$ (from 6 and 24)

4.2 Frame inheritance via template inheritance

In FrameNet, the verb FRY evokes the Apply_heat frame. FrameNet lists 15 semantic roles of this frame, of which only 5 are mentioned above (Agent – called Cook in the Apply_heat frame, Patient – called Food there, Beneficiary, Manner and Place). Many of these roles are also present in many other frames. However, an

inheritance hierarchy makes it possible to avoid redundancy and it is trivial to formalise in LFG with the use of templates. Following FrameNet, we assume that the maximally general frame Event introduces the following 7 roles[13] and marks them as optional: Place, Time, Duration, Explanation, Frequency, Manner and Timespan. Correspondingly, we define the @EVENT_FRAME template which optionally calls templates such as @TIME, etc., which in turn introduce particular dependents in a way illustrated in the previous subsection; cf. (33).

(33) EVENT_FRAME := (@PLACE) (@TIME) (@DURATION) (@EXPLANATION)
(@FREQUENCY) (@MANNER) (@TIMESPAN)

An immediately subordinate frame, Intentionally_act, introduces a few additional roles, including the obligatory Agent and the optional Domain, and inherits most of the roles introduced by Event, apart from Timespan.[14] This may be represented via the template in (34).

(34) INTENTIONALLY_ACT_FRAME := @EVENT_FRAME
¬(↑$_\sigma$ TIMESPAN) @AGENT (@DOMAIN) ...

Note that the way Timespan is not inherited, via the negative constraint ¬(↑$_\sigma$ TIMESPAN),[15] preserves the monotonicity of inheritance, as this semantic role is defined on the higher frame as optional. Similarly, the obligatoriness of a role which is specified as optional on a superordinate frame may be ensured by an existential constraint such as (↑$_\sigma$ MANNER), as in the case of frames evoked by verbs such as BEHAVE or TREAT, for which the expression of Manner is obligatory.

Another frame inheriting from Event and adding a few more semantic roles, including the obligatory Agent,[16] is Objective_influence, which is a superordinate frame of Transitive_action, which in turn introduces the obligatory Patient role; cf. (35)–(36).

(35) OBJECTIVE_INFLUENCE_FRAME := @EVENT_FRAME @AGENT
(@CIRCUMSTANCES) ...

(36) TRANSITIVE_ACTION_FRAME := @OBJECTIVE_INFLUENCE_FRAME
@PATIENT ...

Both Transitive_action and Intentionally_act are immediately superordinate frames of Intentionally_affect, as formalised in (37).

[13] We ignore here another type of FrameNet role, 'Core Unexpressed', not expressed by dependents.

[14] Also Duration is not mentioned in the description of Intentionally_act in the November 2016 release of FrameNet. It is not clear to me whether these omissions are intentional, but we will use the lack of Timespan here to illustrate how such an apparently non-monotonic aspect may be modelled in LFG.

[15] As noted by an anonymous reviewer of the accompanying paper Przepiórkowski 2017a, it would be more elegant not to 'unpack' the TIMESPAN template this way, but rather have a constraint such as ¬@TIMESPAN. However, this would have the effect of negating a sequence – normally interpreted as conjunction – of two statements, one of which is a constructor. As I am not sure what this would mean (but see Przepiórkowski 2017b for a suggestion), I propose this clearer – even if less elegant – encoding.

[16] In FrameNet, this role is called Influencing_entity here, but it is renamed to Agent in the subordinate frame Transitive_action.

(37) INTENTIONALLY_AFFECT_FRAME := @INTENTIONALLY_ACT_FRAME
@TRANSITIVE_ACTION_FRAME ...

The technically unfortunate effect of this is that the template call @AGENT is inherited twice. This is a potential problem as this template includes a meaning constructor, so two copies of this constructor will be present whenever the @INTENTIONALLY_AFFECT_FRAME template is called. There is a straightforward solution to this problem, though, consisting in making the content of the previous definition of the AGENT template optional and adding an obligatory constraint to the effect that the semantic attribute AGENT be defined:

(38) AGENT := ($(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{AGENT})$ $(\uparrow \text{SUBJ}) \in (\uparrow \text{DEPS})$
$\lambda P \lambda x \lambda e.\ P(e) \wedge agent(e, x)$:
$[(\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{AGENT}) \multimap (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$)
$(\uparrow_\sigma \text{AGENT})$

Note that multiple occurrences of the $(\uparrow_\sigma \text{AGENT})$ constraint have exactly the same effect as a single occurrence, so multiple inheritance of this part of the template is not harmful. The only place in the grammar that assigns a value to the AGENT feature is the optional part of the new AGENT template in (38), so – in the case of multiple calls to this template – at least one copy of this optional part must be used. On the other hand, at most one may be used, as more would introduce multiple copies of the meaning constructor within the optional part. Each such constructor causes a consumption of the glue resource introduced by the subject, corresponding to the value of the AGENT attribute, and only one such resource is introduced by the subject. Hence, exactly one of the multiple copies of the optional part of the AGENT template will actually be used.

An important part of the above reasoning is that only one element of DEPS may be the value of SUBJ and, hence, only one value of DEPS may correspond to the AGENT (in the active voice). There is no corresponding restriction on, say, BENEFICIARY, MANNER or PLACE. This means that, in case templates corresponding to such roles are inherited multiple times, they may pick out multiple elements of DEPS, that is, there may be multiple realisations of such roles. This property, called iterability, is one of the tests supposedly distinguishing arguments from adjuncts: only adjuncts, and not arguments, may iterate (see, e.g., Panevová 1974, Bresnan 1982b, Williams 2015, and the discussion in Przepiórkowski 2016). However, according to the current analysis, apart from the subject and the object, any kind of dependent may in principle (subject to multiple inheritance of the corresponding template) be iterated, whether it is realised as a supposed argument, or as a supposed adjunct. This, in fact, seems to better describe the data, given the possible iterability of OBLS (Zaenen and Crouch 2009) or instrumental phrases (Goldberg 2002), sometimes analysed in LFG as arguments (Bresnan 1982b: 164–165).[17]

[17] Obviously, in order to more fully model the iterability of such dependents, the corresponding templates should be explicitly defined as iterable (e.g., replacing optionality with a Kleene star), rather than relying on accidental (and limited) multiple inheritance.

Returning to the running example, the Apply_heat frame also inherits from two superordinate frames, Intentionally_affect and Activity (the latter not discussed here), and also introduces a few specific roles such as Beneficiary,[18] Container and Medium; cf. (39).

(39) APPLY_HEAT_FRAME := @INTENTIONALLY_AFFECT_FRAME
@ACTIVITY_FRAME (@BENEFICIARY)
(@CONTAINER) (@MEDIUM) ...

With such a hierarchy of templates, the lexical entry for *fried* boils down to (40).

(40) lexical entry for *fried*, 3rd version:

fried V $(\uparrow \text{PRED}) = \text{`FRY'}$
$\lambda e.fry(e) : (\uparrow_\sigma \text{EVENT}) \multimap \uparrow_\sigma$
@APPLY_HEAT_FRAME
@PAST

In practice, different verbs belonging to the same frame may additionally introduce specific – possibly different – morphosyntactic constraints on the realisation of the same role, as is the case with the verbs BEGIN and ENTER evoking the Activity_start frame: only BEGIN may realise the Activity role as an infinitival phrase (*begin to negotiate*) and only ENTER may realise it as an *into*-PP (*enter into negotiations*).

5 Conclusion

There is hardly any LFG work on types of adjuncts; instead, different kinds of adjuncts are lumped into the (X)ADJ set. There are a couple of other frameworks which make a categorisation of all types of dependents, arguments and adjuncts alike. Perhaps the most prominent of these is FrameNet, but there is also Functional Generative Description (Sgall et al. 1986), supported (just like FrameNet) by extensive corpus annotation (Hajič et al. 2006), as well as the mainstream cartographic approach (Cinque 1999, 2010). In this paper we propose to carry over the main ideas of FrameNet to LFG: introduce all types of dependents lexically (which does not preclude constructional analyses like that of Asudeh et al. 2013), and organise such extended valency information hierarchically, so as to avoid redundancy and capture generalisations. As shown in Przepiórkowski 2017a, this approach is broadly compatible with standard LFG: templates such as @TIME or @PLACE may add adjuncts directly to the ADJ set, instead of DEPS as assumed here. However, this approach also lends support to the proposal to get rid of the argument/adjunct distinction altogether (Przepiórkowski 2016): both types of dependents are introduced via the same mechanism, with typical adjuncts introduced higher in the hierarchy and inherited by many different frames, and typical arguments introduced closer to the leaves of the hierarchy and, hence, inherited by fewer frames. This approach also models the fact that certain prototypical adjuncts, introduced high in the hierarchy,

[18] This role is introduced so low in the FrameNet hierarchy probably by mistake; it should rather be introduced at the level of Intentionally_act.

may behave more like arguments on some lower frames: this is the case with the Manner role mentioned above. But regardless of its natural place in the version of LFG that does not assume the argument/adjunct dichotomy, we believe that any version of LFG will benefit from the adoption of a more structured approach to the lexicon in general and to valency in particular.

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Expanding the Pipeline: A Prolegomenon to Modeling Multilingual Grammars in LFG

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Abstract

In light of evidence from cognitive neuroscience that both source grammars are simultaneously active in the mind of a bilingual, we discuss the ramifications this has on the modeling of outputs from bilingual grammars, especially those that contain elements from multiple source grammars (i.e., *code-switching*). Here we provide a sketch of the architectural assumptions necessitated in light of these findings. To best model these structures, we introduce an expanded pipeline architecture that builds upon the foundation of previous work by Asudeh and Toivonen (2015). Similar to previous work integrating violable constraints from Optimality Theory (OT) (Prince & Smolensky, 2008) into LFG's parallel correspondence architecture (Bresnan, 2000; Sells, 2001a, 2001b), we augment this architecture with gradient, probabilistic mapping functions between the independent levels of grammar as initially suggested by Goldrick, Putnam, and Schwarz (2016a).

1 Introduction

In this paper, we introduce and discuss adjustments to the pipeline architecture Asudeh and Toivonen (2015), which is common in some versions of LFG, in order to improve its applicability to both monolingual and bi-/multilingual grammars. Since Grosjean (1989), it has become widely acknowledged that bilinguals are not the sum of two monolinguals. This poses an interesting challenge for the field of linguistics. How do we reconcile monolingual production with bilingual–or multilingual[1]–production under the assumption that both mono- and multilinguals are utilizing identical resources, when the two can differ, and when some linguistic phenomena can only be observed in bilingual data? Here, we take a closer look at a small sample of instances of bilingual code-switching, and discuss the implications of such utterances on the pipeline.

Code-switching, or code-mixing, is the phenomenon of bilingual dialogue in which speakers switch between their languages. Previous research has firmly established that code-switching does not occur haphazardly, and that the resultant structures are regulated by linguistic and cognitive constraints (Aguirre Jr., 1980; Poplack, 1980). Additional evidence also provides support for the position that rather than unique, "third grammar" constraints for code-switching, these outputs can best be understood as the result of the interaction between a bilingual's source grammars and knowledge about language in general (Cantone, 2005; Lederberg & Morales, 1985; MacSwan, 2014a, 2014b; Mahootian, 1993; Pfaff, 1979). As such, we operate on the assumption that bilinguals utilize the same faculties as monolinguals, and as linguists we seek to improve our formal models to account for

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[1]We will focus on bilingual production in this paper, yet see no reason why the principles put forth here should not extend to multilinguals.

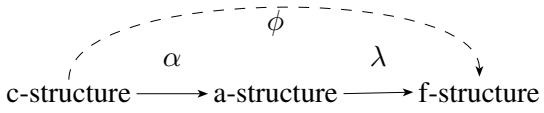

Figure 1: Classic c- to a- to f-structure pipeline

these grammars. An important challenge in this research program is to develop a model that does not assume operations and constraints that are specific to bilingual grammars, while simultaneously allowing for production and comprehension to be gradient, rather than strictly categorical.

Although LFG's existing architecture comes close to achieving this goal in its current state, we introduce minor adjustments to bring it in line with recent psycholinguistic insight into the cognitive architecture. Our focus here will be on supplementing the existing Correspondence Architecture with a means of introducing gradience in the mapping functions and permitting competition to extend through the pipeline.

In the pipeline version of the Correspondence Architecture, information flows from form to meaning through a series of mapping functions. Conventionally, LFG represents a sentence as a constituent structure, a functional structure, and the ϕ mapping function, through which the two structures correspond. According to Butt, Dalrymple, and Frank (1997), the role of the argument structure is incorporated into the representation of the sentence, and ϕ became the sum of two new functions: λ, the correspondence between argument and functional structure, and α, the correspondence between constituent and argument structure (Figure 1). Typically, a one-to-one correspondence is assumed, and any optionality is quickly eliminated. For instance, a ditransitive verb that participates in the dative alternation has two possible c-structures. While the semantics may be the same for both the double-object and oblique constructions, the argument structures are not, and once one a-structure has been selected, only one c-structure is possible.

Here we augment the version of the pipeline correspondence architecture introduced immediately above with violable, weighted mapping functions connecting independent levels of representation. We propose that, in situations of optionality, all options remain residually active. While one option may be preferred and subsequently gain momentum through the pipeline, the dispreferred options can still impact the process and potentially be selected as the optimal output. In this paper, we discuss the need for stochastic mapping functions, in the spirit of similar explorations of integrating LFG with Stochastic OT (Bresnan, Cueni, Nikitina, & Baayen, 2007) and demonstrate how Gradient Symbolic Computation (GSC) (Smolensky, Goldrick, & Mathis, 2014) can fill that need, and bring us closer to a Correspondence Architecture that can accommodate both monolingual and bilingual production. Adopting the adjustments to the pipeline we propose in this paper, brings the model in line with recent theories of language processing such as Christiansen and Chater's (2016) *Chunk-and-Pass* processing strategy.

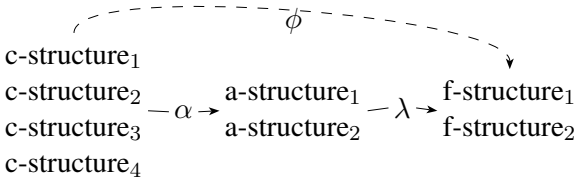

Figure 2: Revised pipeline for language production

This adjusted architecture (see Figure 2) is motivated by recent psycholinguistic research that has shed light on how a bilingual's languages interact and impact each other (Kroll & Gollan, 2014). There is strong evidence that bilinguals' source grammars are co-activated, and inhibitory control is necessary to produce the preferred language. Nonetheless, the dispreferred language is never truly "switched off," and this leads to differences in monolingual and bilingual production and comprehension in a rage of domains, including syntactic and discourse-pragmatics (Sorace, 2011). A wealth of psycholinguistic research shows the parallel nature of the cognitive architecture underlying the language faculty, and in particular work on cognates (Costa, Caramazza, & Sebastian-Galles, 2000; Starreveld, de Groot, Rossmark, & Van Hell, 2014) demonstrates the close relationship between different levels of the grammar (phonology, semantics, lexicon, etc.), and how these levels and languages share resources.

This paper adheres to the follow structure: Section 2 profiles a brief overview of key findings on parallel activation and extended competition in language and cognition. In Section 3, we introduce how residual activation can be modeled in our adjusted pipeline architecture, with Section 4 providing supporting empirical evidence demonstrating the basic desiderata of our proposal. We conclude this paper in Section 5.

2 Parallel Activation and Extended Competition

Research on language processing abounds with evidence in favor of the view that bilinguals co-activate both languages even when only one is in use (Dijkstra, 2005; Kroll, Dussias, Bogulski, & Valdes Kroff, 2012; Kroll & Gollan, 2014; J. Morales, Gómez-Ariza, & Bajo, 2016). Non-selective activation, the fact that both languages are active to some degree even when they are not necessarily needed, has been observed in studies focusing on the lexicon (Lemhöfer & Dijkstra, 2004) and in grammatical properties such as grammatical gender (L. Morales, Paolieri, & Bajo, 2011). In the following, we briefly present collected evidence of parallel activation in both bilingual and monolingual language processing.

2.1 Bilingual competition

Evidence of parallel activation can be seen in the Cognate Facilitation Effect (Costa et al., 2000; Starreveld et al., 2014), in which lexical items that share meaning and phonological form cross-linguistically are are more quickly retrieved. While much research has investigated lexical access in bilinguals, simultaneous activation of both source grammars extends beyond the lexicon, to phonological (Balukas & Koops, 2015), morphosyntactic (Lipski, 2015, 2017), and syntactic (Goldrick et al., 2016a; Kootstra, van Hell, & Dijkstra, 2010) information. Work with multimodal bilinguals, such as speakers of American Sign Language and English, has shown how structural information, such as grammatical markers, is shared (Pyers & Emmorey, 2008), a phenomenon which is difficult to observe in unimodal bilinguals. However, code-switching data may provide evidence of co-activated, competing structural information.

Following seminal work by Muysken (2000), code-switching takes three different forms. **Insertion** is a type of code switching frequently referred to as borrowing. Insertion is defined as the insertion of material from one language into the structure of another (Muysken, 2000, p. 3). In Example (1), the prepositional phrase *in a state of shock* is inserted into the Spanish clausal structure as a unit.

(1) yo anduve *in a state of shock* por dos dias

'I walked in a state of shock for two days'
(Spanish-English insertion, (Pfaff, 1979, p. 296))

Another type of code switching is **alternation**. Alternation is when a bilingual switches between structures from languages (Muysken, 2000, p. 3). Example (2) is an example of Spanish/English alternation, where a switch is made at the coordinating conjunction.

(2) andales pues *and do come again*

'That's alright then, and do come again'
(Spanish-English alternation, (Gumperz & Hernandez-Chavez, 1971, p. 312))

The last type of code switching is **congruent lexicalization**. According to Muysken (2000), in this type of code switching,"material from different lexical inventories" (p. 3) are congruently lexicalized "into a shared grammatical structure" (p. 3). In Example (3), the verb phrase *to give* was congruently lexicalized, leading to a doubling of the verb. In Example (4), we see a doubling of the preposition in a congruently lexicalized prepositional phrase.

(3) they gave me a research grant *koḍutaa*
they gave me a research grant give3.PL.PAST
'They gave me a research grant.'
(English-Tamil congruent lexicalization, (Sankoff, Poplack, & Vanniarajan, 1990, p. 93))

(4) mutta se oli *kidney*-sta *to aorta*-an
but it was kidney-from to aorta-to
'But it was from the kidney to the aorta.'
(Finnish-English adposition doubling, (Poplack, Wheeler, & Westwood, 1989, p. 405))

Such portmanteau constructions are rare and may be viewed as errors, which arise when the bilingual's inhibitory control mechanisms do not prevent the language switch nor the doubled phrase head. This breakdown of inhibitory control sheds light on the linguistic process, and Chan (2015) and Goldrick et al. (2016a) argue that portmanteau constructions are evidence of structural information being co-activated in unimodal bilinguals. Goldrick et al. (2016a) suggest that sometimes the most harmonious and efficient output involves blends where both source grammars can contribute structural attributes.

2.2 Monolingual competition

Competition is not a bilingual phenomenon. Melinger, Branigan, and Pickering (2014) survey types of competition in monolinguals, ranging from lexical to syntactic, a parallel to competition in bilinguals. Nascent research on the role of typological proximity may play in connection with the development of bidialectalism has thus far revealed the conflict between these two systems share certain affinities with bilingualism (Altenberg, 1991; Castro, Rothman, & Westergaard, 2017; Grohmann, Kambanaros, Leivada, & Rowe, 2016; Gürel, 2008). The primary difference between the conflict manifest by bidialectalism vs. bilingualism appears to be the (lack of) overlap between elements from both competing grammars.

A classic example of monolingual syntactic competition is the dative alternation in English (i.e., *give flowers to Anna* vs. *give Anna flowers*). A ditransitive verb can take one of two argument structures, a double object construction or an oblique construction. This is competition in the argument structure, that has an affect on the syntactic structure. Similarly, phrasal verbs exhibit optionality in the positioning of the verb particle. While no occurrences of blended monolingual double object constructions have been attested in the literature, to the best of our knowledge, there are a number of syntactic blends involving phrasal verbs, such as *Would you turn on the light on?* (Melinger et al. 2014, p. 672, cited from Fay, 1980). Such examples exhibit the same surface evidence visible in the portmanteaus of structural competition that is resolved late in the pipeline. This is argued to confirm what Melinger et al. (2014). refer to as *extended competition*. This term refers to the fact that competition occurs throughout the language production

process. When a semantic concept carries with it syntactic optionality, this competition remains unresolved until the stage in the language production process where the structure is built. In Section 3.2 we return to this phenomena to illustrate how these data can be analyzed along the lines of our extended pipeline architecture.

2.3 Parallel Architecture and Inhibitory Control

In light of this research on co-activation, the need for a parallel architecture such as LFG's to model bilingual grammar becomes apparent. Additionally, bilinguals must employ some sort of control filter in order to select the appropriate grammar that will also block out and avoid intrusion from the alternative source grammar (Green, 1998; Green & Abutalebi, 2013; Green & Wei, 2014). Monolinguals make use of these mechanisms as well, albeit to a lesser degree, when processing optionality in argument structure, constituent structure, or even dialectal variation. Leaving aside the debate of whether such control and selection mechanisms are due to domain-specific or domain-general processes (although there is clearly a preference in the literature for the latter, but see Gollan & Goldrick, 2016 for counterarguments), we assume an inhibitory model of control in bilingual grammar and cognition (Abutalebi & Green, 2007; Van Heuven, Schriefers, Dijkstra, & Hagoort, 2008). These inhibitory models "argue that selection occurs at a late locus, once lexical candidates are active in both languages, and it depends on the *competition level*" J. Morales et al. (2016, p. 274). Therefore, we need a model of language production that allows all relevant pieces of linguistic information to cumulatively impact the selection of the surface string.

3 Probability and gradience in the pipeline

Two notable and non-trivial challenges that arise in attempts to model and predict hybrid outputs are the following: First, how can we best define and quantify the notion of (neural) *activity* and how they relate to some sort of *competition level*? Clearly, given the wide gamut of individual differences found in bi- and multilingual grammars, notions such as cognitive control, lexical robustness, and the frequency that these individuals use both/all languages, especially in code-switching contexts, undoubtedly play an important role in determining these factors. A review of such factors can be found in Schwieter and Ferreira (2016). Second, as noted above, this competition seems to extend far beyond lexical items and arguably involves all domains of linguistic structure to various degrees. What notation system of grammatical information or competence can capture both these predominantly discrete and gradient effects simultaneously? In what follows, we employ an LFG model of grammar that that is parallel in design, with correspondences between each respective level mediated by weighted mapping functions.

LFG lends itself to modeling the demonstrated parallel nature of the cognitive linguistic architecture. However, a one-to-one correspondence between infor-

mation structures in the pipeline is difficult to reconcile with the psycholinguistic evidence of co-activation and instances of congruent lexicalization. To adjust the pipeline to accommodate bilingual production, and to allow for the level of gradience that results in various code-switching phenomena, we must adjust the representation of the mapping functions. As we have learned, a bilingual co-activates their source grammars and, despite inhibitory control, cannot completely shut off the language they are not currently using. This means that elements from both source grammars are active simultaneously. By taking a closer look at the examples of portmanteau constructions and the dative alternation in English, we illustrate how applying a probabilistic version of the pipeline architecture can account for these data in a straightforward way with the only significant change being in the functions mapping levels of structure to one another, rather than in the ontology of the pipeline itself.

3.1 The underlying structure of portmanteaus

To begin, we return to the portmanteau construction, as it is the most clear evidence of the parallel activation of linguistic information up until the point of utterance.

(5) they gave me a research grant *koḍutaa*
they gave me a research grant give.3.PL.PAST
'They gave me a research grant.'
(English-Tamil verb doubling, Sankoff et al. (1990, p. 93))

Closer inspection of the portmanteau in (5) reveals that the subcategorization frame for both versions of the verb are identical. Additionally, the phrase structure of the doubled element has a single mirrored difference. In a review of portmanteau constructions, Chan (2015) notes that "portmanteaus emerge in language-pairs in which head-complement order is different for a particular phrase" (p. 105). English verb phrases are left-headed VO constructions, while Tamil verb phrases are right-headed OV constructions. Furthermore, both verbs match in a number of features. Both agree with a third person plural subject, and both verbs are marked for past tense. A detailed analysis of portmanteaus must account for these facts. In LFG terms, we therefore have a single a-structure and a single f-structure, onto which the c-structures map.

However, the presence of the doubled verb raises an interesting question that impacts the pipeline. How do we deal with the two conflicting c-structures that end up merged in the final utterance? Following from that, at what point are lexical items selected that could increase the preference for one c-structure over the other? For instance, selecting English as the preferred language prior to selection of the c-structure should increase the preference for the SVO c-structure and vice versa, if Tamil is selected. The merged c-structures that appear in portmanteau constructions suggest that this choice is made late in the pipeline, and that both English and Tamil lexical items and c-structures remain in competition with one another until

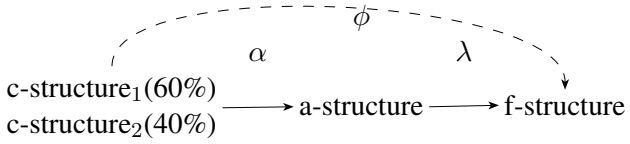

Figure 3: Preliminary revised c- to a- to f-structure pipeline for bilingual production

the very end. Therefore, we assume that there are two competing c-structures, and each c-structure has a probability of being uttered (see Figure 3). For illustrative purposes, we have assign arbitrary probabilities to the individual c-structures in Figure 3. These probabilities are influenced by a number of factors, such as the speaker's linguistic mode, the matrix language, or syntactic priming.

We reach this assumption by establishing a number of foundational concepts. Importantly, the semantic representation of an event is shared in the mind of a bilingual (Kroll, Van Hell, Tokowicz, & Green, 2010). The verb "to give" in our portmanteau example carries with it the same meaning, from the action to the participants, in both English and Tamil. This means that the f-structure is also shared between English and Tamil, as the grammatical functions are identical. In this exercise, we assume that the decision to use a double object construction, rather than an oblique, has been made somewhere further up the pipeline. To yield a shared f-structure, the a-structure must be identical, and therefore shared as well. Under these assumptions, the only location in the pipeline where optionality is possible is the c-structure, and English and Tamil have differing c-structures with a degree of overlap. We therefore have two differing c-structures attempting to map onto the shared a-structure, and thereby the shared f-structure. The mapping of both c-structures to a single f-structure is represented in Figure 4. Here we see that the terminal nodes in the c-structures compete to map to the grammatical functions.

The mapping function must therefore be able to capture the competition in these structures and the multiple output possibilities that exist, albeit with different probable degrees of occurrence. Here, we draw attention to the analysis put forward by Goldrick et al. (2016a), as a possible approach to representing the c-to-f-structure mapping function. In their analysis, they employ Gradient Symbolic Computation (Smolensky et al., 2014) to the process of resolving the word order conflict between English and Tamil. Gradient Symbolic Computation is a version of Harmonic Grammar that is capable of modeling not only the probabilistic distribution of attested outputs, but also the gradience within (bilingual) language outputs. Constraints are weighted for each language specifically, and these weights combine to act on a language-general level. Through language-specific weights, Goldrick et al. (2016a) represent the strength of each c-structure's link to the f-structure, and the combined language-general weight illustrates how the two languages impact one another. The weights can fluctuate, similarly to Stochastic OT, given a number of factors. Importantly, though, in the evaluation of candidates,

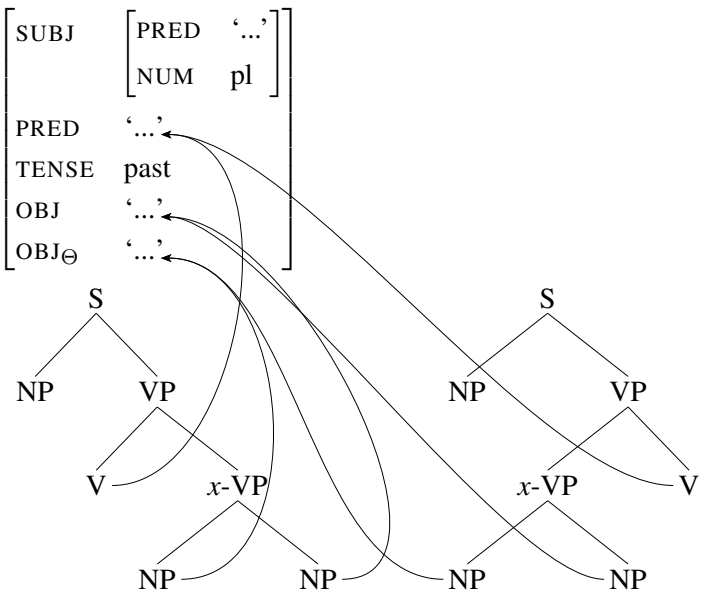

Figure 4: c-to-f structure mapping (ϕ) in bilingual production

no one candidate is deemed optimal. Instead, candidates are assigned a harmony value, and, based on this harmony value, are assigned a probability of being uttered. Any candidate with a non-zero probability may be produced by the speaker.

3.2 The underlying structure of the dative alternation

Returning to monolingual competition, we resume our discussion of the dative alternation. In the case of the dative alternation, there is a direct mapping between each subcategorization frame and a corresponding c-structure. The competition between the double object construction and the oblique construction lies not in the c-structure but instead in the a-structure, and therefore further up the pipeline. Otherwise, the f-structure would not contain the grammatical information necessary to map with the c-structure.

Consider the following monolingual variants of the portmanteau analyzed in Section 3.1. Both (6) and (7) are equally valid for conveying the desired meaning. Yet, one option may be more preferred than the other. This has been studied through a number of lenses, but most relevant here is the work done by Bresnan (2007); Bresnan and Nikitina (2009) and Bresnan et al. (2007). Through corpus studies, Bresnan and colleagues identified patterns in ditransitive verbs that grouped them into preferred tendencies to take either the double object construction, or a prepositional phrase. For instance, for verbs that signify a transfer of possession, such as the verb from our portmanteau, *to give*, English is "heavily

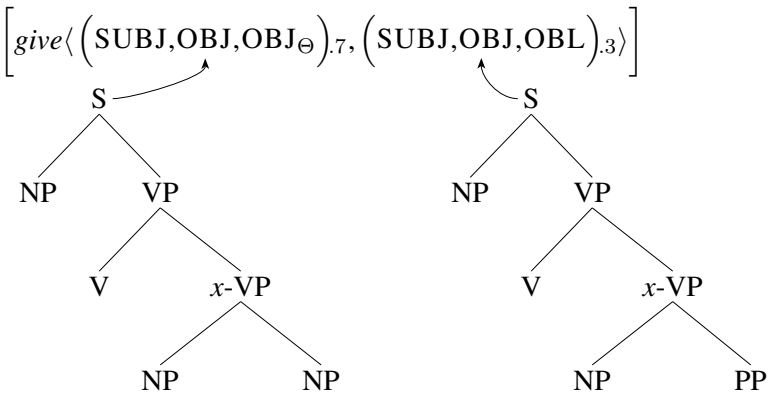

Figure 5: c- to a-structure mapping (α)

biased toward the dative NP construction" (Bresnan & Nikitina, 2009, p. 14).

(6) they gave me a research grant

(7) they gave a research grant to me

This preference for the dative NP construction could be represented as an optimization process in Stochastic OT, as in Bresnan and Nikitina (2009). We build on the probabilistic nature of Gradient Symbolic Computation and propose instead that, in the a-structure, each potential subcategorization frame has a certain probability of occurrence, where the probabilities add up to a total of 1. A representation of this can be seen in Figure 5.

3.3 Reassembling the pipeline

With the insights we have gained by examining competition in both bilingual and monolingual language production, we must now bring all of the pieces together. For the sake of space constraints, we do not elaborate further on the the GSC-treatment of the mapping functions and refer the reader to Goldrick et al. (2016a) and Goldrick, Putnam, and Schwarz (2016b) for a more detailed, illustrative treatment of portmanteaus. Instead, we focus here on the conceptualization of the new pipeline and the principles that underlie it, on the example of the portmanteau construction that also involves the dative alternation, Example (5).

The revised pipeline comprises a number of links; here specifically the mapping of c-to-a-structure, a-to-f-structure, c-to-f-structure, and the cumulative effect of competition in each link. In reassembling the new pipeline, we build upon the evidence of parallel activation, extended competition, and gradience. In what follows, we will model and discuss each link, before discussing the expanded pipeline as a whole and its implications.

Arguments	Probability
DoubleObject$_{en}$	.7
Oblique$_{en}$	.3

Figure 6: English a-structure with probabilities

Arguments	Probability
DoubleObject$_{ta}$	.6
Oblique$_{ta}$	.4

Figure 7: Tamil a-structure with probabilities

We begin with the piece of the pipeline closest to the semantics, and furthest from the utterance, the mapping function λ, which maps the a-structure to the f-structure. As stated above, the verb "to give" participates in the dative alternation in both English and Tamil (Sundaresan, 2006). Therefore, there are two possible argument structures for both English and Tamil. From the Bresnan and Nikitina (2009) study on the dative alternation, we know that the double object construction is preferred in English for this specific verb (Figure 6). A similar study has, to our knowledge, not been performed for Tamil. For illustrative purposes, we therefore will assume that Tamil also has a preference for the double object construction, albeit not as strong as the English preference (Figure 7). A monolingual contends with two options, while a bilingual contends with all four, though they may influence on another. By coming together in the mind of a hypothetical perfectly balanced bilingual, the preferences for each potential argument structure is impacted (Figure 8).

Each potential argument structure corresponds with a specific f-structure. We therefore have two competing f-structures in both the monolingual and bilingual speaker. The preference for the double object construction in our hypothetical speaker translates to a preference for its corresponding f-structure. Importantly, keeping in mind the evidenc of extended competition, the dispreferred a-structure and f-structure are still residually active, while the link between the preferred a-structure and f-structure gains momentum in the pipeline. This, we represent by placing the preferred structure in boldface (Figure 9).

The next piece is the c-structure that correspond with each a-structure. In a monolingual, a single c-structure maps to each a-structure, as depicted in Figure 5. For a bilingual, the picture is more complicated. Two c-structures compete for each

Arguments	Probability
DoubleObject	.65
Oblique	.35

Figure 8: Bilingual a-structure with probabilities

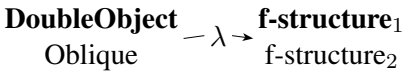

Figure 9: a-to-f-structure mapping

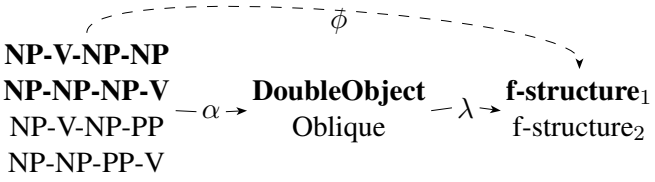

Figure 10: Momentum in the pipeline

a-structure. In the case of the Tamil-English bilingual, an SVOO and an SOOV surface structure compete to map to the double object a-structure, and similarly for the oblique a-structure. Through the interaction between the two languages, and the momentum gained through the linguistic preference(s) for the double object construction, the preference for the respective c-structures in both English and Tamil builds (Figure 10), leading to predictive anticipation.

At the point of mapping c-structure to f-structure, momentum for the preferred construction has built to a point that the likelihood of the competing dispreferred f-, a-, and c-structures has nearly reached zero, but not diminished entirely. In this very late stage of language production, both the English and Tamil word orders are still very much active and must be reconciled. Given the right linguistic circumstances (e.g. a code-switching environment, a certain degree of proficiency in both languages, etc.), the likelihood of neither c-structure can be reduced sufficiently to allow the other to prevail. In such situations, it becomes optimal to blend the two c-structures.

4 Discussion

In light of this body of research on multilingual grammar and cognition, it is no longer possible to look at languages individually, but instead we must integrate both source grammars into a unified model when modeling bilingual production. In this section we highlight how the expanded pipeline we introduce here is an ideal fit for Christiansen & Chater's (2016) *Chunk-and-Pass processing* strategy.

The necessity to integrate various elements of linguistic knowledge simultaneously for the purpose of production and comprehension is an established fact. Christiansen and Chater (2016) correctly point out that "as we hear a sentence unfold, our memory for preceding material is rapidly lost" (p. 95) This leads to their proposal of language processing from a *Now-or-Never* perspective: "if linguistic information is not processed rapidly, that information is lost for good" (p. 95). The most relevant questions that surface in connection with the *Now-or-Never* process-

ing bottleneck concerns ***when*** this information is integrated into a common unit and ***how much*** information can be included in a single unit? From an architectural standpoint Christiansen and Chater (2016) assert that "because memory limitations also apply to recoded representations, the cognitive system further chunks the compressed encodings into *multiple levels of representation* of increasing abstraction" (p. 98). From their perspective, linguistic units which they refer to as ***chunks*** are composed of multiple levels of linguistic representations that are rapidly generated. The process of generating chunks proceeds incrementally, with individual chunks occurring in succession, producing anticipatory processing. This view of language processing results in a model that is heavily dependent on local dependencies, where the learning, production, and comprehension of a grammar takes part at exclusively local intervals.

The rapid integration of multiple cues (Christiansen & Chater, 2016, Chapter 5) in a multi-level architecture of cognition faces working memory constraints due to the *Now-or-Never* nature of language, which means that inevitably some aspects of information will be lost. These representations (i.e., chunks) are, at least to some degree, lossy, in spite of the system's best attempt to be as discrete as possible (Smolensky et al., 2014) and Putnam, Carlson, & Reitter 2017 for a similar position). To ensure that the most important (which is often also the most frequently-produced) information is preserved, information stored within these chunks is compressed, where particular aspects of information are condensed and combined.

Given the rapid demands on successful language production and comprehension, we acknowledge some form of a compression facilitates these processes and reduces algorithmic complexity. The primary function of compression enables the grammar to eliminate informational redundancy whenever possible, thus leading to both more efficient structure building and decoding (see Chater, Clark, Goldsmith, and Perfors (2015, Chapter 2)). Future work on aspects of bilingual grammars from this perspective must revisit and refine the compression algorithm that takes place internally among competing structures of a particular level of representation. Here again is where the notions of overlap and typological proximity may indeed play a decisive role in determining which common elements shared among level-internal candidates may merge (or compress) to become a 'common' or 'shared' structure.

The architectures advanced by Christiansen and Chater (2016) and Putnam, Reitter, and Carlson (2018) are consonant with the neurocognitive research on the bilingual mind reviewed in the previous section, and as we discuss below, can be easily integrated into a parallel architecture such as LFG. As evidenced by the data discussed and analyzed in the previous section, our augmented version of the pipeline architecture can account for the gradient nature of linguistic knowledge without the addition of stipulative theory-internal machinery.

5 Conclusions and directions for future research

In this paper we established the need for the augmented pipeline presented in Figure 2 in order to account for hybrid output representations attested in bilingual grammars (in particular, with reference to code-switching phenomena such as portmanteau constructions). In order to avoid the redundant competition and algorithmic complexity associated with two completely separate grammar systems in conflict with each other, our suggested pipeline introduces an alternative that is consistent with both the parallel correspondence architecture which is commonplace in LFG as well as the literature on the cognitive neuroscience of bilingualism to date.

This proposal raises interesting prospects for the analysis of bilingual data, while at the same time it encounters daunting challenges. To conclude this paper, we allude to three domains of inquiry that emerge as important areas of related research to be pursued in future studies using this model. First, consider the situation when two source grammars possess two contrasting underlying systems for satisfying a shared attribute; how will a compromise be reached? For instance, if two languages mark tense distinctively from one another, how can this best be captured in compressed levels of individual levels of representation (i.e., f-structure)? Second, and related to the first point, how can we best model multiple structures of grammar in an LFG-architecture that are compressed, and as a result, gradient and lossy, as they interact with one another via functional mapping. Initial studies that investigate aspects of syntax from a GSC-perspective have thus far have only involved two levels of grammar (Brehm & Goldrick, 2017; Goldrick et al., 2016a; Putnam & Klosinski, to appear). Future work focusing on linguistic phenomena that involve the role of common information and overlap involving multiple levels of grammar will advance our understanding of the role of contrasting information and compression (e.g., Schwarz, in progress; Schwarz, Brehm, & Putnam, in preparation) and, as a result, may force us to revisit particular architectural assumptions in LFG. This overlapping information, commonly referred to as *mutual information* (Blevins, 2016; Cover & Thomas, 2012), represents an important next step to modeling compression in bi- and multilingual grammars as well as establishing a more detailed description of typological classifications (Brown, Chumakina, & Corbett, 2013). Third, and related to the two previous challenges noted above, in combination with the development of a more detailed compression algorithm, future work must also develop an accessible way and means to establish how elements from other levels of grammar can lead predictive parsing.

In closing, we take solace in the fact that our call for an expanded pipeline is consistent with Christiansen and Chater's 2016 notion of the *Now-or-Never Bottleneck* and other probabilistic models such as Gradient Symbolic Computation (GSC; Goldrick et al. 2016a; 2016b, Smolensky et al. 2014) in our initial attempt to model bilingual grammars in LFG.

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Asymmetries in Italian Matrix Wh-questions: Word Order and Information Structure

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Abstract

We develop an analysis that accounts for word order asymmetries found in Italian *wh*-questions. In particular, the different orderings of subject and verb in *perché*-questions as opposed to *wh*-questions involving other *wh*-items.

In line with Butt (2014) and Mycock (2006, 2013), we see a strong interaction of information structural content and the structure of questions. We argue that the word order differences mirror the semantic divergence of *perché* in contrast to other *wh*-items such as *chi, quando* or *dove*, among others. We suggest that *perché* differs from the other *wh*-items with regard to the partition it introduces at i-structure. While all *wh*-items introduce a partition between FOCUS and BACKGROUND at i-structure, we argue for the BACKGROUND to be articulated with *perché*. We show that this correctly captures the fact that *perché* can scope over a focus operator, while all other *wh*-items are within the scope of a focus operator, as well as the word order asymmetries found in Italian matrix *wh*-clauses.

1 Introduction

In this paper, we propose an analysis of matrix *wh*-questions in Italian from a Lexical-Funtional Grammar perspective. The structure of Italian *wh*-questions has been investigated in derivational approaches for over two decades. However, this issue has been rarely tackled from a perspective that does not draw on transformational notions.

We focus on matrix *wh*-questions and address asymmetries between two classes of *wh*-items, which we call "Class 1" and "Class 2" (cf., among others, Rizzi, 2006; Bocci & Pozzan, 2014):

CLASS 1		CLASS 2	
Italian	**English**	**Italian**	**English**
chi	'who'	*perché*	'why'
(che) cosa	'what'	*come mai*	'how come'
dove	'where'	*D-Linked wh*-elements:	
quando	'when'	*quale libro* 'which book'	
come	'how'		

Table 1: Class 1 and Class 2 *wh*-items

The data we discuss in this paper demonstrate a strong interaction between c-structure and i-structure. The paper is structured as follows: Section 2 illustrates three systematic asymmetries between Class 1 and Class 2 *wh*-items in Italian matrix *wh*-questions; Section 3 reviews existing analyses; Section 4 presents our LFG analysis; Section 5 concludes this paper. We are currently working on including our findings and analysis into a grammar fragment of Italian, using the Xerox Linguistic Environment (XLE) (Crouch et al., 2011).

2 Asymmetries in matrix *wh*-questions: word order and information structure

In this section we outline the data, illustrating the different surface structures of Italian matrix *wh*-questions. Three important asymmetries can be observed between *wh*-questions displaying Class 1 vs. Class 2 *wh*-items. These asymmetries result from c-structural constraints, but are also connected to the informational status of the subject (and of other GFs). The distribution of subjects in *wh*-questions is a long standing issue in the literature on the syntax of Italian, and Romance languages in general (Rizzi, 1996; Poletto, 2000; Barbosa, 2001; Cardinaletti, 2007).

Observation 1:

While a *wh*-item is fronted in both (1) and (2), the placement possibilities for the SUBJ-NP *Anna* differ substantially:

(1) **Quando** {*Anna} balla, {Anna}?
when {*Anna} dance.PRS.3SG {Anna}
'When does Anna dance?'

(2) **Perché** {Anna} balla, {Anna}?
why {Anna} dance.PRS.3SG {Anna}?
'Why does Anna dance?'

While the subject cannot be realised between the main verb and a Class 1 item like *quando* in (1), this preverbal position is acceptable and in fact unmarked with the Class 2 element *perché* ('why') in (2).

Observation 2:

Bocci & Pozzan (2014) point out that questions introduced by *perché*, and with the subject in postverbal position, allow the subject to receive a contrastive focus interpretation without additional prosodic marking (3b). On the other hand, a *wh*-question with this type of interpretation for the subject is not felicitous if the subject is realised preverbally, as in (3c).[1] In this case, the choice between a preverbal and a postverbal subject thus depends on information structure. Questions introduced by a Class 1 *wh*-element do not allow a focus interpretation of the subject.

(3) a. (Speaker A)

Gianni mi ha appena portato il libro
John me AUX.3SG just bring.PST.PTCP the book

'John has just brought me the book.'

[1]The contrast between (3b) and (3c) is neutralised if the subject-NP is realised with focal stress.

b. (Speaker B)

Perché te l'ha portato Gianni (e non
why to-you CL.3SG.M-AUX.3SG bring.PST.PTCP John and not
Leo)?
Leo

'Why did John bring it to you and not Leo?'

c. (Speaker B)

#Perché Gianni te l'ha portato (e non
why John to-you CL.3SG.M-AUX.3SG bring.PST.PTCP and not
Leo)?
Leo

'Why did John bring it to you and not Leo?'

Yes-No questions exhibit the same behaviour:

(4) a. (Speaker A)

Gianni mi ha appena portato il libro
John to-me AUX.3SG just bring.PST.PTCP the book

'John has just brought me the book.'

b. (Speaker B)

Te l'ha portato Gianni? Credevo
to-you CL.3SG.M-AUX.3SG bring.PST.PTCP John? think.PST.1SG
che te lo dovesse portare Leo.
that to-you it should bring Leo.

'Did John bring it to you? I thought that Leo should have brought it.'

c. (Speaker B)

#Gianni te l'ha portato? Credevo
John to-you CL.3SG.M-AUX.3SG bring.PST.PTCP? think.PST.1SG
che te lo dovesse portare Leo.
that to-you it should bring Leo.

'Did John bring it to you? I thought that Leo should have brought it.'

Regarding this property, yes-no questions and *perché*-questions behave like declarative sentences:

(5) a. Gianni ha telefonato.
John AUX.3SG call.PST.PTCP

b. Ha telefonato Gianni.
AUX.3SG call.PST.PTCP John
'John called.'

In (5b), the subject can receive a narrow (information, or merely contrastive)[2] focus interpretation by occupying a postverbal position. The same focus reading is, however, unavailable for preverbal subjects (5a).

In contrast, in questions with a Class 1 *wh*-item, as in example (1), the postverbal subject is "marginalized" (Antinucci & Cinque, 1991; Cardinaletti, 2001), meaning that it is realised to the right of the verb (complex), destressed and interpreted as presupposed information. Hence, a postverbal subject can only get a narrow focus interpretation if the introducing *wh*-element is *perché*.

Alternatively, postverbal subjects in Class 2 *wh*-questions can get an interpretation similar to the one of "marginalized" subjects in Class 1 *wh*-questions:

(6) **Perché** te l'ha portato, Gianni?
why to-you CL.3SG.M-AUX bring.PST.PTCP John
'Why did John bring it to you?'

Observation 3:

Additionally, *perché* is compatible with a contrastive/corrective focus in the left periphery of the sentence, differing once more from Class 1 *wh*-expressions:

(7) **Perché** QUESTO avremmo dovuto dirgli e non
why this AUX.3PL to-have-to.PST.PTCP say.him and not
qualcos'altro?
something-else
'Why THIS we should have said to him, not something else?' (Rizzi, 2001)

(8) ***Quando** QUESTO avremmo dovuto dirgli e non
when this AUX.3PL to-have-to.PST.PTCP say.him and not
qualcos'altro?
something-else
'When THIS we should have said to him, not something else?' (Rizzi, 2001)

[2]We adopt Bocci & Pozzan's (2014) definition of "merely contrastive focus" as a focus creating "a contrast internal to the sentence that does not imply the correction of a previously asserted proposition" (cf. Bocci & Pozzan 2014:33).

Note that in structures like (7), the word order is fixed: the contrastively focused XP can never precede *perché*:

(9) *QUESTO **perché** avremmo dovuto dirgli e non
this why AUX.3PL to-have-to.PST.PTCP say.him and not
qualcos'altro?
something-else
'Why THIS we should have said to him, not something else?' (Rizzi, 2001)

3 Previous Accounts

As mentioned in the introduction, there are several analyses which seek to account for these asymmetries, and especially for the ban on preverbal subjects in questions introduced by a Class 1 *wh*-item (1). Since these are all situated within derivational theories, we will only outline the most prominent ones.

According to Rizzi (1996, 2001, 2006), Class 1 and Class 2 *wh*-items fulfill the so-called *WH-Criterion*[3] in different ways. Put simply, the criterion requires the following: A *wh*-operator must be in the Specifier of a head X^0 that carries the interrogative feature [+wh] (Rizzi, 1996).

In his analysis, all *wh*-items are hosted within the CP system, but not in the same position. Class 1 items only meet the criterion by moving to the left periphery of the clause, thereby crossing the subject and triggering "subject-verb inversion": the inflected verb carrying the *wh*-feature must move to the complementiser position to create the required Spec-head configuration with the *wh*-operator, depicted below:

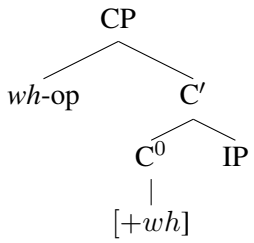

Figure 1: Spec-head configuration with the *wh*-operator

Assuming an articulated left periphery, Rizzi (2006) argues that a Class 1 item moves to the specifier position of the Focus head, and the TP is subsequently moved to the left periphery as well, thereby crossing the subject:

(i) [$_{CP}$ where$_i$ [$_{C'}$ has$_j$ [$_{IP}$ John t_j gone t_j]]]

[3]The definition as given in Rizzi (1996:150):
(A.) A *wh*-operator must be in a Spec-head configuration with an $X^0[+wh]$
(B.) An $X^0[+wh]$ must be in a Spec-head configuration with a *wh*-operator. (Rizzi, 1996)

On the other hand, the Class 2 item *perché* is directly merged in a higher position that does not attract movement, namely the specifier of Int(errogative). In the latter case, no movement is needed and the subject can appear between the interrogative and inflected verb. However, the movement of a Class 1 item, with subsequent movement of the TP, prevents the subject from intervening between the interrogative and the main verb. Rizzi's analysis leads to the following structure of the complementiser position:[4]

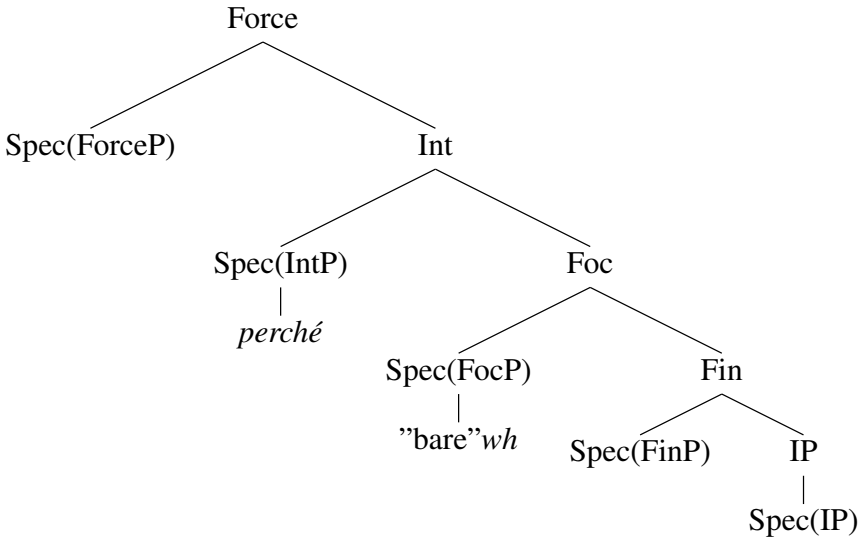

Figure 2: Structure of the complementiser position (Rizzi, 2006)

In contrast to Rizzi, Cardinaletti (2007) argues that movement from I to C does not take place in Romance questions at all. While supporting the idea that *wh*-items are hosted in CP, and preverbal subjects in a lower SubjP position within the IP, she does not assume that the verb (or a projection of the verb) moves to the C-domain.

According to her work, the ban against preverbal subjects as in (1) is due to a selective intervention effect which rules out subjects in the specifier of SubjP in questions. Adapting her previous hypothesis, she postulates more than one preverbal subject position, each one specialised to host different subjects. Full DPs and strong pronouns are hosted in the specifier of SubjP, pronominal subjects, e.g. the empty *pro* or weak subject pronouns, are hosted in the specifier of TP, leading to the following structures:

[4]For the sake of convenience we left out optional topic projections that can be inserted below each functional projection.

(ii) [$_{\text{SubjP}}$ $Gianni_i/lui_i/egli_i$ [$_{\text{TP}}$ t_i V$_j$[... [$_{\text{VP}}$ $t_i t_j$]]]]

(iii) [$_{\text{SubjP}}$ [$_{\text{TP}}$ $pro_i/il_i/tu_i$ V$_j$ [... [$_{\text{VP}}$ t_i t_j]]]]

The concluding generalisation is that "only strong subjects are to be excluded from occurring between the *wh*-phrase and the verb in *wh*-questions, whereas weak subjects (either null or overt) are permitted" (Cardinaletti 2007:66).

The proposal by Shlonsky & Soare (2011) differs in that it does not assume *why* to be directly merged in the specifier of IntP, but moved there from the specifier of the functional projection ReasonP.

Stepanov & Tsai (2008) suggest that *why* must be inserted in the left periphery within CP. As such, *why* takes the entire IP as its argument, allowing for the correct scope relations.

4 Our Analysis

In this paper, we focus on the differences between *perché* and Class 1 *wh*-items and do not consider the other members of Class 2. Given that this paper aims at an analysis within the framework of LFG, we integrate c- and f-structural constraints combined with i-structural information. We thereby take into account work on *wh*-questions in other languages, such as Urdu/Hindi, and the general relation between discourse functions and questions (Butt & King, 1996; Butt, 2014; Mycock, 2006, 2013).

In their work, Butt & King (1996) define discourse functions by using binary values for the two features [±NEW] and [±PROM(INENT)]:

	+NEW	**−NEW**
+PROM	FOCUS	TOPIC
−PROM	COMPLETIVE INFORMATION	BACKGROUND INFORMATION

Table 2: Discourse Functions (Butt & King, 1996)

Adopting Mycock (2013) and her account for the discourse functions that *wh*-words may have, we consider the feature [±NEW] to have a relational definition. Referring to Lambrecht (1997), Mycock (2013) argues that new information can be conveyed regardless of whether the designata of different parts of the sentence has been mentioned before or not: "Given an appropriate context a sentence consisting solely of anaphoric expressions such as *She did it* serves to establish relations between the various elements of the proposition, thus conveying new information and changing the addressee's representation of the world." (Mycock, 2013, p. 2). With regard to the feature [±PROM], we adopt the definition given by Butt & King (1996) in that it depicts whether or not information is of high importance to the information structure of the discourse at hand.

We first assume that the presuppositions, which we represent as BACKGROUND, associated to both Class 1 and Class 2 *wh*-items are "open" propositions where an operator binds a variable. However, we argue that these elements differ with regard to the partition they introduce at i-structure. In order to account for the differences between Type 1 *wh*-items and *perché*, we need to take a closer look at their respective semantic properties.

It has generally been observed that reason/cause *wh*-items like *why* interact differently with focused elements compared to other *wh*-items (irrespective of the argument vs. adjunct distinction). Consider the following sentence pairs (Stepanov & Tsai, 2008):

(10) a. Why did Adam eat the apple?
b. Why did ADAM eat the apple?
c. Why did Adam eat the APPLE?
d. Why did Adam EAT the apple?

(11) a. When did Adam eat the apple?
b. When did ADAM eat the apple?
c. When did Adam eat the APPLE?
d. When did Adam EAT the apple?

While each question in (10) has different expectations as to what counts as an acceptable answer ((b.) Because he (Adam) was the one that Eve worked on; (c.) Because it (the apple) was the only food around; etc.), all questions in (11) can be answered with one and the same answer (e.g. At 9 am on December 14). Thus, while the truth value of an answer depends on the focused element in a *why*-question, the truth value of the answer does not relate to the focused constituent with *when* (Stepanov & Tsai, 2008).

However, the contrast illustrated in (10) and (11) cannot straightforwardly be transferred to Italian. As we have shown in Section 2, Class 1 *wh*-items like *quando* 'when' cannot appear with a focused XP in matrix questions. Matrix constructions mirroring the structures in (11) are thus ungrammatical. Clefted structures must instead be used, as in (12), leading to following two paradigms:

(12) a. Perché ADAM ha mangiato la mela?
b. Perché Adam ha mangiato LA MELA?
c. Perché Adam ha MANGIATO la mela?
d. Perché Adam ha mangiato la mela?
Why Adam AUX.3SG eat.PST.PTCP the apple
'Why did Adam eat the applpe?

(13) a. Quand'è che ADAM ha mangiato la mela?
b. Quand'è che Adam ha mangiato la MELA?

c. Quand'è che Adam ha MANGIATO la mela?

d. Quand'è che Adam ha mangiato la mela?
When-is-it that Adam AUX.3SG eat.PST.PTCP the apple
'When was it that Adam ate the apple?

Parallel to the English sentences, the presence of another focused XP influences the expectations of a felicitous answer in (12) but not in (13). Like the question in (10b), the question in (12a) implicates that someone else could have eaten the apple, but did not.

However, this reading is unavailable for the question in (13a) (which parallels (11b)). Such a question can be uttered in a situation in which other people apart from Adam ate the apple too, but the speaker is only interested in Adam. In order to explain this asymmetry, Stepanov & Tsai (2008:602) argue that while *when* is in the scope of the focus operator, the focus operator itself is in the scope of *why*:

(14) $(\exists : x = Adam)$ (When *t*) (*x* ate the apple at t)

(15) (Why) $(\exists : x = Adam)$ (*x* ate the apple)

In other words, INTERROGATIVE FOCUS can have scope over CONTRASTIVE FOCUS with *why*, but not with *when*. Dretske (1972:412) describes what we have shown for *why* in (10) and (12) as:

> If *C(U)* is a linguistic expression in which *U* is embedded, and *U* can be given different contrastive foci say U_1 and U_2, then it often makes a difference to the meaning of C(U) whether we embed U_1 or U_2.

We argue that the different scope possibilities just shown can be explained if we assume that Class 1 *wh*-items and *perché* introduce different partitions at the level of i-structure.

To account for the presented data, we suggest a slight modification of the notion of BACKGROUND: While Class 1 items introduce a partition in the i-structure between FOCUS and BACKGROUND, we assume the same partition for *perché*, but with an articulated BACKGROUND INFORMATION. Specifically, *why* introduces a partition between FOCUS and BACKGROUND, but the BACKGROUND can itself be articulated and contain other i-structure categories like TOPIC, FOCUS and BACKGROUND [5]:

[5]For ease of exposition, we follow Rooth (1997) and use (abstract) trees to represent semantic composition. Nonetheless, we do not assume that semantic composition follows c-structure representation.

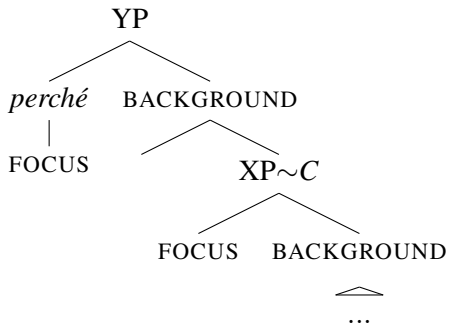

Figure 3: Proposed i-structure configuration for *perché*

Adapting Rooth (1997), *C* is a semantic variable, denoting an alternative set and ∼ represents the focus interpretation operator that contributes a constraint on the variable *C*. According to Hamblin (1973), the value of a question is represented by a set of possible answers. Such a set is represented by *C*. The focus interpretation operator ∼ illustrates where the i-structure information is accessed (see Rooth 1997). In the semantic composition, the lowest BACKGROUND and FOCUS form one unit, which itself forms the BACKGROUND to the FOCUS *why*. If we reconsider questions with *perché* and a focused XP as in (12a), repeated in (16):

(16) Perché ADAM ha mangiato la mela?
Why Adam AUX.3SG eat.PST.PTCP the apple
'Why did Adam eat the apple?'

Decomposing from top-to-bottom: *perché* corresponds to the highest FOCUS, while the focused XP *Adam*, together with IP *ha mangiato una mela*, form the BACKGROUND to the focal *perché*. In turn, that BACKGROUND consists of the FOCUS *Adam*, with BACKGROUND *ha mangiato una mela*. In contrast, the partition into FOCUS and BACKGROUND introduced by Class 1 items can be depicted as:

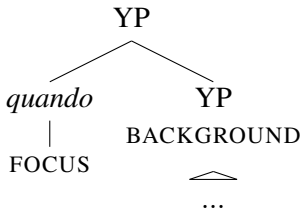

Figure 4: Proposed i-structure configuration for Class 1 *wh*-items

In this case, the introduced partition places the *wh*-item in FOCUS and necessarily forces the subject to be backgrounded information, because the category BACKGROUND is not further articulated with Class 1 *wh*-items.
Apart from the differing i-structure partitions, we argue that the two classes of *wh*-

items also differ with respect to the access of the i-structural information within semantic composition:

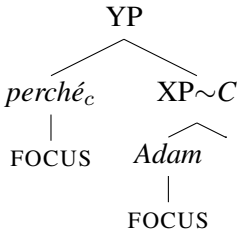

Figure 5: Semantic composition of *perché*

Here, the i-structural information is added to the semantic composition at XP, that is as a complement to, and embedded under, *perché*. As such, it is in the scope of *perché*.

However, with Class 1 *wh*-items, we assume the i-structure information is added to semantic composition at YP, in which the *wh*-item is included and embedded itself:

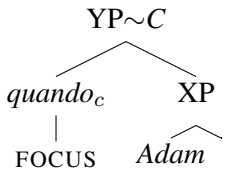

Figure 6: Semantic composition of Class 1 *wh*-items

This accounts for the fact that only *why* but not Class 1 items can have scope over the focus operator.

With regard to c- and f-structural constraints we propose the following: Both, Class 1 *wh*-items, and contrastive foci are inserted in a c-structural position associated with a functional uncertainty path. Accordingly, in a structure like (1) *quando* 'when' corresponds to FOCUS, whereas the subject must be realised in a position associated with BACKGROUND INFORMATION because, as argued in the previous section, Class 1 *wh*-items introduce BACKGROUND that cannot be further split into additional i-structure categories. Importantly, the preverbal position, i.e. SpecIP, is not such a position, since it is associated with the discourse function TOPIC.

In contrast, *perché* allows for an articulated BACKGROUND. Consequently, the introduced partition at i-structure differs considerably: While subjects are forced into the BACKGROUND with Class 1 items, they are free to be positioned in c-structure nodes corresponding to TOPIC or BACKGROUND (the preverbal and postverbal positions in 17 respectively) or contrastive FOCUS (18) with *perché*:

(17) **Perché** {Anna} balla, {Anna}?
why {Anna} dance.PRS.3SG, {Anna}?
'Why does Anna dance?'

(18) **Perché** te l'ha portato GIANNI (e non Leo)?
why to-you CL.3SG.M-AUX.3SG bring.PST.PTCP John and not Leo
'Why did John bring it to you and not Leo?'

The resulting c-structure template that we propose is shown below. To allow for a more comprehensive presentation, we also illustrate each of the three important subtrees separately.

Resulting C-Structure Template

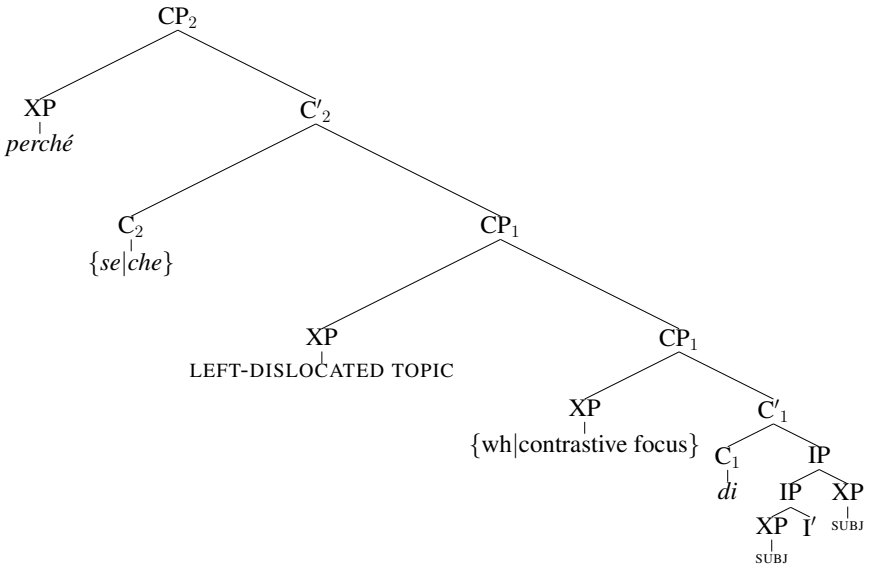

Figure 7: Resulting C-Structure Template

The main reason for assuming two CPs is the rich and highly articulated structure of the left periphery in Italian (Rizzi, 1997; Cinque, 1999; Rizzi & Bocci, 2017).[6] The c-structure thus reflects the ordering of complementisers and topics in Romance clitic left-dislocated constructions: while the TOPIC is preceded by the finite complementiser *che* ('that'), it must be followed by the infinitival complementiser *di* ('of'):

[6]The present c-structure is not meant to represent the case of CP recursion but rather two different C-related projections. As suggested by a reviewer, CP_1 can be thought of as the FinP projection and CP_2 as the ForceP projection by Rizzi (2006). However, we prefer remaining neutral to the specific implications of these projections.

(19) Ho deciso **che**, [$_{\text{TOPIC}}$la macchina], la comprerò
AUX.1SG decide.PST.PTCP **that**, [$_{\text{TOPIC}}$the car], it buy.FUT.1SG
quest'anno
this'year
'I decided that, the car, I will buy it this year.'
'I decided to by the car this year.' (Rizzi & Bocci, 2017:3)

(20) Ho deciso, [$_{\text{TOPIC}}$la macchina], **di** comprar.la
AUX.1SG decide.PST.PTCP, [$_{\text{TOPIC}}$the car], **of** buy.INF.CL
quest'anno
this'year
'I decided, the car, of to buy it this year.'
'I decided to by the car this year.' (Rizzi & Bocci, 2017:3)

In sentence (2), repeated in (21), the preverbal subject corresponds to such a left-dislocated TOPIC situated in the specifier of CP_1. Alternatively, the preverbal subject can be situated in the specifier of IP. Both positions are available and probably lead to slight differences at i-structure. However, we do not go into further detail on this matter. On the other hand, the postverbal subject is an instantiation of BACKGROUND, placed in IP (illustrated in the configuration of IP on the following page).

(21) **Perché** {Anna} balla, {Anna}?
why {Anna} dance.PRS.3SG, {Anna}?
'Why does Anna dance?'

Subsequently, we illustrate each of the three important subtrees of our proposed c-structure template.

Configuration of CP_2 - Position of *perché*

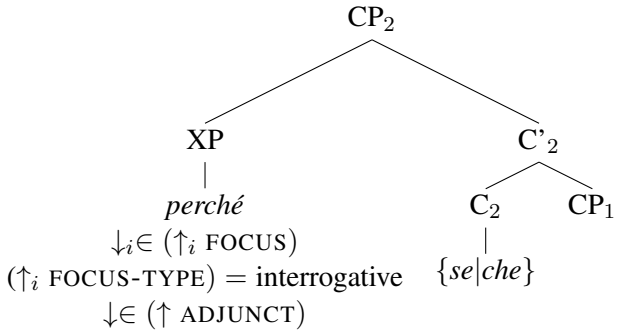

Figure 8: Position of *perché*

Configuration of CP_1 - Position of Class 1 *wh*-items

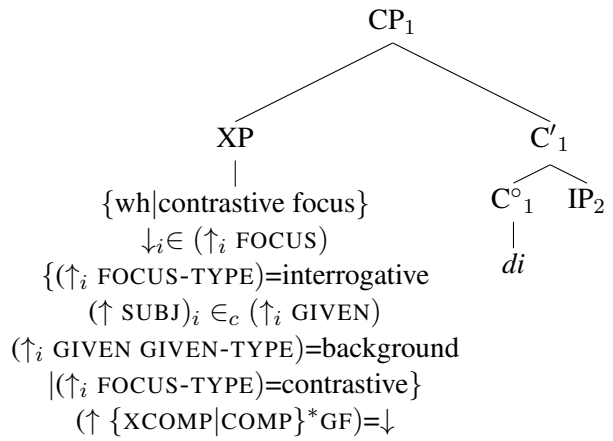

Figure 9: Position of Class 1 *wh*-items

Configuration of IP - further Subject Positions

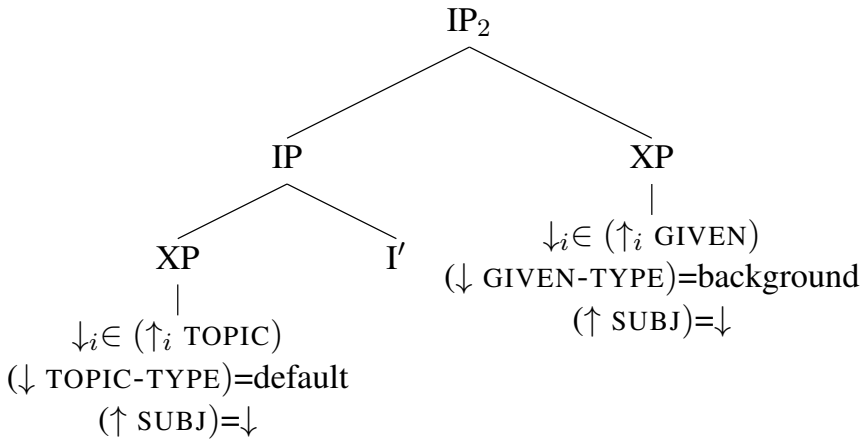

Figure 10: Subject Positions

5 Conclusion

In this paper, we proposed an analysis for word order asymmetries in Italian matrix *wh*-questions. In particular, we investigated the differences between Class 1 *wh*-items and *perché*. Our proposal integrates and combines their different behaviours and properties at the levels of c- and f-structure, as well as i-structure. We suggest that *perché* introduces a partition at i-structure between FOCUS and BACKGROUND, like Class 1 *wh*-items, but unlike those, the BACKGROUND is articulated and can itself be further split into additional i-structure categories. This allows *perché* to co-occur with another focused XP, influencing the truth conditions for felicitous answers. However, the BACKGROUND associated with Class 1 *wh*-items is not articulated, and cannot contain additional i-structure categories. We propose that this difference is reflected at c-structure: *Perché* is inserted in a higher c-structure position hosting sentential operators corresponding to clause-level adjuncts. As such, subjects are free to be positioned in c-structure nodes corresponding to TOPICS or BACKGROUND or contrastive FOCUS. As for Class 1 *wh*-items, we take these to be in the same position as contrastive foci. Specifically, we suggest that Class 1 *wh*-items are inserted in a c-structural position associated with a functional uncertainty path, forcing the subject to be realised in a position associated with BACKGROUND information. Our current and future work involves an implementation of these results in a small grammar fragment of Italian.

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Cross-Linguistically Viable Treatment of Tense and Aspect in Parallel Grammar Development

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Abstract

This paper reports on a robust treatment of tense and aspect that is designed for computational purposes such as the crosslinguistically broad ParGram effort. Our ParTMA (Parallel Tense/Mood/Aspect) project builds on theoretical insights within formal semantics and pragmatics, but places them on a broader crosslinguistic footing and develops a computationally viable interface between morphosyntax and semantics/pragmatics. We illustrate how our approach works with respect to selected phenomena that include tense underspecification, morphosyntactic variation and sequence of tense effects.

1 Introduction

The work reported on here is part of a larger project on developing a crosslinguistically and computationally viable annotation scheme for tense/aspect phenomena. The work was originally inspired by work within the ParGram effort Butt et al. (2002, 1999), which included several discussions on how to deal with tense/aspect. One problem faced by ParGram was that the semantics of tense/aspect could not necessarily be "read off" the morphosyntax of a given expression. Another was that theoretical linguistic work on tense/aspect up until recently tended to engage only with a small minority of the world's languages and therefore with only a narrow sample of the overall crosslinguistic patterns (Giorgi & Pianesi, 1997; Kamp & Reyle, 1993; Klein, 1994; Smith, 1991).

On the other hand, typological studies have amply demonstrated the rich variety of expression across tense and aspect categories (e.g. Comrie 1985; Croft 2012; Dahl 1985) and the existing formal approaches have shown that tense and aspect is expressed via complex interactions across morphology, syntax, semantics and pragmatics, whose individual parts have not been fully understood (for an overview see Tonhauser (2015)).

Consider the following example from the "Scorpion Story" often used in typological or language documentation research.

(1) a. Once a scorpion was standing by a river.
be.Past stand.Prog
(English)

b. ek t^haa bicc^{h}u jo daryaa ke kinaare k^{h}aṛaa t^haa
one be.Past scorpion Rel river Gen.Obl bank stand.Perf be.Past
(Urdu)

c. Konon ada seekor kalajengking berdiri di pinggir sungai
once there.is a scorpion stand on edge river
(Indonesian)

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This example illustrates three different ways of encoding both tense and aspect. The situation of a scorpion standing by a river bank sometime in the past is encoded periphrastically in English. A 'be' auxiliary inflected for past tense is combined with a main verb that carries the progressive *-ing* morphology (*AUX + V+ing*). In Urdu, the situation is expressed via a perfective morphology on the main verb in combination with a past 'be' auxiliary. In Indonesian, on the other hand, there is no overt tense or aspect marking. However, the initial expression 'Konon'(trans. *it is said, that*) signals at a modal, back-shifted context.

Given this type of variation in the expression of tense/aspect, a central challenge, particularly from a computational perspective, is the formulation of a crosslinguistically applicable mapping from morphosyntactic cues to semantics and pragmatics. We sketch such a mapping in this paper and show how it fits in well with the existing LFG and ParGram architecture.

The paper is structured as follows: The next section provides more background on tense and aspect. In section 3 we present our own proposal for the treatment of tense and aspect, focusing especially on aspects that pertain to grammar engineering. In section 4 we use the novel analysis of tense and aspect to explore syntactic, semantic and pragmatic variation in the categories of tense and aspect, thereby providing a more detailed understanding of the inner workings of the new proposal. Section 5 sums up the paper.

2 Tense and Aspect in LFG and ParGram

Research on tense and aspect encompasses a vast domain. Given the confines of this paper, we leave aside related areas such as evidentiality and mirativity. We also focus mainly on tense in this section and open up the analysis to aspect as the argumentation in the paper unfolds.

2.1 ParGram

The ParGram effort provided the basis and the inspiration for the overall project of devising a crosslinguistically and computationally viable system for calculating tense/aspect. The ParGram effort dates back to 1996, with German, English and French constituting the original grammars (Butt et al., 2002, 1999). Over the years, grammars for a typologically rich set of languages were added within ParGram and a parallel treebank, the ParGramBank, began to be compiled (Sulger et al., 2013). ParGramBank is hosted via the INESS treebanking infrastructure (Rosén et al., 2009; Rosén et al., 2012). The languages currently covered by ParGram grammars of varying sizes are: English, French, Georgian, German, Hungarian, Indonesian, Malagasy, Norwegian, Polish, Tigrinya, Turkish, Urdu, Welsh, Wolof.[1]

[1]There are also Chinese, Korean and Japanese grammars; however, these are not currently publicly accessible.

Given that the ParGram grammars focus on modeling the morphology and syntax of a language, but that the morphology and syntax of a language does not completely determine the semantics and pragmatics of tense and aspect, the strategy adopted within ParGram was to encode the morphosyntactic information provided by the language at f-structure, but not to attempt putting this information together in any more sophisticated way (i.e., piecing together the overall information of periphrastic expressions).

"The f-structure thus now encodes exactly those distinctions which are made overtly in each of the languages without attempting to second guess a semantic analysis [...]. (Butt et al., 1999, p. 69)"

The overall goal of this strategy is to provide a morphosyntactically informed basis for further semantic processing.[2] But this semantic/pragmatic interpretation of tense and aspect categories hinges on linguistic properties that go beyond what can be inferred from the morphosyntax.

2.2 ParTMA and Temporal Semantics

As part of our larger project, we have been extending the ParGramBank with sentences taken from the testsuites constructed by Dahl (1985).[3] The crosslinguistic survey compiled by Dahl (1985) elicits sentences by providing a specific context that tests for variation in the expression of tense/aspect.

As a case in point supporting the ParGram strategy to date, consider the two sentences from Norwegian (2a) vs. Indonesian (2b) which are provided as appropriate given the context formulated in (2).[4]

(2) [Q: When you visited Peter yesterday, what did he do after you had dinner? ANSWER:]

a. Peter skrev et brev
Peter write.Past a letter
'Peter wrote a letter.'

b. Peter akan menulis se.buah surat
Peter FUT AV.write one.CL letter
'Peter wrote a letter.'

The contrast in morphosyntactic encoding of parallel semantics is obvious: (2a) uses a past tense marker while (2b) uses a future tense marker. But both roughly correspond to the English sentence 'Peter wrote a letter.', as reflected in the translation. However, the parallelism is only apparent. To understand this we have to

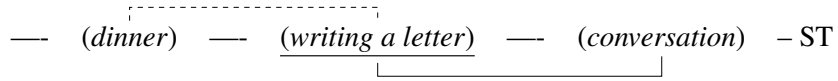
[2]Our proposal thus stands in contrast to earlier approaches which encoded semantic features related to the interpretation of tense and aspect at the level of f-structure. One such approach is Glasbey (2001), who advocates including semantic features in the syntactic lexicon.

[3]For this, we relied heavily on the ParGram grammar writers and would like to thank them again for providing both data and banked analyses to the ParTMA treebank.

[4]AV = active voice, CL = classifier, FUT = future

examine the meaning the two sentences express. Focusing on the temporal allocation of the eventuality *writing a letter*, two temporal relations are essential if one takes into consideration the question given in the conversation context. First, the relation to the speech time (ST) and second the relation between *writing a letter* and the dinner, which is already situated in the past by virtue of the temporal modifier *yesterday*.

(3) Temporal progression chart:



An analysis of the facts outlined above leads us to the conclusion that in Indonesian the relation between the dinner and the writing in the context is highlighted by the future morphology, while the relation to the time of the conversation remains implicit. On the other hand, the relation that is overtly expressed in Norwegian holds between the 'writing' eventuality and the time of the conversation. Crucially, both of the tenses here have an antecedent in the previous discourse and relate different temporal variables.

This minuscule case study of comparing just one instance of tense morphology has shown that several layers of linguistic analysis must be taken into consideration in the analysis of tense: morphosyntax, semantics and pragmatics.

2.3 Tense/Aspect Semantics in LFG

The example from Indonesian showed that we need to deal with several different types of tenses: absolute tenses, relative tenses and complex tenses. To make this point more clearly, consider what happens when the same Indonesian sentence of (2) is uttered in an out-of-the-blue-context.

In this case, the two English examples (4b)) and (4c)) represent rough paraphrases of the two readings we could get for the Indonesian sentence. Both paraphrases contain a tense (*will* and *was*, respectively) that behave deictically (i.e., referring to the speech time), but the additional future construction *going to* in (4c)) must be interpreted relative to the past shift, just as the future marker in Indonesian in (2).[5]

(4) a. Peter akan menulis se.buah surat
Peter FUT AV.write one.CL letter
b. Tom will write a letter.
c. Tom was going to write a letter.

[5]We do not claim that either of the languages has purely relative or purely deictic tenses, although the former is theoretically more appealing since deictic tenses can be interpreted as a subset of relative tenses (Comrie, 1985).

This allows English to overtly express different temporal relations that, in Indonesian, are subsumed by one syntactic marker. This is not at all uncommon but it shows us that syntactic markers have to be carefully examined from a semantic perspective to arrive at a proper understanding of the linguistic properties they represent. With this in mind, we explore the necessary mapping from syntax to semantics in more detail.

To get a clearer picture of which elements are derived from the syntax and which elements are semantically motivated, let us investigate a small semantic typology based on the observations we made so far about English and Indonesian. We implement these insights in terms of a classical extensional tense theory, where our temporal pronouns represent Klein's topic time (Klein, 1994). Thus, we provide a lambda term that picks up a temporal variable corresponding to the topic time(TT) of the sentence and tests if it fulfills the truth conditions posed by the respective tense, which are expressed in terms of a relation with an evaluation time(ET), e.g. past tense: $TT \prec ET$, future tense: $ET \prec TT$.

(5) a. $[\![past_d]\!] = \lambda P.\lambda t.t \prec t_0 \wedge P(t)$
b. $[\![future_d]\!] = \lambda P.\lambda t.t_0 \prec t \wedge P(t)$
c. $[\![future_r]\!] = \lambda t.\lambda t'.t' \prec t \wedge P(t)$

Our preliminary analysis (to be revised) consists of two completely deictic tenses, (5a) and (5b) indicated with a *d* subscript, which are obligatorily linked to the speech time and a relative tense, (5c) marked with a *r* subscript, whose $\lambda t'$ provides a slot for a contextually salient evaluation time. In other words, the first two tenses are interpreted absolutely with respect to the speech time, while the last tense is interpreted with respect to some salient variable (which could also be the speech time). [6]

Overall this first analysis allows us to cover several types of tenses: absolute tenses, relative tenses and complex tenses. An analysis with a similar spirit is, in principle, provided by Haug (2008) for glue semantics.

2.3.1 Glue semantics and Co-Description

We believe our approach goes beyond the proposals in Haug (2008) by providing a better way of combining pragmatic inferencing with the semantic interpretation of tense/aspect. In order to demonstrate this, we examine a typical glue semantics analysis in more detail.

Glue semantics generally assumes analysis via co-description (Asudeh & Toivonen, 2009; Bresnan & Kaplan, 1987). Consider for example the following lexical entry for 'slept'.

[6]The last case, the back-shifted future tense, could be modeled in terms of an iterated tense in the spirit of Klecha & Bochnak (2016) if we assume that all temporal relations are expressed by tenses. The approach essentially combines two nodes of the type $< i, t >$ and $< i, < i, t >>$ (disregarding world variables) to a node $< i, t >$ that conjoins the two $< i, t >$ elements. In this case, we would combine the relative future tense with the past tense to yield the back-shifted reading.

(6) Lexical entry for 'slept':

a. slept V
   (↑ PRED) = 'sleep'
   (↑ TENSE) = PAST
   (↑ SUBJ) = $\uparrow_\sigma$ ARG

b. i. $\lambda x.\lambda t.\exists e.sleep(e) \wedge agent(e) = x \wedge \tau(e) = t :$
   $\uparrow_\sigma ARG \multimap (\uparrow_\sigma TT) \multimap \uparrow_\sigma$

   ii. $\lambda P.\lambda t.P(t) \wedge t \prec ET : ((\uparrow_\sigma TT) \multimap \uparrow_\sigma) \multimap (\uparrow_\sigma TT) \multimap \uparrow_\sigma$

The co-descriptive lexical entry in (6) consists of two parts: 1) The 'syntactic part' that provides the properties necessary for building the c- and f-structure; 2) the 'semantic part' that consists of two glue formulae ((6b-i) and (6b-ii)), which can be composed into a constructor for the lexical entry 'slept'. A glue formula comprises a semantic representation on the left and a linear logic representation on the right. This guides the compositional process. For our purposes, we only need to understand the process of functional application, i.e., the substitution of variables by appropriate arguments. In linear logic this roughly corresponds to the linear implication rule $A, A \multimap B \vdash B$, which says that we can generate a resource *B* from the rule $A \multimap B$ if a resource *A* is available. In this case *A* corresponds to a element of the appropriate type and B is the corresponding result of the functional application.

The glue formula in (6b-i) serves to combine the verb 'slept' with its thematic arguments (the meaning corresponding to the subject $(\uparrow_\sigma ARG)$) and (6b-ii) is our constructor for past tense which picks up a resource of the shape $((\uparrow_\sigma TT) \multimap \uparrow_\sigma)$ and returns a resource with the same compositional properties, whose event run time, i.e. the duration of the event $(\tau(e))$, is set equal to a time interval that is restricted to the past.[7] This means that we can create a temporally restricted predicate after we have combined it with its thematic arguments, since the resulting semantic element is of the form $(\uparrow_\sigma TT) \multimap \uparrow_\sigma$, which corresponds to the premise of the linear implication $A \multimap B$ on the glue side of (6b-ii). As a result we are provided with a tensed predicate with an open lambda slot for the topic time.[8] Technically speaking, the proof is unfinished at this point with the premise: $\lambda t.P(t) \wedge t \prec ET : (\uparrow_\sigma TT) \multimap \uparrow_\sigma$.

One strategy to complete the proof is to apply an existential closure operator that is syntactically introduced by the clause-type feature: $\lambda P.\exists t[P(t)] : (\uparrow_\sigma TT) \multimap \uparrow_\sigma$. Another strategy is to let pragmatics introduce a temporal variable that is compatible with the proposition. The fact that there are multiple solutions to the problem at hand, especially with regard to pragmatic reasoning about time intervals, shows that there is more work to be done in terms of finding a constrained and principled approach towards calculating tense and aspect.

[7] The syntactic subject is projected onto a semantic argument role at the semantic structure.

[8] We simplified the approach in this case for illustrative purposes. For details see Haug (2008)

2.3.2 A Computational Approach via Description by Analysis

An alternative to the co-description approach is one generally referred to as "description by analysis" (Halvorsen & Kaplan, 1988), by which a semantic analysis is arrived at on the basis of information provided by another level of representation. For semantics, this is generally taken to be the f-structure.

The description by analysis approach tends to be the one chosen by computational applications, since it allows an abstraction away from the underlying morphosyntax and also frees the system from following strict compositionality as determined by the phrase structure analysis. Instead, a f-structural information must be placed in correspondence with semantic information, leading to the formulation of a syntax/semantics interface. This can in turn be supported by external by lexical semantic resources such as WordNet or VerbNet (Bobrow et al., 2007; Crouch & King, 2006). The benefit of this approach is that we can more easily deal with the polysemy of certain morphosyntactic constraints, as discussed below. This is therefore the approach that we adopt in our proposal.

As an example, consider polysemy in the category of tense in English with respect to two types of examples: 1) counterfactuals (7a); 2) the sequence-of-tense phenomenon (7b).

(7) a. I wish I **had** a car.
b. John said that Mary **was** sick.

The two tenses highlighted in the examples above are uses of the past tense morphology that do not strictly correspond to the expected semantics, namely, temporal anteriority. Note that both of them occur in a embedded context. Intuitively, this means the meaning of the past tense morpheme in English shifts its meaning according to the context it occurs in: the context is a combination of syntactic and semantic properties. For example, the meaning shift in (7a) from past to non-past & counterfactuality could be a result of the embedding under a bouletic modal, i.e. in contexts where desires are expressed (von Fintel, 2006).

Example (7b) illustrates the sequence-of-tense (SOT) phenomenon, which typically occurs when a propositional attitude verb inflected with past morphology governs a verbal predicate, often a stative, that is also inflected for past morphology.[9] The predicate in question then expresses tenselessness with regard to the matrix predicate. However, there seems to be some sort of temporal constraint imposed by the subjective now (the time that the attitude holder believes to correspond to the *now*) in the epistemic context of the modal component of the propositional attitude verb. In other words, the semantics of the matrix predicate – coincidentally again a modal component – affect the temporal interpretation of the embedded predicate (Abusch, 1997). More specifically, the epistemic now of the worlds over

[9] See Kusumoto (1999) for a discussion of the 'stative' requirement of embedded predicates. In our eyes, the arguments are a bit shaky, thus in this paper we assume that, typically, only statives can express the SOT phenomenon. Some accounts describing the SOT phenomenon hinge on this assumption (see Altshuler & Schwarzschild (2012)).

which the modal quantifies, the doxastic alternatives, is an upper constraint for the temporal variable that the past tense of the embedded predicate adheres to. Thus, SOT expresses a simultaneous reading with regard to the matrix event in addition to a back-shifted reading where the embedded tense shifts back the event's topic time relative to the epistemic now, which corresponds roughly to the topic time of the embedded event. The sentence in (7b) can thus be understood as having two readings as a result of deleting or weakening the embedded past tense.

In conclusion, both the syntactic context and semantic properties of the surrounding context affect the interpretation of tense markers, which are themselves thus inherently polysemous/underspecified. This is awkward to model in a co-descriptive approach, as it entails anticipating the various possible readings within the lexicon and/or the morphology. Under the description by analysis approach, the interpretation of tense marking can be modeled more intuitively as the result of a complex interacting system of syntactic, semantic and pragmatic information.

3 Our Proposal for the Syntax-Semantics Interface

In this section we propose an eventuality structure that encodes only the temporal (and potentially modal) dimension of an event provided by a (partial) f-structure. In other words a semantic representation of f-structure nodes that introduce an event variable and thus a subset of the semantic structure employed in glue semantics.

This architecture is proposed as a direct consequence of our overall aim: to have an annotation scheme for tense and aspect that is computationally and cross-linguistically viable. Given that the morphosyntactic expression of tense/aspect varies across languages and that languages employ different semantic strategies, e.g., as we saw for English vs. Indonesian, the design decision here is to avoid problems of compositionality and instead provide an inter-operable annotation that can be read off of LFG syntactic representations in a first pass.

This in principle means that tense and aspect is treated as a mostly independent system that is connected to other semantic systems via morphisms. This plays a role, for example, when dealing with lexical aspect where there is a crucial relation between objects in the nominal and objects in the verbal domain (Krifka, 1998). Exploring these mathematical relations goes beyond the scope of this paper. Here, we focus strictly on the representation of tense and aspect categories as mappings from syntax to semantics and as semantically and pragmatically constructed meanings.

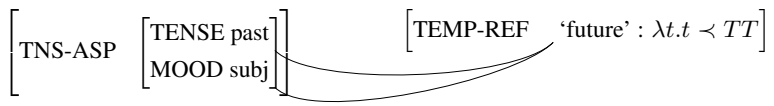
3.1 Semantics

The first step is to capture the semantic intuitions that we have worked out in section 2. The mapping principles from f-structure to an eventuality representation are encoded in terms of inference rules and represent the syntax/semantics interface. For example, assume we want to map the syntactic feature TENSE 'past' to a semantic representation of past tense. For this, we use a implication rule *TENSE*

'past' $\rightarrow$ *TEMP-REF 'past'*, as in (8). A implication rule holds as long as it is not over-written by a stronger rule. The strength of an implication rule $\alpha \rightarrow \beta$ is determined by the number of premises it has. The more premises, the stronger the rule. Thus, for a specific feature and value ϕ there might be an alternative annotation of the same feature with a different meaning ϕ' and the two variants originate from different inference rules: $\alpha \rightarrow \phi$ and $\alpha \wedge \beta \rightarrow \phi'$. In this case, the latter rule would apply since it is more specific than the former. This will be illustrated more concretely in section 4.[10]

(8) 

Consider for example the sentence: *A child was born who would be king.* The past tense of the first verbal predicate could be parsed and placed in correspondence with a semantic representation as in (8). The tense marked on the verb *would* could be represented in the syntax as in (9) (based on Abusch (1998)). However, our tense rule, then, would give us a false semantic interpretation, since it also allows for future time reference with respect to the speech time (see Dowty (1982) for discussion). Thus, we need to create a stronger rule that replaces the general tense rule with a relative future tense, as shown in (9).

(9) 

This type of rule can now be used to relate different semantics to different types of syntactic contexts, generating primary meanings.

3.2 Pragmatics

In this section, we turn to the role of pragmatics in the interpretation of tense and aspect. As pointed out by Haug (2008), pragmatic reasoning must build on our first semantics pass.

"[...] The truth-conditions which derive from the semantics cannot be overridden by pragmatic inferencing. (Haug, 2008)"

For us this means that the role of pragmatics is to restrict the available readings based on contextual inference. Consider the zero-marked Indonesian example (10).

(10) [The most recent market happened yesterday.
Q: Have you met Peter before?]

saya bertemu Peter di pasar (itu)
I MID-meet Peter at market (that)
'I met Peter at the market.'

[10]This principle is inspired by the maximize presupposition constraint presented in Heim (1991) and applied to the domain of tense, e.g., in Cable (2013).

Since there is no overt tense and aspect marking, there is no information that can be placed into correspondence with any meaningful tense value at the semantic level. All that can be concluded is that the temporal reference is unspecified, as shown in (11).

(11) $\left[\text{TNS-ASP} \quad \left[\text{MOOD indicative}\right] \quad \left[\text{TEMP-REF} \quad \text{`unspec'} : \lambda t.t\right]\right]$

In our example, it is the context which resolves the temporal location of the 'meeting' event, namely the market that took place yesterday. An essential part of resolving temporal relations is determining identity relations between eventualities.[11] There are two instances where this is important in (10). The identity relation between the 'meeting' event in the question and the 'meeting' event in the answer and the identity relation between the market in the discourse context and the market in the answer. How can we anchor the resolution of this identities in the formal system presented here?

First, let us make a very general statement: Finite verbs have a location in time. This location can be expressed as a temporal relation between the corresponding event and the evaluation or speech time. Thus, let us make a bolder claim: Tenseless finite verbs inherit a deictic tense from the context.[12] For the present purposes we accept this without argument.

Given this assumption, the question that must be resolved is how this inheritance can be modeled in our system? As shown in (11) the expressiveness of the explicit mapping from syntax to semantics is basically zero. However, in the given context, (10) has a clear meaning. We illustrate this by treating the discourse context as a conjoint set of constraints on the event variable – a representation that can in principle be modeled within Abstract Knowledge representations (Bobrow et al., 2007) or (segmented) discourse representation theory (Asher & Lascarides, 2003). For reasons of space and simplicity of exposition, we adopt this simple notion.

(12) $\{market(e) \wedge \tau(e) \subset yesterday \wedge yesterday \prec t_0\}$

(13) $\{meet(e) \wedge market(e') \wedge ag(e) = I \wedge th(e) = Peter \wedge loc(e) = loc(e') \wedge \rho(TT(e), t_0)\}$

The set of propositions in (13) represents the target sentence in (10). Both the market and the meeting are treated as an event whose share the same location. Agent and theme are self-explanatory in this case. However, the last element of the conjunct is interesting for us: ρ marks a relation variable.[13] This relation needs to be inherited from the context. For this to happen, the market in the context

[11] An observation also made by other approaches to temporal semantics, specifically TimeML (Saurí et al., 2006).

[12] Such verbs for example occur in Indonesian, where there is no overt finiteness marker on verbs. However, their syntactic context as well as their compatibility with certain finite auxiliars that are available in some syntactic constructions but not in others indicate that the Indonesian grammar possesses some sort of unmarked finiteness (Arka et al., 2013).

[13] We adopt this notion from Asher & Lascarides (2003).

and the market mentioned in the sentence have to be identical, because we then get the (trivially inferred) relation $yesterday \prec t_0$ as a possible reference for our relation variable. This process also correctly predicts that it is not specified at which instance of the market eventuality Peter is met. Thus, if there are multiple possible markets in the previous context, the variable relation could pick up any of them. However, this also means that if there is a future market mentioned in the context, it would be a possible antecedent for the relation in (13). This is not necessarily false and if we include the Question Q in (10), then the 'before' relation would constrain the possible values for ρ by virtue of the identity relation between the two instances of the event 'meet Peter' expressed in the question and the answer.

In this model, event identity is simply inferred from the syntax and semantics that is derivable from the surface structure.[14] Thus, the two market events in (12) and (13) are identical for the reason that they are expressed in a similar fashion overtly in the context and because the semantic constraints on them are not contradictory. For the present purposes we will accommodate this simple method of inferring event identity. Thus, zero-marked verbal predicates can inherit their tense features from identical antecedents in the discourse context. With this, we can define inheritance rules for the category of tense. In what follows, we have implemented entailments in terms of the $\rightarrow$ relation. We define contextual inferences, or contextual inheritance in terms of the $\circ$ relation (or compatibility relation).

(14) a. ctx($t_{TT} \prec t_0$) $\wedge$ MOOD 'indicative' $\circ$ TEMP-REF past : $t_{TT} \prec t_0$
b. ctx($t_{TT} \otimes t_0$) $\wedge$ MOOD 'indicative' $\circ$ TEMP-REF present : $t_{TT} \otimes t_0$
c. ctx($t_0 \prec t_{TT}$) $\wedge$ MOOD 'indicative' $\circ$ TEMP-REF future : $t_0 \prec t_{TT}$

The rule set in (14) states that, if we find a relation in the context, via inheritance, then the eventuality inherits that feature as its own tense feature. It is important to note that this does not mean that the zero-marked predicate expresses these semantics, but rather that the semantics are compatible with the expression, if it is warranted by the context.

If no suitable antecedent is available for the predicate, axiomatic inferences need to step in to resolve the temporal allocation of the eventuality. A simple example of such an axiom is the simplicity principle (Smith, 2006), which states:

(15) **Simplicity Principle of Interpretation**
Choose the interpretation that requires the least information added or inferred.

We are interested in inferring a temporal relation via this principle. In a language such as Indonesian, this can be difficult task. For example, in order to in-

[14] This in principle means we identify eventuality identities in the same fashion as is done with AKR semantics for question-answering systems (Bobrow et al., 2007). A commonality that is very much intended.

terpret (16), we first have to infer (via the simplicity principle) that the sentence is about a single house. In this case the VP 'build a house' is bounded (Krifka, 1998).

(16) John membangun rumah
John AV.build house
'John built a house.'

Since there is no overt aspectual marker, the simplest interpretation is a bounded one. A direct result of this is that the event cannot be about the present time, since the building event cannot possibly fit within what is perceived as *now* (Smith, 2006). Thus, the sentence can only be about the past or the future. However, the asymmetry between future and past tense makes past tense the simpler choice, since the future typically has a modal component. The result is that without any additional information we would infer that (16) is about a house building event in the past. Obviously, axiomatic interpretations of sentences are based on the semantics rather than the syntax and thus never express the primary meaning but rather an inferred secondary meaning.

3.3 Interim Summary

In this section we have seen a modeling of pragmatically inferred features, which, unsurprisingly, heavily depends on event identity. In cases, where contextual inferences fail to provide semantic features, axioms have to be stipulated that provide us with a suitable semantic interpretation. In this section we used the axioms assumed by Smith (2006).

Overall, we have devised a principled way of providing a syntax/semantics mapping for tense and aspect categories. Two main stages of semantic interpretation were illustrated: 1) primary meaning, i.e. a direct mapping from syntax to semantics; 2) pragmatic inferencing of semantic features through inheritance from earlier instances of the same situation in the context and the axiomatic modeling of pragmatic constraints.

4 Tense and Aspect and linguistic variation

In the previous section we proposed a basic system to describe different tense and aspect categories. In this section we look at more types of linguistic variation to illustrate how the system deals with more complex semantic phenomena across languages.

4.1 Parallel Alignment via INESS

For the exploration of linguistic variation and parallelism we rely on a mechanism that is provided by the INESS infrastructure: the cross-linguistic alignment system for parallel treebanks Rosén et al. (2009). This allows for phrase alignment

between LFG representations of parallel treebanks and, thus, provides an effective way of exploring cross-linguistic variation. The alignment tool allows us to mark alignments between cross-linguistically parallel phrases. The corresponding elements of the linguistic representations need to be syntactically compatible which means that there should be no contradictory constraints in the aligned f-structures. We carry this approach over to f-structure analysis to capture syntactic variation.

(17)
$$\left[\begin{array}{l} \text{OBJ} \left[\begin{array}{l} \text{PRED 'brev'} \\ \text{GEND} \quad \left[\text{FEM} -, \text{MASC} -, \text{NEUT} +\right] \\ \text{NTYPE} \quad \left[\begin{array}{l} \text{NSEM} \quad \left[\text{COMMON count}\right] \\ \text{NSYN common} \end{array}\right] \\ \text{SPEC} \quad \left[\text{DET} \left[\begin{array}{l} \text{PRED 'en'} \\ \text{DET-TYPE article} \end{array}\right]\right] \\ \text{CASE obl, DEF} -, \text{DEF-MORPH} -, \\ \text{NUM sg, PERS 3, REF} + \end{array}\right] \\ \qquad \left[\begin{array}{l} \text{OBJ} \left[\begin{array}{l} \text{PRED 'surat'} \\ \text{NTYPE} \quad \left[\begin{array}{l} \text{NSEM} \quad \left[\text{COMMON count}\right] \\ \text{NSYN common} \end{array}\right] \\ \text{PERS 3, TRANS letter} \end{array}\right] \end{array}\right] \end{array}\right]$$

Example (17) illustrates a set of parallel f-structures – NPs at c-structure – describing the object 'a letter' of our recurring example (2). Despite the clear difference in complexity between the two partial f-structure they can be aligned, since none of the features that occur in the two structures contradict one another. However, we aim for a deeper level of alignment between linguistic structures.

In our project we rely on ParGram grammar analyses compiled on the basis of the Dahl's (1985) testsuites. This parallel treebank is publicly available via the INESS treebanking infrastructure as ParTMA.[15] It includes data aligned from English, Georgian, German, Greek, Hungarian, Indonesian, Italian, Norwegian, Polish and Urdu.

4.2 Syntactic variation

There are various types of cross-linguistic variation beyond the purely morphosyntactic variation already discussed. By representing tense and aspect categories as mappings from syntax to semantics we get a clearer picture of cross-linguistic variation. For this purpose let us contrast our Norwegian dinner example with the corresponding sentence in German, as shown in (18). In the German (18b), the perfect is semantically parallel to the Norwegian past tense. In fact, in many instances the meaning of the German present perfect and the German past are indistinguishable

[15] http://clarino.uib.no/iness

(Musan, 2002). However, this does not follow straightforwardly from the morphosyntactic cues.

(18) [Q: When you visited Peter yesterday, what did he do after you had dinner? ANSWER:]

a. Peter skrev et brev
Peter write.Past a letter

b. Peter hat einen Brief geschrieben
Peter have.Pres a letter write.PPart

As can be seen, the two partial aligned f-structures that correspond to the German present perfect and the Norwegian past, respectively, contradict one another in two instances: the TENSE and the PERF features. Still, both of these f-structures can be mapped onto the same semantics, as shown below.[16]

(19)
$$\begin{bmatrix} \text{TNS-ASP} & \begin{bmatrix} \textbf{TENSE present} \\ \textbf{PERF +} \\ \text{MOOD indicative} \end{bmatrix} \end{bmatrix} \qquad \begin{bmatrix} \text{TNS-ASP} & \begin{bmatrix} \textbf{TENSE past} \\ \textbf{PERF} - \\ \text{MOOD indicative} \end{bmatrix} \end{bmatrix}$$

(20)
$$\begin{bmatrix} \text{TNS-ASP} & \begin{bmatrix} \text{TENSE pres} \\ \text{PERF +} \\ \text{MOOD indicative} \end{bmatrix} \end{bmatrix} \qquad \begin{bmatrix} \text{TEMP-REF} & \text{`past'} : TT \prec ET \end{bmatrix}$$
$$\begin{bmatrix} \text{TNS-ASP} & \begin{bmatrix} \text{TENSE past} \\ \text{PERF} - \\ \text{MOOD indicative} \end{bmatrix} \end{bmatrix}$$

Thus, the sentences are semantically alignable despite their syntactic difference, at least in the present context. This analysis begs the question of how to treat the third sentence that we have discussed in the same context.

(21) a. Peter akan menulis se.buah surat
Peter FUT AV.write one.CL letter
'Peter wrote a letter.'

b.
$$\begin{bmatrix} \text{TNS-ASP} & \begin{bmatrix} \text{TENSE future} \\ \text{MOOD indicative} \end{bmatrix} \end{bmatrix} \qquad \begin{bmatrix} \text{TEMP-REF} & \text{`future'} : \lambda t.t \prec TT \end{bmatrix}$$

The example in (21a) differs morphosyntactically and semantically from the corresponding German, Norwegian and English. Nonetheless, it is used to describe the same situation. In other words, all four variants can pick up the same event

[16]This effect does not mean that the two syntactic constructions are identical in the semantics they select. However, delving into the details of this topic goes beyond the scope of this paper. For an overview see Musan (2002).

variable, but they express different properties of the situation it occurs in. Thus, there is a parallel between the languages at a pragmatic level. (22) illustrates the desired meaning of our example (recall the temporal progression chart in Section 2.2).

(22) $\{letter(y) \wedge write(e) \wedge ag(e) = P \wedge theme(e) = y \wedge dinner(e') \wedge TT \prec t_0 \wedge \tau(e') \prec e \wedge e, e' \subset yesterday\}$

We have previously established that temporal relations are an integral part of the anaphoric nature of tenses, to the point that temporal relations in the discourse context can be picked up by temporal markers. The situation described by (22) is compatible with all of the three examples discussed so far. However, German and Norwegian overtly encode the relation $TT \prec t_0$, while Indonesian encodes the relation $\tau(e') \prec e'$.

In Kamp & Reyle (1993) another type of temporal relation is addressed: The relation of two topic times in subsequent sentences. The current topic time is related to the previous topic time by a presuppositional relation. It is, thus, important to note that the difference between sentences that express the future relation in (22) and sentences that express the absolute past relation in (22) may differ in the topic time they make available to the further discourse. This becomes more apparent if we look at the corresponding English sentences.

(23) a. John wrote a letter.
b. John was going to write a letter.

In (23a) the interpretation is such that the writing event took place, even if we squeeze in an additional event in between, as in *John wrote a letter. However, before that he took a shower.* On the other hand, in example (23b), it is not necessarily the case that the 'write a letter' event takes place and thus intuitively and by virtue of its grammatical form (non-finite) it does not seem to provide a topic time. Instead, the sentence implies that the topic time is still whatever *was* is picking up as temporal variable. There are various approaches to analyzing this, but the gist is, that there seems to be a modal operator, for example, a plan operator involved in these examples (Copley, 2009). However, from a purely temporal perspective, the difference falls out if we assume that the future marker in Indonesian and the *going to* construction in English are realizations of prospective aspect.

(24) a. $[\![past]\!] = \lambda P.\lambda t_{TT}.t_{TT} \prec t_0 \wedge P(t)$
b. $[\![prosp]\!] = \lambda P.\lambda t.\exists e[t \prec \tau(e) \wedge P(e)]$
c. $[\![prv]\!] = \lambda P.\lambda t.\exists e[t \supset \tau(e) \wedge P(e)]$

Under this assumption, there is a glaring difference between three languages with regard to how our dinner example is treated. While all three of them are still compatible with (22), only the presuppositional link inferred from the English past tense moves the topic time forward, while the overtly expressed prospective aspect

only moves the run-time of the event, but not the topic time forward. This corresponds nicely to the role of aspect to manage the relations between topic times in successive sentences that has been pointed out throughout the literature (Asher & Lascarides (2003); Comrie (1985); Kamp & Reyle (1993); Klein (1994); Smith (2006), just to name a few). The sentence *John wrote a letter.* would then be a combination of past tense and perfective aspect. The perfective aspect would shift the topic time to a point after dinner and simultaneously the run-time would be shifted to be contained within that topic time.

To summarize, our first observation was that syntactically contradictory representations can still be mapped onto the same meaning, although several complex semantic and pragmatic factors play a role. We have also seen that variation of both the syntax and the semantics leads to differences in terms of the interpretation of a sentence at the discourse level, although we only sketched a potential analysis of this type of variation. In the next section we focus on semantic variation.

4.3 Semantic variation

Semantic variation has already been addressed in this paper in terms of the distinction between deictic tenses, relative tenses and grammatical aspect. All of these have proven to be, in some instances, superficially similar but differing in the details. We illustrate this in terms of a semantic phenomenon that we have brought up before: sequence-of-tense.

The SOT phenomenon is a case of polysemy of morphological markers that introduce a semantic past. The effect is illustrated in the example below: The embedded predicate 'be-sick' can either be interpreted as simultaneous to the matrix event 'say' or in the past relative to it.

(25) Tom said that Karen was sick.
   a. Tom said: Karen is sick.
   b. Tom said: Karen was sick.

In the present framework we can devise a rule that captures these facts straightforwardly. For readability we have dissected the rule into various parts in (26). COMP refers to the fact that *E2* is embedded in a complement of *E1*.

(26) Let *E1* and *E2* be events constrained by syntax and semantics, then the following constraints have to hold:
   a. $COMP(E1, E2) \wedge PAST(E1) \wedge PAST(E2)$
   b. *E1* is a propositional attitude verb
   c. *E2* is a stative verb
   d. *E1* and *E2* are semantically or pragmatically past

The constraints in (26) expresses the minimal syntactic requirements, while b) through d) express the semantic/pragmatic requirements. If these requirements are met, the embedded semantic past is weakened to a relative tense picking up

the topic time of the matrix event and the embedded event expressing non-future. The non-future value can be resolved to either simultaneity or anteriority by pragmatic inferences. These semantics are also compatible with explicit restriction of the involved temporal variables via temporal modifiers.

However, we note at this point that the SOT phenomenon is not crosslinguistically robust (Grønn & von Stechow, 2010; Kusumoto, 1999, 2005). This means that the constraints devised in (26) as well as all the other rules are language specific. However, by describing tense and aspect categories in terms of correspondences between syntax and semantics, the substantial differences between the languages can be pin-pointed, rather than being led astray by superficial parallelism. For a more extensive discussion on this subject, see Zymla (2017).

5 Conclusion

In this paper we introduced a principled way of describing the interpretation of tense and aspect categories from syntax to semantics all the way to the pragmatic level. In order to achieve this, we employed a representation that displays linguistic categories as mappings from structure to meaning. The term structure covers morphological and syntactic information, while meaning is divided into primary meaning, i.e. directly inferable meaning and semantically constructed or pragmatically inferred secondary meaning.

We present an approach that interprets tense and aspect features as mappings from syntax to semantics, rather than as purely syntactic or semantic categories. Thus, a linguistic category can be understood as a set of rules that take as premises syntactic (and potentially semantic) features and generate (additional) semantic inferences akin to the resource-logical approaches to semantics used in LFG. A basic example of this is the explicit mapping from f-structure to semantic representation as in (27).

(27) a. $\left[\text{TNS-ASP} \left[\begin{array}{l}\text{TENSE past}\\ \text{MOOD indicative}\end{array}\right]\right] \quad \left[\text{TEMP-REF} \quad \text{`past'} : t \prec t_0\right]$

b. TENSE ‘past’ $\wedge$ MOOD ‘indicative’ $\rightarrow$ TEMP-REF ‘past’ : $t \prec t_0$

The analysis of linguistic categories as mappings from syntax to semantics allows for a straightforward comparison of the categories and their implementation as inference rules allows for various applications in NLP. Within LFG specifically, the linguistic representations can be directly mapped onto XLE transfer rules, rewrite rules that have already been used to map between syntax and semantics (Crouch, 2005; Crouch & King, 2006). Thus, the system presented here lays the foundation to generate new semantic resources for XLE grammars such as the ParGram grammars.

The syntax/semantics interface is fairly straightforward to implement and is supported by existing approaches to tense and aspect within LFG. To resolve prag-

matic inferences, we argued for a system that is heavily based around deriving identity functions between eventualities. Furthermore, we sketched possible axiomatic implementations of pragmatic information along the lines of Asher & Wada (1988) and based on the pragmatic account of temporal interpretation in Smith (2006).

Overall, the system that we advocate in this paper allows for the interpretation of covert processes in the inferential (pragmatic) and compositional (semantic) assembly of tense and aspect features across languages. This allows for a principled way of creating semantic resources for the analysis of tense and aspect within LFG, especially, with regard to the exploration of language parallelism and variation.

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