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Editors' Note

The program committee for LFG'03 were Jonas Kuhn and Tara Mohanan. We would like to thank them for putting together the program that gave rise to this collection of papers. Thanks also go to the executive committee and the reviewers, without whom the conference would not have been possible. We particularly thank George Aaron Broadwell, who did everything but take us to the local race course!

The table of contents lists all the papers presented at the conference and some that were accepted but could not be presented. Some papers were not submitted to the proceedings. For these papers, we suggest contacting the authors directly via their e-mail addresses.

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Asymmetries between Passivization and Antipassivization in the *Tarramiutut* Subdialect of Inuktitut

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Abstract

This paper investigates some of the properties of passivization, antipassivization, and two types of causatives in the *Tarramiutut* subdialect of Inuktitut, within the Role and Reference Grammar framework. Data from the use of the floated quantifier, "*atuniit*", as well as interclausal binding will be used to suggest that NPs which express arguments in constructions which, in their most canonical use, leave the argument unspecified behave as peripheral adjuncts. Since this is not the case with antipassives, undergoers in antipassive constructions behave as core arguments, rather than as peripheral adjuncts. This paper will also investigate the interaction between antipassivization and dative shift. The data will be used to argue that a "lexical intransitivization" account of antipassivization, which would claim that there is no undergoer in antipassive constructions, makes incorrect predictions. I will argue that the undergoer in antipassive constructions has a similar status to accusative undergoers in nominative/accusative languages. The strongest prediction that this paper can make is that the two types of voice alternations investigated in this paper are representative of the types of voice alternations which are available cross-linguistically. If this is true, than binding phenomena can be predicted based on the primary use of a construction.

1. Overview

This paper will present new data which will be used to argue that antipassivization has a different effect on the status of undergoers than passivization has on actors in *Tarramiutut*.[1] The arguments in this paper will be made in Role and Reference Grammar. However, it would be important to explain these asymmetries in any syntactic theory. The major claims with regard to voice alternations in Inuktitut will be that while passivization demotes the actor to the status of a peripheral adjunct, the undergoer in antipassive constructions has an equivalent status to an accusative undergoer in nominative/accusative languages.

Based on Dorais' dialectical classifications, Eastern Canadian Inuktitut is a dialect of Inuit, which is a member of the Eskimo-Aleut language family (Dorais 1990). *Tarramiutut* is a subdialect of Inuktitut spoken in Northern Quebec along the Ungava Bay. All of the sentences in this paper have been checked with Joanna Okpik, who comes from the village of Quartaq, which is within the *Tarramiutut* speaking region. In some cases, similar examples were elicited from either Annie Okpik, who is also from Quartaq, or from Elizabeth Annahatak, who is from a neighboring village, Kangirsuk. Johns (2001) has suggested that the degree to which antipassive constructions parallel accusative constructions in nominative/accusative languages may be subject to dialectical variation. Hopefully, the tests used in this paper can be applied to other dialects in the future.

[1] My thanks to Alana Johns, Aaron Broadwell, Keren Rice, Jean-Pierre Koenig, and Robert Van Valin for their comments and suggestions. I am also thankful to Joanna Okpik, Anni Okpik, and Ilisapi Annahatak for providing me with the data.

1.1 Overview of voice alternations in Inuktitut

Inuktitut is an ergative language which allows for a three-way voice contrast for transitive verbs. With intransitive verbs, the inflectional morphology agrees with the single argument, and the single argument is placed in absolutive case, as illustrated by example (1), below.

(1) Jaani itir -tuq
Jaani(ABS) enter-IND(3s)
Jaani entered.

For transitive verbs in the ergative construction, the verbal inflection agrees with both the actor and the undergoer. The actor takes ergative case, and the undergoer takes absolutive case, as in example (2).

(2) Jaani-up nanuq qukir –ta -nga
Jaani-ERG bear(ABS) shoot-IND-3sA:3sU
Jaani shot the bear.

For transitive verbs in the antipassive construction, the verbal inflection agrees with the actor only. The actor takes absolutive case, and the undergoer takes secondary case. I have chosen the label of secondary case as a neutral term, following Dorais (1990) and Johns (1996). I will argue that its function in antipassives is essentially equivalent to accusative case in nominative/accusative languages. Example (3) is the antipassive version of example (2).

(3) Jaani nanur-mik quki-i-juq
Jaani(ABS) bear-SEC shoot-AP-3s
Jaani shot a bear.

For transitive verbs in the passive construction, the verbal inflection agrees with the undergoer only. While the undergoer takes absolutive case, the actor takes dative case. As with *by*-phrases in English, the actor is often left unspecified. An example of a passive is given in (4).

(4) nanuq qukir-ta -u –laur -tuq Jaani-mut
bear(ABS) shoot-PASSPRT-be-PAST-IND(3s) John-DAT
'The bear was shot by John"

1.2 Theories about voice alternations in Inuktitut

There are three major approaches to voice alternations in the literature. In the first approach, the status of the undergoer in antipassivization is similar to the status of dative *by*-phrases in passives, but different from the status of accusative undergoers in nominative/accusative languages. These theories generally treat secondary case-marked NPs, as well as dative *by*-phrases, as obliques, which may or may not be adjuncts depending on the theory. This has been argued for in an LFG framework by Manning (1996), and by Grimshaw and Mester (1986), and in a principles and parameters approach by Johns (1996). It should be noted that, in a more recent paper, Johns has also suggested that the status of secondary case-marked NPs in antipassives varies between the dialects, and that, in the more Eastern dialects, such as Labrador Inuttut, the secondary case in antipassives is equivalent to the accusative case in the nominative/accusative languages (Johns 2001). Labrador *Inuttut* is very closely related to *Tarramiutut,* the dialect which will be investigated in this paper.

Another approach is given by Bittner(1994), and Bittner and Hale (1996). Undergoers in antipassive constructions are placed in a similar but different position to accusative undergoers in nominative/accusative languages. The difference is that, in ergative languages, the undergoer is not directly a complement to the verb, but rather a branch of a noun phrase which also contains a trace of an antipassive morpheme, which is incorporated by the verb. This larger noun phrase containing both the antipassive morpheme and the NP marked with secondary case is placed in the same position relative to the verb where accusative objects are placed in nominative/accusative languages. Their account of passivization places *by*-phrases, which, in the West Greenlandic dialect which their analysis is based on, get ablative rather than dative case, in the specifier of the verb phrase. This is the same position which is given to ergative actors in ergative constructions. Thus, neither the actor in passivization, nor the undergoer in antipassivization, are treated as structural adjuncts. While the mechanisms for case assignment given in Bittner (1994) and Bittner and Hale (1996) are too complicated to discuss in this brief literature review, it should be noted that the cases given to both *by*-phrases and undergoers in antipassives are considered to be oblique.

The third major approach to voice alternations will be referred to as the accusative approach to antipassivization. Under this approach, the status of the undergoer in antipassives is similar to that of accusative undergoers in nominative/accusative languages. Proponents of this view most likely treat passivization differently from antipassivization, since the standard views of passivization generally treat passive *by*-phrases differently from undergoers in accusative constructions. In a principles and parameters approach, several researchers have placed the undergoer in antipassives in same position that accusative undergoers are given in nominative/accusative languages. Included in this group are Bok-Bennema (1991), Manga (1996a,b), Van Geenhoven (1998, 2002), and Spreng (2001). Johns has also argued that, for the more eastern Canadian dialects of Inuit, the secondary case in antipassives should be treated as an accusative case (Johns 2001). In the minimalist framework, Bobaljik and Brannigan (2003) have placed the undergoer in antipassives in the theta position associated with objects in accusative languages. They claim that the undergoer gets oblique case morphology, however, it is unclear what their criteria are for claiming that a case is morphologically oblique. One could easily argue that this account is essentially in lines with the accusative approach to antipassivization. This general approach has been taken up in LFG by Falk (2000).

Falk's analysis of ergativity and antipassivization is very similar to the account which I intend to give for antipassivization in Role and Reference Grammar. The undergoer of a transitive verb is treated as an OBJECT in both constructions. The difference between the two constructions is related to subjecthood. Falk divides the traditional notion of subjecthood into two grammatical primitives, GF^, which he claims to be the thematically most prominent argument, and PIV, for "pivot" (The notion of "pivot" is borrowed from Foley and Van Valin (1984) and Dixon (1994)). The voice alternation between ergative voice and antipassive voice is related to which argument is equated with PIV. In the antipassive construction, GF^ is equated with PIV, whereas, in the ergative construction, object is equated with PIV.

This mechanism of voice alternation is very similar to one of the major forms of voice alternation in Role and Reference Grammar (Van Valin and LaPolla 1997). This is referred to as Privileged Syntactic Argument (PSA) Modulation voice. An analysis of antipassivization which involves PSA Modulation voice only would function as follows. The difference between ergative voice and antipassive voice is that the undergoer counts as the PSA (or pivot) in ergative voice, whereas, in antipassive voice, the actor is the PSA (or pivot).

The other major mechanism of voice alternation in Role and Reference Grammar is Argument Modulation Voice. In such a voice alternation, "non-canonical realization" is given to an argument. Argument modulation voice may, but need not, occur in conjunction with PSA Modulation Voice. There are two types of Argument Modulation Voice given in Van Valin and LaPolla (1997). The first type involves demotion of an argument to the status of a peripheral adjunct. Another type of argument modulation is referred to as "lexical intransitivization". In "lexical intransitivization", a verb fails to be assigned an actor or an undergoer, despite having two logical arguments. The argument which fails to be assigned status as either an actor or an undergoer need not be demoted to the status of a peripheral adjunct. The predictions of a lexical intransitivization account, as well as the role of undergoers in Role and Reference Grammar will be discussed in section 5.

1.3 Proposed analysis

The data in this paper will be consistent with the accusative approach to antipassivization. I intend to argue that antipassivization involves PSA modulation only. Analyses in which antipassivization involves either form of Argument Modulation Voice will be shown to make problematic predictions. This will lead to an analysis in which secondary case-marked nouns in antipassives are treated as undergoers, and they are not demoted to the status of peripheral adjuncts, as is the case with accusative undergoers in nominative/accusative languages. On the other hand, I will argue that passivization does involve argument modulation, demoting the actor to the periphery.

Two major types of evidence will be used to support these analyses of passivization and antipassivization. Section 3 will make use of a floated quantifier, *atuniit*, "each". When used as a floated quantifier, there appears to be a restriction that it cannot be construed with peripheral adjuncts. Data from passive constructions and antipassive constructions will illustrate that dative *by*-phrases in passives pattern with peripheral adjuncts, but secondary case-marked undergoers do not.

Section 4 will investigate the interaction of interclausal binding with two types of causative constructions. While antipassivized *tit*-causatives create arguments which may be antecedents for interclausal binding, *naq*-causatives create dative *by*-phrases which cannot be antecedents for interclausal binding. These phenomena will be related to a cross-linguistic tendency for binding phenomena to be sensitive to a core versus peripheral distinction as argued for by Van Valin and LaPolla (1997). They will also be used to make an argument that whether or not an argument has the status of a peripheral adjunct can be related to the use of the construction. Passive constructions and *naq*-causatives both share the feature that the argument which may be expressed with a dative NP is usually omitted, and the argument in question is interpreted as "someone, people, something, or things". I will make the claim that this property of constructions can be used to predict whether or not an NP expressing a semantic argument of the verb is treated as a peripheral adjunct.

Section 5 will investigate the possibility of a "lexical intransitivization" account for antipassives. In a lexical intransitivization account, secondary case-marked arguments would not count as undergoers. I will argue that, since the notion of undergoer is essential to explaining dative shift phenomena in Inuktitut, and dative shift does occur in antipassives, undergoers must be present in antipassive constructions.

Section 6 will be the summary. There will also be a discussion of what cross-linguistic predictions can be made if one assumes that the two types of voice alternations observed in Inuktitut are the only two types of voice alternations which are possible cross-linguistically, and that that whether or not an argument is usually left semantically unspecified can be used to predict which type of voice alternation is at work.

2. Core arguments versus peripheral adjuncts in Role and Reference Grammar

This section will review the distinction made between core arguments and peripheral adjuncts in Role and Reference Grammar, based on Van Valin and LaPolla (1997). It should be noted that the use of the term "core" in "core argument" differs from its use in LFG. In section 3, data will be presented which suggests that *atuniit*, "each" is sensitive to a core versus peripheral distinction. This test will be used to argue that, while dative actors in passives are demoted to the status of peripheral adjuncts, secondary case-marked undergoers in antipassives are treated as core arguments. Similar arguments will be made in section 4, where the interaction of interclausal binding with two types of causatives will be investigated.

For clauses in the active voice, all of the verbs semantic arguments are core arguments. Thus, all of the bracketed NPs or PPs in examples (7) to (9) represent core arguments.

(7) [I] presented [Lou] [with some flowers]
(8) [I] gave [the book] [to John]
(9) [I] talked [to Mary] [about Philip]

Applicative constructions and benefactive shift create derived core arguments, which are not actually semantic arguments of the verb. The motivation for this claim comes from the fact that applicative constructions and benefactive shift often effects the position and marking of the shifted noun phrase, and these processes often feed passivization. Thus, "Mary" in example (10) below is a derived core argument.

(10) [I] baked [Mary] [the cake]

In some cases, arguments which are semantic arguments of the verb are not core arguments. This includes arguments with a demoted status which are usually omitted. Thus, *by*-phrases in English are not core arguments. Rather, they are peripheral adjuncts.

Argument adjuncts are semantic arguments of the verbs which are introduced by a preposition which gives additional semantic information that is not specified by the verbal semantics. Both of the italicized PPs in (11) and (12) are argument adjuncts.

(11) I put the book *in the bag*.
(12) I ran *out of the house*

Peripheral adjuncts include elements which are not part of the semantic representation of the verb which have not been made into derived core arguments of applicative or benefactive shift constructions. All of the italicized PPs in (13) to (16) are peripheral adjuncts.

(13) I saw John *in the library*.
(14) I baked the cake *for Terry*.
(15) I saw Mary *after the Party*.
(16) I spoke to Craig *for five minutes*.

Verbal arguments with a demoted status which are usually left unexpressed are also considered to be peripheral adjuncts. The *by*-phrase in example (17) is a peripheral adjunct.

(17) Mary was seen *by John*.

3. Asymmetry between Passivization and Antipassivization with "each", *Atuniit*

In this section, I will argue that the quantifier, *atuniit,* "each", is sensitive to a core versus peripheral distinction. When used as a floated quantifier, there are restrictions on what nouns it may or may not be construed with. I will argue that the generalization is that *atuniit* may be construed with a plural NP if it is a core argument, when *atuniit* is placed in a position which is discontinuous from the plural NP. However, *atuniit* may not be construed with a peripheral adjunct if *atuniit* is placed in a position discontinuous from the peripheral adjunct. It should be noted, however, that, for many of the examples which I have tested, where it is not possible for *atuniit* to be construed with a peripheral adjunct, grammaticality is restored if *atuniit* is placed in a position immediately following the peripheral adjunct. The asymmetry between core arguments and peripheral adjuncts which will be the main focus of this section only applies to sentences where *atuniit* is placed in a position discontinuous from the plural noun phrase. This test will be used to illustrate that, while secondary case-marked arguments in passives pattern with core-arguments, dative NPs in passives pattern with peripheral adjuncts. This is consistent with the accusative view of antipassivization, since accusative undergoers in nominative/accusative languages are assumed to be core arguments.

3.1 Basic Pattern of Quantification with *Atuniit*

The basic pattern of quantification with *atuniit* is summarized in (18). Ergative actors may be construed with *atuniit*. Similarly, absolutive NPs may be construed with *atuniit*, whether they express the undergoer in an ergative or a passive construction, or the actor in an antipassive construction. In contrast, the dative NP in passive constructions may not be construed with *atuniit*, when *atuniit* is placed in a position discontinuous from the dative NP. However, secondary case-marked NPs in antipassives can be construed with *atuniit*, when *atuniit* is placed in a position discontinuous from the plural noun phrase.

(18)	Actor	Undergoer
ergative constructions	yes	yes
antipassive constructions	yes	yes
passive constructions	no	yes

Example (19) illustrates that *atuniit* can be construed with an ergative actor in an ergative construction when *atuniit* is used as a floated quantifier.

(19) anguti-it arnaq taku-laur-ta -ngat atuniit
man-ERG.pl woman(ABS) see-PAST-IND-3plA:3sU each
'The men each saw the woman.'

Similarly, example (20) illustrates that *atuniit* may also be construed with an absolutive undergoer in an ergative construction, when placed in a position discontinuous from the absolutive NP.

(20) arna -up anguti-it taku-laur -ta -ngit atuniit
woman-ERG man-ABS.pl see-PAST-IND-3sA:3plU each
'The woman saw each of the men.'

Turning now to antipassive constructions, example (21) illustrates that absolutive actors in antipassive constructions may be construed with *atuniit*, when *atuniit* is used as a floated quantifier.

(21) anguti-it arna -mik taku-laur -tu -it atuniit
man -ABS.pl woman-SEC see -PAST-IND-3pl each
The men each saw a woman.

Similarly, secondary case-marked undergoers in antipassive constructions may also be construed with *atuniit*, when *atuniit* is used as a floated quantifier, as illustrated by example (22).

(22) arnaq anguti-nik taku-laur -tuq atuniit
woman(ABS) man -SEC.pl see -PAST-IND(3s) each
The woman saw each of the men.

In contrast, dative NPs expressing the actor in passives may not be construed with *atuniit*, when *atuniit* is placed in a position discontinuous from the dative NP. This is illustrated by (23).

(23) arnaq   anguti-nut   taku-ja   -u -laur   -tuq   (*atuniit)
      woman(ABS) man   -DAT.pl see -PASSPRT-be-PAST-IND(3s) (*each)
      The woman was seen by (*each of) the men.

Unsurprisingly, absolutive undergoers in passives may be construed with *atuniit*, when *atuniit* is used as a floated quantifier as illustrated by the grammaticality of (24), below.

(24) anguti-it   arna   -mut   taku-ja   -u –laur   -tu   -it atuniit
     man-ABS.pl woman-DAT see-PASSPRT-be-PAST-IND-3pl each
     The men were each seen by the woman.

The data in this section have demonstrated that there is an asymmetry between passivization and antipassivization. While passivization makes it impossible for the actor to be construed with *atuniit*, antipassivization does not have the same effect on undergoers in antipassives. Data in the next two sections will be used to argue that *atuniit* is sensitive to a distinction between core arguments and peripheral adjuncts. I will conclude that dative *by*-phrases cannot be construed with *atuniit* when *atuniit* is used as a floated quantifier because the actor has been demoted to the periphery. However, antipassivization does not have a similar effect on the undergoer.

3.2 Dative Core Arguments

In RRG, dative recipients of dyadic verbs are considered to be core arguments, since they are semantic arguments of the verb. Example (25) illustrates that dative recipients can be construed with *atuniit*, when *atuniit* is placed in a position discontinuous from the plural noun phrase.

(25) qimirqua-mik   anguti-nut   aittu-i-laur-tu-nga   atuniit
      book   -SEC   man   -DAT.pl give-AP-PAST-IND-1s each
      “I gave a book to each of the men.”

3.3 Other peripheral adjuncts

Stronger evidence for claiming that *atuniit* is sensitive to a core versus peripheral distinction comes from the fact that NPs which do not express semantic arguments of the verb may not be construed with *atuniit*, when *atuniit* is used as a floated quantifier. This is illustrated by the fact that the locative expression in (26), meaning “in the libraries”, cannot be construed with *atuniit*, when *atuniit* is placed in a position discontinuous from the locative NP. Since “in the libraries” is not a semantic argument of the verb in this sentence, it is, therefore, a peripheral adjunct.

(26) qimirquaqarvi-ni Jaani taku-sima-ja-ra (*atuniit)
library-LOC.pl John see-PERF-IND-1s:3s (*each)
'I have seen John in (*each of) the libraries.'

Similarly, the dative NP in (27) expresses an instrument which is not a semantic argument of the verb in this sentence. Unsurprisingly, it cannot be construed with *atuniit*, in its use as a floated quantifier.

(27) qirmusijauti -nut nanuq taku-ja -u -laur -tuq (*atuniit)
binoculars -DAT.pl bear(ABS) see -PASSPRT-be-PAST-IND(3s) (*each)
The bear was seen with (*each of) the binoculars.

The data in this section have been used to argue that *atuniit* is sensitive to a distinction between core arguments and peripheral adjuncts. The data have also shown an asymmetry between antipassivization and passivization. While dative *by*-phrases in passives are peripheral adjuncts, NPs with secondary case in antipassives are core arguments, not peripheral adjuncts.

The difference in the status of secondary case-marked undergoers in antipassives and dative NPs in passives can be related to a difference in use. In passives, the dative NP is usually omitted. It is left semantically unspecified with a meaning "someone, people, something, or some things." Manga (1996a,b) has illustrated that it is also possible to omit the undergoer in antipassive constructions, in which case the undergoer is left semantically unspecified. However, this does not represent the canonical use of the antipassive. Manga (1996a,b) uses several tests to illustrate that there is a difference in the interpretation of the undergoer in ergative constructions and antipassive/accusative constructions. Absolutive undergoers in ergative constructions get a specific interpretation, whereas this is not a requirement for secondary case-marked NPs in antipassive constructions. Berge (1997) has pointed out that, in texts, antipassivization is most commonly used when the undergoer represents new information. This appears to be the most canonical use of the antipassive. The possibility of omitting a secondary case-marked NP is unremarkable, since any NP can be dropped in this language. The fact that the omitted argument is interpreted as "someone, something, people, or things" is related to the tendency for undergoers to be interpreted as non-specific indefinites. In contrast, omission of the actor can be argued to be the most canonical use of the passive voice. While the actor is clearly part of the semantic representation of the verb, we can claim that it is an inherent property of the passive construction that the actor is left unspecified. A general property of peripheral adjuncts is that they add information which is not generally associated with the predicate. Thus, the status of dative *by*-phrases as peripheral adjuncts stems from the fact that the most canonical use of the passive construction is with the actor unspecified.

4. Two types of causatives, *atuniit*, and interclausal binding

This section will investigate two types of causatives, *tit*, and *naq*. In *tit*-causatives, the derived verb stem can undergo an alternation between ergative and antipassive voice. In the antipassive voice, it is one of the arguments of the incorporated verb stem which is placed in secondary case. This argument is placed in absolutive case in the ergative voice. The corresponding argument is usually omitted in *naq*-causatives, though it may optionally be expressed in dative case.

Section 4.1 will illustrate that, when *tit*-causatives are antipassivized, the argument placed in secondary case may be construed with *atuniit*. Section 4.2 will illustrate that the dative argument associated with *naq*-causatives may not be construed with *atuniit*. Since the dative expression in *naq*-causatives is similar to dative *by*-phrases in passives in that it is usually omitted, and the floated quantifier test yields similar results for the two constructions, I will suggest that the dative NP is a peripheral adjunct in both constructions.

Section 4.3 will investigate interclausal binding as it interacts with these two types of causative constructions. In the interclausal binding test, *imminit*, "than self", has an antecedent which is introduced in another clause. It will not be possible to go through a complete overview of what the restrictions are on what does or does not constitute a possible antecedent for interclausal binding, since space is limited. The data presented will, however, illustrate that there is a contrast with respect to interclausal binding, as it relates to the two types of causatives which will mirror the asymmetry observed with *atuniit*. While secondary case-marked arguments associated with antipassivized *tit*-causatives can be antecedents for interclausal binding, dative *by*-phrases associated with *naq*-causative constructions cannot be.

4.1 *Tit*-causatives and *atuniit*

Example (28) is an instance of a *tit*-causative in ergative voice. In this example, *tit* has been suffixed onto the intransitive verb *aanniaq* "be sick"[2]. For simplicity, all of the examples in this section will make use of incorporated intransitive verbs. It should be noted, however, that the pattern for incorporated transitive verbs is quite similar. In this example, the single argument of the incorporated verb, *angutiit*, "men" is placed in absolutive case. Example (28) also illustrates that this absolutive NP can be construed with *atuniit*.

(28) anguti-it aannia-**ti** -laur -ta -ngit atuniit
man -ABS.pl sick -**TIT**-PAST-IND-3sA:3plU each
"It made each of the men sick"

The antipassive version of (28) is given in (29). In the antipassive, the single argument of the incorporated intransitive verb is placed in secondary case. Example (29) also illustrates that the secondary case-marked NP in constructions involving antipassivized *tit*-causatives can be construed with *atuniit*.

[2] For simplicity, all of the examples involving either *naq*-causative or *tit*-causatives in this paper will make use of incorporated intransitive verbs. For transitive verbs, in this dialect, it is the actor which undergoes the case alternations which will be addressed for *tit*-causatives and *naq*-causatives in sections 4.1 and 4.2.

(29) anguti-**nik** aannia **-tit –si** -laur -tuq atuniit
man-**SEC.pl** be.sick-**TIT**-**AP**-PAST-IND(3s) each
"It made each of the men sick"

4.2 NAQ-causatives and *atuniit*

When *naq*-causatives are formed from an intransitive stem, the single argument usually omitted, and left semantically unspecified. Typically "people" is used to express the omitted argument in the English translation. An example is given in (30).

(30) aannia –na -laur -tuq
be.sick-NAQ-PAST-IND(3s)
"It made people sick"

The argument which is usually omitted can be expressed with a dative NP, as in (31). This example also illustrates that this dative NP cannot be construed with *atuniit*, in it's use as a floated quantifier.

(31) anguti-nut aannia-na-laur-tuq (*atuniit)
man -DAT.pl be.sick-NAQ-PAST-IND(3s) (*each)
"It made (*each of) these men sick"

Because the dative NP in *naq*-causatives is generally omitted, leaving the argument in question semantically unspecified, and the floated quantifier test yields similar results for dative NPs in both *naq*-causative constructions and in passives, it seems reasonable to suggest that dative NPs in *naq*-causatives have the same status as *by*-phrases in passives. The data from *naq*-causatives supports the view that an NPs status as a peripheral adjunct is related to its use. Peripheral adjuncts add information which is not usually coded in a sentence headed by the verb which heads that sentence.

4.3 Interclausal binding

This section will show the interaction of the two types of causatives with interclausal binding. While secondary case-marked arguments in antipassivized *tit*-causatives can be antecedents for interclausal binding, dative NPs in *naq*-causatives cannot be antecedents for interclausal binding. These data will be considered additional supporting evidence for the claim that dative *by*-phrases have a different grammatical status from secondary case-marked NPs in antipassive constructions.

The main clauses in the examples in this section will be in the form given in 32, below.

(32) Jaani -mit takinirsaqalaurtuq[3]
John -ABL there.was.someone.taller
"There was someone taller than John."

In the examples of interclausal binding in this section, the ablative NP will be *imminit*, "than self", and its antecedent will be in a dependant clause. In example (33), the dependent clause is translated as "although the giant was in Iqaluit". In this sentence, *Imminit* takes *inutjuaq* "giant" as an antecedent.

(33) immi-nit [inutjuaq <u>iqalun</u>nii -galuar -su-ni] takinirsaqalaurtuq
self -ABL giant(ABS) be.in.Iqaluit-although-APP -3s there.was.someone.taller
"Although the giant$_i$ was in Iqaluit, there was someone/something taller than him$_i$/her$_i$"

Since the main point of this section is to illustrate that there is an asymmetry between *naq*-causatives and *tit*-causatives with respect to interclausal binding, it will not be necessary to give a detailed account of what can or cannot be an antecedent for interclausal binding in other constructions. Based on my fieldwork, I have found that the restrictions for interclausal binding in *Tarramiutut* are largely the same as those given for West Greenlandic by Bittner (1994)[4].

Because the examples which I have collected are morphologically complex, a staged derivation is given in (34a-d). The clause in (34d) will be the dependent clause used to test the interaction of interclausal binding and *naq*-causativization. In (34a), a third person singular indicative suffix has been added to a verb root, meaning "run", to get "he/she is running." Example (34b) differs in that *guma*, "want" has been suffixed onto "run", before the indicative suffix has been added. The resulting word means, "he/she wants to run". In (34c), *naq* has been suffixed after *guma*, "want". The word created means, "it makes people want to run". However, a dative NP has been added which expresses the single argument of the incorporated predicate, "wants to run", yielding, "it makes John want to run". In (34d), a number of additional suffixes have been added in place of the indicative morphology, resulting in a clause meaning, "although it made John want to run."

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[3] The word *takinirsaqalaurtuq*, "there was someone taller" is formed as follows. The root *taki*, "be tall" is followed suffixed with *nirsaq*, to yield "one which is taller". This is, in turn, suffixed by *qaq*, "have:, which, in this sentence, is interpreted as "there is". *Takinirsaqaq* is then suffixed with *lauq*, the past tense marker. The word is then given third person singular indicative inflection. For many of the younger speakers the standard of comparison is placed in dative case, rather than ablative case.

[4] However, that account does not address the interaction between interclausal binding and causativization. Based on the data which I have collected for *Tarramiutut*, causativization is required to show that secondary case marked arguments can be antecedents for interclausal binding. The basic restrictions on interclausal binding for clauses which do not involve causativization are as follows. The single argument of an intransitive verb, or the undergoer of a verb which has been passivized, or an actor of a verb which has not been passivized can be an antecedent for interclausal binding. Undergoers of transitive verbs cannot be antecedents for logophoric binding unless the verb has been passivized. The situation where secondary case-marked arguments can be antecedents for interclausal binding only arises in causatives, where the argument bearing secondary case is an argument of an incorporated predicate. The argument bearing secondary case must be one which would be a possible antecedent for interclausal binding if the predicate were not incorporated by a causativizing suffix.

(34) a) ulla-tuq
run-IND(3s)
"He/she is running."
b) ulla-guma-juq
run-want-IND(3s)
"He/she wants to run."
c) ulla-guma-nar-tuq Jaani-mut
run-want-NAQ-IND(3s) John-DAT
"It makes John want to run."
d) Jaani-mut ulla-guma-na -raluar -ti -lu -gu
John-DAT run-want-NAQ-although-OBV-APP-3s
"Although it made John want to run...."

In example (35), 34(d) is used as a subordinate clause, where the main clause means, "there was someone faster". While it is similar in form to example (33), where the interclausal binding test was introduced, it is ungrammatical to place *imminit*, "than self" at the beginning of this sentence.

35. (*immi-nit) [Jaani-mut ulla-guma-na -raluar-ti -lu -gu] sukannisaqalaurtuq
self -ABL [John-DAT run-want-NAQ-indeed-OBV-APP-3s] there.was.someone.faster
'Although it made John want to run, there was someone faster (*than self).'

The reason why it is ungrammatical to place *imminit* at the beginning of (35) appears to stem from the fact that there is no possible antecedent for *imminit*, since the sentence becomes grammatical if *imminit* is replaced by a proper noun with ablative case, as in (36).

36. Anni -mit [Jaani-mut ulla-guma-na -raluar -ti -lu-gu] sukannisaqalaurtuq
Anni -ABL [John-DAT run-want-NAQ-indeed-OBV-APP-3s] there.was.someone.faster
"Although it made John want to run, there was someone faster than Anni."

The next couple of examples will be used to illustrate that secondary case-marked NPs in antipassivized *tit*-causatives can be antecedents for interclausal binding. Example (37) is a subordinate clause which is minimally different from the one used in the previous two examples (35 and 36). *Naq* has been replaced by *tit*, *which* in turn has been antipassivized. As predicted, the single argument of *ullaguma*, "want to run", is placed in secondary case, rather than in dative case.

37. Jaani-mik ulla -guma-tit -si -galuar –ti -lu -gu
John -SEC run-want -cause-AP-although-OBV-APP-1s
"Although he/she/it made John want to run...."

Example (38) tests the ability for the secondary case marked argument in (37) to function as an antecedent for interclausal binding. It illustrates that coreference between *imminit* and a secondary case-marked argument associated with an antipassivized *tit*-causative is possible. This is in contrast to example (36), where it was not possible for the corresponding dative NP to be an antecedent for interclausal binding in the *naq*-causative construction.

38. immi-nit [Jaani-mik ulla-guma-tit -si -galuar –ti -lu -gu] sukannisaqalaurtuq
self -ABL John-SEC run-want -cause-AP-although-OBV-APP-3s] there.was.someone.faster
Although he/she/it made John$_i$ want to run, there was someone faster than him$_i$.

The data in this section have reconfirmed that there is a syntactic asymmetry between secondary case-marked arguments in antipassives and dative *by*-phrases in constructions where the argument in question is usually left semantically unspecified. Van Valin and LaPolla (1997) have claimed that, in many languages, there is a restriction that antecedents for anaphoric binding must be core arguments. Such a restriction is used to explain why it is not possible to have an anaphor in subject position which is bound by a *by*-phrase in languages such as English. These data are consistent with an approach which treats dative *by*-phrases in passives as peripheral adjuncts rather than core arguments, and with the claim that binding phenomena are frequently sensitive to a core versus peripheral distinction.

The data in this section have also added further support to the claim that an NP's status as a core argument versus a peripheral adjunct is related to its use, since whether a dative NP patterns with core arguments or peripheral adjuncts can be predicted. Both passives and *naq*-constructions involve dative NPs which are usually omitted, leaving the argument in question semantically unspecified, and the dative NP patterns with peripheral adjuncts in both constructions. Peripheral adjuncts allow NPs to be introduced into the syntax, which are not usually semantically specified in sentences headed by the verbal predicate. Core arguments express arguments which are usually semantically specified in sentences headed by a given verbal predicate. It appears that, given the range of constructions containing a dative NP that have been presented in sections (3) and (4), these criteria have been adequate to determine whether or not an NP patterns with peripheral adjuncts or core arguments.

In a personal communication, George Aaron Broadwell has suggested that it may be useful to investigate an analysis of the status of *by*-phrases in passives which makes reference to the discourse properties of the construction. I believe that the status of dative *by*-phrases as adjuncts can most likely be understood in these terms. The actors in these constructions, because they are usually omitted, are grammaticized, such that, in the unmarked case, they play no role in the continued discourse. In the case of the passive, when the actor is topical, either the ergative voice or the antipassive voice will be preferred, since, in both of the ergative and antipassive voices, if the NP expressing the actor is omitted, the sentence is interpreted with pronominal reference for the actor. There is little reason to use the passive in this context. Similarly, since the actor is usually omitted in passives, the passive is most likely not the unmarked voice used in situations where the actor is new information. If this is the case, than we can claim that, in the passive voice, the actor has been grammaticized to be unlikely to play an important role in the continued discourse. Similar arguments can be made for the *naq*-causative. In cases where the actor represents either old or new information, the *tit*-causative is most likely preferred.

If we claim that it is an inherent property of passives and *naq*-causatives that the actor is unlikely to play an important role in the continued discourse, then it is unsurprising that dative *by*-phrases in *naq*-causatives cannot be antecedents for interclausal binding. Within the LFG framework, Broadwell (2003) has proposed that the most promising way to account for some of the differences between two types of passives in Kaqchikel, is to have constructional templates which give pairings between argument structure, functional structure, and information structure settings. Using these constructional templates, he is able to specify both the oblique agent and the SUBJECT in one of the passive constructions as being restricted to (-new) information. This accounts for a number of syntactic restrictions associated with that construction. It may prove to be interesting to see if a similar discourse feature can be used to account for the adjunct status of dative *by*-phrases in passives and *naq*-causatives.

5. "Lexical Intransitivization" in RRG (based on (Van Valin and LaPolla 1997))

While the previous two sections have argued that, while passivization demotes the actor to the periphery, antipassivization does not, there is an other mechanism in RRG which would allow the secondary case-marked NP to be treated as a core argument, but which would treat it differently from accusative undergoers in nominative/accusative languages. This other mechanism is known as "lexical intransitivization". In "lexical intransitivization", an argument retains its status as a core argument, but fails to be assigned status as either an actor or an undergoer. Section (4.1) will be a review of the role of undergoers in Role and Reference Grammar. In section (4.2), I will argue that the interaction of antipassivization and dative shift is not captured easily in a lexical intransitivization account, and that it is preferable to claim that undergoers are present in antipassive constructions. The status of secondary case in antipassive constructions, as a case which is given to core undergoers, is analogous to the status of the accusative case in nominative/accusative languages.

5.1 Ditransitive verbs and dative shift in RRG (Van Valin and LaPolla 1997, Van Valin 2001)

In RRG, a verb may only have one actor and one undergoer. This restriction necessitates an analysis of ditransitive verbs where one of the arguments is not treated as either an actor or an undergoer. It also allows for an analysis of dative shift constructions where the alternation between shifted and unshifted forms depends on which argument is treated as the undergoer. In (39), "the book" is treated as the undergoer, whereas in (40), "John" is treated as the undergoer.

(39) I gave **the book** to John.
(40) I gave **John** the book.

This analysis has the advantage that, in some dialects, the subject of passives is restricted to undergoers. Sentence (41) is the passive of sentence (39). The undergoer has been given subject status in (41), but it has not in (39).

(41) **The book** was given to John.

Similarly, example (42) is the passive of example (40).

(42) **John** was given the book.

For many speakers, example (43) is ungrammatical. This is an alternative passive of (40), where the subject is not an undergoer.

(43) %The book was given **John**

The constructional templates for English consistently place undergoers adjacent to the verb. The case rules are as follows. Undergoers are unmarked for case. Non-undergoer recipients are marked with the preposition *to*. For "to give", themes which are not treated as undergoers are left unmarked. It should be noted that actual mechanism for status as either an actor or an undergoer in Role and Reference Grammar makes reference to an arguments position on a layered lexical conciptual structure, rather than to themeatic roles such as theme and recipient. Similarly, the case conventions for arguments which are not treated as actors and undergoers make reference to the relative position of the argument to other arguments in the layered conceptual structure. It should also be noted that Van Valin and LaPolla (1997) argue that the default realization of themes which are not treated as undergoers is with the preposition "with". It is a lexical property of the verb "give" that themes which are not treated as undergoers are not marked with a preposition.

A "lexical intransitivization" account of antipassivization would claim there is no undergoer in antipassive constructions. A phenomenon such as dative shift would be impossible in antipassive constructions, since the two constructions differ primarily with respect to which argument has been assigned status as an undergoer. Data from the next section will show that dative shift is possible in antipassive constructions. I will use this as an argument that it is preferable to claim that undergoers are present in antipassive constructions.

4.2 Interaction of Antipassivization and Dative Shift

For the verb "to give", there are four different possible case arrays for the three semantic arguments. These possibilities are outlined in table (44)[5].

(44) Options for ditransitive verbs

Voice	Agent	Theme	Recipient
a) Ergative	Erg	**Abs**	Dat/*Sec
b) Ergative	Erg	Sec	**Abs**
c) Antipassive	Abs	**Sec**	Dat
d) Antipassive	Abs	Sec	**Sec**

[5] Using the restrictions on the use of *atuniit* as a floated quantifier, the data which I have collected suggest that, for all of the possible case realizations in table (44), the agent, the theme, and the recipient all count as core arguments.

In the ergative voice, the actor gets ergative case. The either the theme or the recipient gets absolutive case. When the theme does not get absolutive case, it is placed in secondary case. When the recipient does not get absolutive case, it is placed in dative case. In antipassive constructions, the theme is placed in secondary case. The recipient may be placed in either secondary case or dative case.

According to Bittner, the case array in (44d), where both the theme and the recipient are placed in secondary case, is only considered to be grammatical by some speakers of West Greenlandic (Bittner 1994, page 87). All three of the speakers of the Tarramiutut subdialect on whom I have tested these sentences find them to be grammatical. Since the structure of the argumentation in this section will be such that one theory is preferred over the other based on the grammaticality of the case array in (44d), some of the possible analyses of dialects where 44(d) is ungrammatical will be addressed at the end of this section.

The data from ergative constructions suggest that recipients which are not treated as undergoers get dative case, and themes which are not treated as undergoers get secondary case. A lexical intransitivization account for antipassivization would claim that there is no undergoer in antipassives. Since neither the theme nor the recipient would count as an undergoer, the cases used for themes and recipients which are not treated as undergoers would be used. This would yield the case array in (44c), but it would not give an explanation for (44d), since the data from ergative constructions (44b) suggest that recipients which are not treated as undergoers cannot get secondary case.

The accusative approach to antipassivization makes a different set of predictions. In this approach, undergoers are present in antipassive constructions, as well as in ergative constructions. Since undergoers are present in antipassive voice as well as in ergative voice, the two constructions differ with respect to what case is given to the undergoer. The undergoer is given absolutive case in ergative constructions, but secondary case in antipassive constructions. The data from ergative constructions still lead to an analysis in which themes and recipients which are not treated as undergoers get secondary and dative case, respectively. Thus (44c) is the antipassive equivalent of (44a), and (44d) is the antipassive equivalent of (44b). This approach seems to be much more able to explain the possibility of (44d) in this dialect.

Examples of the case-arrays displayed in table (44) are given in examples (45) to (49). Example (45) illustrates that, in ergative voice, when the theme is given absolutive case, the recipient is placed in dative case.

(45) pattaq inummarim-mut aittu-lauq -ta -ra
ball(ABS) adult -DAT give-PAST-IND-1sA:3sU
I gave the ball to the adult.

Example (46) illustrates that it is not possible to mark the recipient with secondary case in ergative constructions where the theme gets absolutive case.

(46) *inummarim-mik pattaq aittu-lauq -ta -ra
adult -SEC ball(ABS) give-PAST-IND-1sA:3sU
‘I gave the ball to the adult.’

Example (47) illustrates that, when absolutive case is given to the recipient in ergative constructions, the theme gets secondary case.

(47) inummarik patta-mik aittu-lauq -ta -ra
adult(ABS) ball-SEC give-PAST-IND-1sA:3sU
I gave the adult a ball.

Example (48) illustrates that, in the antipassive voice, it is possible to mark the recipient with dative case, while marking the theme with secondary case.

(48) inummarim-mut aittu-i -laur -tu -nga patta-mik
adult -DAT give-AP-PAST-IND-1s ball -SEC
I gave the ball to the adult.

Example (49) illustrates that it is possible to mark both the theme and the recipient with secondary case.

(49) inummarim-mik aittu-i -laur -tu -nga patta-mik
adult -SEC give-AP-PAST-IND -1s ball -SEC
I gave the adult a ball.

The data in this section have been used to argue that it is preferable to claim that undergoers are present in antipassive constructions. This data is consistent with theories which give a similar treatment to antipassive constructions as is given for accusative constructions in nominative/accusative languages. Secondary case is a case assigned to core undergoers which have not been given a privileged status as an absolutive argument, much as accusative case is a case which is given to core arguments which have not been given a privileged status as a nominative argument.

For dialects in which it is impossible to mark both the theme and the recipient with secondary case, a lexical intransitivization account does make the correct predictions, and this is one possible analysis for these dialects. However, there is another possible reason why this construction may be ruled out for some speakers of some dialects. Van Valin (2001) has argued that a number of facts about dative shift constructions in English, some of which have been very important in the principles and parameters literature (e.g. Barss and Lasnik (1986) and Larson (1988)), can be accounted for by claiming that, when the recipient is treated as the undergoer, it must be more topical than the theme. The data which he discusses include a restriction against the recipient being indefinite while the theme is definite in shifted constructions. Similarly, there is a requirement in shifted constructions that the recipient take wide scope with respect to the theme. Since quantifier scope interactions are dealt with by focus structure in Role and Reference Grammar, Van Valin argues that this scope freezing effect must stem from a requirement that the recipient be topical with respect to the theme in shifted constructions. Van Valin (2001) also relates this to a restriction against forming WH-questions which question a recipient undergoer. Again, the restriction stems from the inability for recipient undergoers to take contrastive focus.

Berge's (1997) analysis of West Greenlandic texts demonstrated that absolutive arguments tend to be topical. Bittner (1994) and Bittner and Hale (1996) have pointed out that absolutive arguments cannot take narrow scope with respect to negation.[6] This effect is expected if there is a restriction that absolutive arguments be topical. Other authors have pointed out additional restrictions on the interpretation of absolutives. Manga (1996a,b) has provided evidence that absolutive "objects" take a specific reading. Wharram (2003) has argued that indefinite absolutives must take scope over the entire sentence, claiming that they are non-quantificational. These findings give further support that there is a grammaticalized discourse role associated with absolutives, which leads to a wide scope interpretation.

This allows for another possible explanation for why it is impossible to express both the recipient and the theme in secondary case for speakers of some dialects. Assuming that, as in English, the more marked undergoer assignment treats the recipient as the undergoer, there may also be a requirement that recipient undergoers be more topical than themes, which, in some dialects, may result in a requirement that the recipient undergoer be assigned absolutive case.

5. Summary and Predictions

Data from the use of *atuniit*, "each", as a floated quantifier, as well as from the interaction of interclausal binding with two types of causatives, has been used to argue that, while secondary case-marked NPs in antipassive constructions are core arguments, dative *by*-phrases in passives and *naq*-causatives are peripheral adjuncts. Data from dative shift constructions was used to argue that antipassivization does not involve "lexical intransitivization" in *Tarramiutut*. This leads to an analysis of secondary case as a case which is assigned to core undergoers which are not assigned absolutive case.

While these data do suggest that syntactic theory must allow for two distinct types of voice alternations, it is still possible to make a few cross-linguistic predictions. The first is that whether not the NP which expresses an argument is demoted to the periphery is related to whether or not the argument in question is usually left unspecified. The core contains the verbal or nominal predicate as well as the arguments which are usually expressed in the given construction. In constructions where an argument is usually omitted, the argument is left semantically unspecified within the core. A phrase which functions to identify such an argument is part of the periphery, since peripheral adjuncts function to give additional information which is not specified in the core. Van Valin and LaPolla have argued that binding phenomena are often sensitive to a core versus peripheral distinction, such that elements in the core may bind elements in the periphery, but not vice versa (Van Valin and LaPolla 1997, pp. 406-407). Thus, it should be possible to predict binding phenomena based on whether or not an argument is usually left semantically unspecified in a given construction.

At the end of section 4, it was argued that it is possible to claim that antipassivization does not involve "lexical intransitivization", even in dialects where it is not possible to express the recipient in secondary case in antipassive constructions, by making reference to topicality restrictions. A much stronger claim would be that lexical

[6] Based on my own fieldwork, this generalization does not extend to absolutive arguments when it is the single argument of an intransitive verb.

intransitivization does not exist as a possible type of voice alternation cross-linguistically. Voice alternations which effect the status of an actor or an undergoer, but which do not demote the actor to the periphery, would never strip the arguments in question of their status as an actor or an undergoer.

Van Valin and LaPolla have argued that, in some languages, such as German, there is a restriction that only actors or undergoers can be antecedents for binding (Van Valin and LaPolla 1997, pp. 397-400). If lexical intransitivization does not exist as a possible type of voice alternation, then binding phenomena which are sensitive to an argument's status as an actor or an undergoer should not be effected by voice constructions whose primary use is not to leave either the actor or the undergoer semantically unspecified.

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The Dutch it-cleft constructions

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Abstract

In this paper I argue that the Dutch it-cleft is in fact two constructions: one with the transitive copula and a nominal focus and the other with the intransitive copula and a non-nominal focus. The analysis of transitive clefts as copular sentences with a discontinuous topic accounts for the puzzling agreement without violating the generally assumed word order rules nor subject verb agreement.

1 Introduction [1]

Dutch it-clefts are a puzzling construction. They consist of the same basic elements as English clefts—the pronoun *het* (it), a copula, the focused phrase and a final clause—but agreement is different: if the focus is plural, then the copula is plural too, even though the subject is *het* (it) (1a). This appears to be in conflict with the otherwise strict subject verb agreement in Dutch.

Accounting for the agreement in Dutch clefts is further complicated by the fact that the argument structure of clefts depends on whether or not the focus is a pronoun: if the focus is a full noun phrase, *het* is in the preverbal subject position and the focus in the post-verbal object position (1a-1b). But if the c-focus is pronominal, then it is in subject position and *het* is in object position (1c).

A second challenge for the analysis of Dutch clefts is the difference between the sentences with a nominal focus (1a-1c) and those with a non-nominal focus (1d-1e). In the first three examples, the final clause is a relative clause, headed by either the plural/common relativizer *die* (1a-1c) or the singular neuter relativizer *dat* (1b). In the examples (1d-1e) the final clause is a complementizer clause headed by the complementizer (*dat*).[2]

(1) a. Het zijn jouw kinderen, die(pl) huilen
it are your children who(pl) cry
It is your children who cry

b. Het is jouw kind(sg_neut), dat(sg_neut) huilt
it is your(sg) child(sg_neut) who(sg_neut) cries
It is your child who cries

c. Ik ben het, die(comm) dit doet
I am it who(comm) this does
It is me who does this

d. Het was in Amsterdam, dat ik hem voor het eerst ontmoette
it was in Amsterdam that I him for the first time met
It was in Amsterdam that I first met him

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[2] The complementizer is homonymous to the neuter relativizer. We know that it is in fact the complementizer because there are no neuter nominal 'traces' in the embedded clause.

e. Het is omdat ik moe ben, dat ik thuisblijf
it is because I tired am that I home-stay
It is because I am tired that I stay at home

I will argue that the Dutch it-cleft is in fact two constructions: one with the transitive (specificational) copula and a discontinuous topic for clefting nominals and one with the intransitive (existential) copula for clefting other syntactic categories. I will account for the agreement patterns in (1) without violating the generally assumed fixed word order rules for Dutch nor subject verb agreement. In addition, I will show how both the argument structures in (1b) and in (1c) can be generated by one set of rules.

I do not discuss the status or characteristics of the complement of the transitive copula in this paper, nor do I say anything about the different types of uses of the copula (e.g. predicative, specificational, existential). I will call the complement OBJ, even though I realize that it is not a regular object, e.g. it cannot passivize. The two main characteristics of the non-subject cleft argument are that it is an NP and not (necessarily) predicative: proper names and pronouns can appear in this position. The predicative use of bare nouns (2) is ungrammatical in clefts. For a discussion on copular complements and different usages of the copula, see (Declerck, 1988; Higgins, 1976).

(2) * Het is dokter die hij worden wil
it is doctor that he become wants

Section 2 presents an analysis of transitive clefts and section 3 proceeds with an analysis of intransitive clefts. In section (4) I discuss some open ends and possible applications of the mechanism presented below to other syntactic constructions.

2 Transitive clefts

The first type of cleft has a final relative clause and a nominal focus, which is either a pronoun or a semantic NP (1a-1c). The construction has various interesting features: it appears to violate the otherwise strict subject verb agreement, the relative clause appears not to agree with its antecedent if this antecedent is a pronoun and the argument structure depends on the syntactic category of the focus.

2.1 Agreement

In Dutch, the verb agrees with the subject in number and person. Example (1c) shows that this is also the case in clefts: the nominative first person singular pronoun is in the sentence initial subject position and the verb shows first person singular agreement.

If the pronominal focus in (1c) is replaced with a semantic NP, the argument structure changes. The focused constituent is now in object position and *het* (it) is in subject position (1b). Now that *het* is the subject, we expect the copula to show third person singular agreement, but surprisingly, this is not the case: if the focus NP is plural, the copula is plural too (1a).

Note that the pronoun *het* in the cleft construction has been analyzed as the expletive pronoun (Smits, 1989). However, in clefts with a nominal focus the pronoun *het* can be replaced by the demonstrative pronoun *dat* (that) or *dit* (this), which are never expletive (3).[3] This is similar to the German cleft construction, which also allows for a demonstrative pronoun instead of the German pronoun *es* (it) (Smits, 1989).

(3) Zijn dat konijnen die daar lopen?
are that rabbits that(pl) there walk?
Are those rabbits walking over there?

Is *het* really the subject? The word order in Dutch is relatively fixed, but main clauses do allow for subject object inversion. If the plural NP in example (1a) is in fact the inverted subject and *het* is the inverted object, than the plural agreement on the verb would be in accordance with subject verb agreement. This analysis fails for multiple reasons. In the first place, inverted objects must be stressed and *het* is necessarily unstressed. Therefore, the object pronoun *het* cannot undergo inversion. Secondly, embedded clauses do not allow inversion, but in embedded clefts, *het* again appears in subject position if the focus is a NP (4a) and in object position if the focus is a pronoun (4b).

(4) a. omdat het jouw kinderen zijn, die huilen
because it your children are, that cry
because it is your children, that cry

b. omdat ik het ben, die dat doet
because I it am, who that does
because it is me who does that

Additional evidence for the subject-hood of *het* can be found in raising constructions, where the main verb functionally controls the subject of the embedded verb. If the embedded clause is a cleft, the raised subject is *het* (5) (recall that embedded clauses in Dutch are SOV and do not allow for subject object inversion).

[3] In the following, whatever I say about the agreement features of *het* (it) also applies to the pronouns *dat* (that) and *dit* (this).

(5) omdat het jouw kinderen lijken te zijn, die huilen.
because it your children seem(pl) to be that cry
because it seems to be your children, that cry.

Now that we have established that the pronoun *het* is the subject, how can we account for the agreement features of the verb? Example (5) illustrates that both the raising verb and the embedded copula show plural agreement. Following the strict subject verb agreement in Dutch, we have to conclude that *het* is plural in the examples (1a), (4a) and (5).

There is independent motivation for the existence of a plural and/or common *het/dat/dit* (it/that/this). The distribution of these pronouns is not restricted to clefts and raising constructions: they also show up in other types of copular sentences, both as personal pronouns (6-7) and resumptive pronouns (8) (example from (Rullman and Zwart, 1996)). A classic discussion in Dutch linguistics deals with the question which of the constituents is subject in sentences like (6a) (Merckens, 1961; Bos, 1961), where the word order suggests that *dat* is the subject, but subject verb agreement suggests that *schurken* (crooks) is the subject. It is possible to analyze the pronoun as the subject (in accordance with the Dutch word order rules) and account for the plural agreement on the verb if the pronoun has a plural value for NUM.

(6) a. Het/dat/dit zijn schurken.
it/that/this are crooks
They are crooks.

b. Het/dat/dit is een mooie vrouw.
it/that/this is a beautiful woman
It/that/this is a beautiful woman.

(7) a. * Het/dat/dit zijn mooi.
it/that/this are beautiful

b. Wat vind je van dit boek? Het is mooi.
what think you of this book(sg.neut) it are beautiful
What do you think of this book? It is beautiful.

c. * Wat vind je van deze auto? Het is mooi.
what think you of this car(comm) it is beautiful

(8) a. Jan en Piet, dat zijn soldaten.
John and Pete that are soldiers
John and Pete, they are soldiers.

$$
het\text{:}\ \begin{bmatrix} \textsc{pred} & \text{`PRO'} \\ \textsc{pers} & 3 \\ \textsc{num} & (\text{sg}) \\ \textsc{gen} & (\text{N}) \\ \textsc{prontype} & \text{`cop'} \end{bmatrix}
$$

Figure 1: Lexical entry for *het*

b. * Ambtenaren, dat zijn vervelend.
civil servants that are boring

The contrast between the examples (6a) and (7a) and between (8a) and (8b) illustrates that the apparently non-agreeing pronouns can only be used appropriately if an NP object is present. Note that the agreement constraints on the verb have to be constraining equations, not defining equations.

The pronoun itself does not show agreement, but subject verb agreement in example (6a) and resumptive pronoun antecedent agreement in example (8a) indicate that the value for NUMBER on the subject is in fact plural (and GENDER is common). If no nominal object is present, the pronoun *het* (it), the resumptive pronoun *dat* (that) and the demonstratives *dit* (this) and *dat* (that) are still possible, but only if they are singular and neuter (7b-7c).

This pattern can be accounted for if we assume a lexical entry for *het* as in figure 1,[4] where the pronoun has an optional singular neuter agreement value. This means that if there is a nominal object, agreement between the subject and the object of the copula can override the default agreement value of the pronouns, which is what happens in the plural examples. Since the predicative adjective does not have agreement features, there is no agreement in number or gender between the subject and the adjective: the subject cannot 'get' agreement values from the predicate. As a result, the subject can only satisfy the agreement constraints on the verb by instantiating the default value for number and person: singular neuter. This explains why the examples (7c) and (8b) are out. In addition, the pronoun is has a feature PRONTYPE with value 'cop' (copular). This feature value pair sets apart *het* (it), *dat* (that) and *dit* (this) from all other pronouns. It reflects the fact that these three pronouns form a distinct class with a specific syntactic distribution and semantics (Declerck, 1988).

[4] The parentheses around the optional features translate to the following disjunction: $(\uparrow\textsc{num}) \vee (\uparrow\textsc{num})=\text{sg}$ and $(\uparrow\textsc{gen}) \vee (\uparrow\textsc{gen})=\text{neut}$.

2.2 The relative clause

Clefts with a nominal focus have a final relative clause.[5] The relativizer appears to agree in gender with the focus: *die* for common singular nouns and plurals and *dat* for neuter singular. It would nevertheless be incorrect to state that the clefted element is the antecedent, because the embedded verb does not agree in person with the focus (1c), as it does in adjoined relative clauses (9).[6]

(9) Ik, die jou altijd steun(1sg), zal(1sg) je ook nu helpen
I who you always support(1sg) will you also now help(1sg)
I, who always support you, will also help you now

Alternatively, one could assume that the object, rather than the focus, is the antecedent. This would entail that in the pronoun cases, the antecedent is *het*. The third person agreement on the embedded verb in (1c) would thereby be explained.

Example (10) appears to be a counterexample to this analysis: the embedded verb is plural, whereas the antecedent is *het*. Similarly, the relativizer in (11) is of common gender, while the antecedent is *het*. However, with the lexical entry proposed in figure 1, these examples are no longer problematic.

(10) Wij zijn het, die dat doen
we are it that do that
It is us who do that

(11) Zij is het die hem irriteert
she(comm) is it that(comm) him irritates
She is the one that irritates him

One disadvantage of the object antecedent approach remains: since the focus is sometimes the subject and sometimes the object of the cleft sentence, the discourse function of the relative clause would vary under this analysis: the clause would be

[5] I assume an analysis of relative clauses along the lines of (Dalrymple, 2001) and (Falk, 2001): the relative clause is a headless CP with the relative pronoun in SpecCP. The fronted phrase is the TOPIC of the embedded clause and the f-structure of the relative pronoun is the value of a feature RELPRO

[6] In old-Dutch and in some bible texts one can also find first person verbs in it-clefts. I do not account for these archaic examples here.

(1) Ik ben het die uw overtredingen uitdelg om mijnentwil
I am it that your transgressions take-away(1sg) for my-wish
It is me that takes away your transgressions because that is my wish

part of the TOPIC if the focus is a pronoun (and subject), and part of the FOCUS otherwise. This makes the object antecedent approach an unattractive analysis.

The fact that it is difficult to find an antecedent for the relative clause, has led to the hypothesis that there is no antecedent and the relative clause is a free relative. Akmajian (1970) analyzed English clefts as pseudoclefts that had undergone a transformation, moving the free relative to the right edge. A closely related analysis was presented for Dutch in (van der Beek, 2001). There, the extraposed clause is analyzed as a free relative clause that is extraposed by means of independently motivated extraposition rules. The analysis of the final clause as a free relative accounts for the agreement facts: if the free relative is in fact the extraposed subject, then the plural free relative in (1a) does agree with the plural verb.

An important counterargument to free relative accounts is that the form of the relative clause is not the same as a free relative: instead of the relativizers *die* and *dat* for common and neuter antecedents, free relatives use *wie* and *wat* for free relatives refering to animate versus inanimate objects.[7] Furthermore, free relatives are always singular, with a universal or exhaustive reading, whereas the final clause of a cleft can be plural (1a).

A second problem for the free relative analysis is that extraposition of free relatives involves expletive insertion. Both the free relative and the expletive map to the same argument function, so that the requirements of both coherence and completeness are met. As we have seen, we cannot treat the pronoun *het* in clefts as the expletive pronoun. This means that *het* has a PRED feature, which would clash with the PRED of the extraposed subject under the free relative analysis.

The relative clause is not a modifier of the OBJ or FOCUS and it is not a free relative. That leaves two possible analyses: the antecedent of the final clause is either the SUBJ or TOPIC. The subject antecedent analysis was first suggested for English by (Jespersen, 1927). According to his analysis, the final clause is a relative clause that restricts the interpretation of *it*. In English, this is always both subject and topic. Jespersen developed his analysis for English and thus does not account for the Dutch agreement pattern: it does not follow from this analysis that the relativizer obligatorily has the same gender as the clefted element in Dutch nor that the verb in example (1a) should be plural. With the lexical entry for *het* presented in figure 1, the agreement pattern could be accounted for. But the Jespersen analysis has the same disadvantage as the object antecedent analysis: the discourse function of the relative clause would vary.

[7] But note that the reference grammar of Dutch (Haeseryn and others, 1997) does allow *die* and *dat* as the heads of free relatives, although the non-cleft examples are marginal. In addition, the dictionary of Dutch from 1500-1976 does list them as possible heads of free relatives ((de Vries and others, 1882-1998), column 2517-2518)

That finally brings us to the analysis I propose in this paper: the relative clause as a modifier of the topic pronoun *het*. This analysis predicts the correct NUM and GEN values if we combine it with the lexical entry for *het* discussed before. The NUM and GEN values of the pronoun unify with those of the object. The verb can now check for the appropriate values on the subject, which is either the pronominal focus or the topic pronoun *het* with the unified agreement features of the object. The agreement between the relativizer and the antecedent is also unproblematic under this analysis, because the antecedent *het* now has the same agreement features as the focus. The relative clause is always a part of TOPIC. This nicely reflects the observation that the information in the final clause of a cleft has to be given (Declerck, 1988). The next section will show how this analysis can be formalized.

2.3 Formalization

I have argued that the pronoun *het* (it) has a lexical entry with default agreement values. The transitive Dutch it-cleft consists of this pronoun, a second nominal argument—the focus—and a relative clause. The antecedent of the relative clause is the topic pronoun *het*.

The different parts of the analysis are combined in the c-structure rules in figure 2. The rules are for main clause clefts. Although the c-structure rules for subordinate clauses are different, the idea is the same: two nominal arguments and a relative clause on the right edge. It is this relative clause that carries the construction specific f-structure specifications for focus on the clefted element and the pronoun *het* with discourse function TOPIC in either subject or object position, bearing a feature ADJ that is filled by the final clause as a whole.

Like in regular relative clauses, the relative pronoun in the final clause can be embedded (12). These examples are automatically accounted for by the regular relative clause rules.

(12) Het is Jan aan wie ik denk
it is John on who I think
It is John who I am thinking of

The concept of a sentence final CP that maps to the ADJ of the non-expletive pronoun *it* is also found in Berman's analysis of extraposed argument clauses in German (Berman, 2001). An example c-structure is given in fig. 3, the corresponding f-structure in fig. 4.

The c-structure rules in figure 2 show that the transitive it-cleft is a construction, with construction specific features: the relative clause does not form a $\bar{\text{N}}$ with its

IP	⇒	DP (↑SUBJ)=↓	I’ ↑=↓	(CP) (↓TYPE)=$_c$rel (↑FOCUS) (↑TOPIC ADJ)=↓ (↑TOPIC PRONTYPE)=’cop’
I’	⇒	I ↑=↓	VP ↑=↓	
VP	⇒	DP (↑OBJ)=↓	V ↑=↓	

Figure 2: C-structure rules for nominal clefts

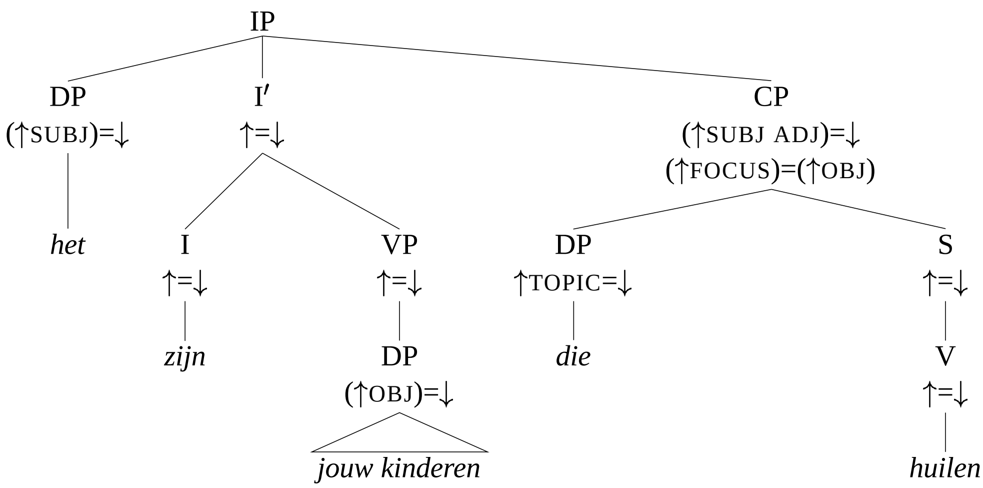

Figure 3: C-structure for (1a) *Het zijn jouw kinderen die huilen*

$$\left[\begin{array}{ll}
\mathrm{PRED} & \text{'be-equal-to}\langle(\uparrow\mathrm{SUBJ})(\uparrow\mathrm{OBJ1})\rangle\text{'} \\
\mathrm{SUBJ} & \left[\begin{array}{ll}
\mathrm{PRED} & \text{'pro'} \\
\mathrm{AGR} & \text{3pl} \\
\mathrm{ADJ} & \left\{ \left[\begin{array}{ll}
\mathrm{PRED} & \text{'cry}\langle(\uparrow\mathrm{SUBJ})\rangle\text{'} \\
\mathrm{TYPE} & \text{'rel'} \\
\mathrm{RELPRO} & \left[\begin{array}{ll} \mathrm{PRED} & \text{'pro'} \\ \mathrm{AGR} & \text{3pl} \end{array}\right] \\
\mathrm{SUBJ} & \left[\ \right]
\end{array}\right] \right.
\end{array}\right] \\
\mathrm{OBJ} & \left[\begin{array}{ll}
\mathrm{PRED} & \text{'child-of}\langle(\uparrow\mathrm{POSS})\rangle\text{'} \\
\mathrm{AGR} & \text{3pl} \\
\mathrm{POSS} & \left[\begin{array}{ll} \mathrm{PRED} & \text{'pro'} \\ \mathrm{AGR} & \text{2sg} \end{array}\right]
\end{array}\right] \\
\mathrm{FOCUS} & \left[\ \right] \\
\mathrm{TOPIC} & \left[\ \right]
\end{array}\right]$$

Figure 4: F-structure for (1a) *Het zijn jouw kinderen die huilen*

antecedent, the relative clause is obligatorily at the right edge and the TOPIC has to be of a particular pronoun type. On the other hand, we used the independently motivated c-structure rules for transitive sentences and expanded them to also cover cleft sentences. The only component that was added is the optional relative clause with the construction specific information.

The analysis leaves the fixed Dutch word order intact: the canonical subject position, filled by *het*, is associated with the grammatical subject function. At the same time, it meets the requirement of subject verb agreement: the pronoun *het* is in fact plural, since it unifies its AGR values with those of the object. This unification also predicts the observed pattern of agreement between the relativizer and the pronoun.

Agreement in number and gender between the two arguments of the copula appears to be a general but violable (13) principle. I assume some form of optimization here. Alternatively, one could formulate the following construction specific constraint on the CP in the c-structure rules: $(\uparrow\mathrm{SUBJ\ NUM})=(\uparrow\mathrm{OBJ\ NUM})$ (and a similar one for GEN). However, these would not account for gender agreement in other copular sentences such as (14).

(13) Als zij mij waren, dan zouden ze hetzelfde doen
if they me were than would they the same do
If they were me they would do the same

(14) a. Dit boek is het enige dat ik gelezen heb
this(neut) book is the(neut) only that(neut) I read have
This book is the only one that I read

b. Deze rok is de enige die me past
this(comm) skirt is the(comm) only that(comm) me fits
This skirt is the only one that fits me

The rules in figure 2 do not specify the verb to be copular. This can be achieved by constraining the complement to be of the copular-specific type. Because I did not discuss the status of the complement of the copula earlier and simply called it OBJ, I will do the same here. Alternatively, it could be specified on the final clause as a construction specific constraint.

I do not account for the distribution of the two argument structures of the transitive cleft in this paper. The rules in figure 2 generate both argument structures for both pronouns and semantic NPs. It is assumed that general constraints penalize pronouns—and in particular focused pronouns—in object position, excluding sentences like (15). This assumption is supported by the fact that the same effects can be observed in non-cleft copular sentences. In (Haeseryn and others, 1997) several non-cleft copular constructions are mentioned with their particular usage of pronouns and from this list we can conclude that pronouns are generally avoided in non-subject positions. If *both* arguments are pronominal, then the local or the stressed pronoun is in subject position. An account for one example of this phenomenon is sketched in (Coppen, 1996), but it seems possible to formulate a more general account for the distribution of pronouns in copular sentences based on a pronominal hierarchy like the one (Müller, 2002) proposes for German.

(15) a. * omdat het hem is die huilt
because it him is who cries

b. ?? omdat jouw zoon het is die huilt
because your son it is who cries

The analysis of relative clause clefts as instances of transitive copular sentences is supported by the fact that this type of cleft can be rephrased as a canonical specificational sentence, see example (1a) and the rephrase (16).

(16) Diegenen die huilen, zijn jouw kinderen
the-ones who cry are your children
Those who cry are your children

3 Intransitive clefts

So far, we have looked at it-clefts with nominals in the focus position. But not only noun phrases can be clefted: also PPs (1d), CPs (1e), AdvPs (17a) and arguably APs (17b) can appear in it-clefts.

(17) a. Het was toen pas, dat ik een vermoeden kreeg
it was then only, that I a suspicion had
It was not until then, that I became suspicious

b. ? Het is rood, dat hij zijn kamer verft
it is red that he his room paints
It's red that he paints his room

3.1 Differences between transitive and intransitive clefts

The structure of these clefts is different from the it-clefts with a nominal focus. In the first place, they have a final complementizer clause instead a relative clause. This clause is always headed by the complementizer *dat* (that). That-clauses, but not relative clauses, can function independently as an argument in Dutch.

Secondly, while the transitive cleft had a variable argument structure, this second type of cleft has only one possible word order and argument structure: the pronoun *het* (it) is always in subject position. Also, the agreement on the copula is invariantly third person singular. In contrast to the transitive cleft, this construction does not allow the pronoun *het* to be replaced by a demonstrative.

Finally, in clefts with a complementizer clause instead of a relative clause the focus may fill one of the argument functions of the embedded verb, as in example (18).

(18) Het is aan hem dat ze denkt
het is of him that she thinks
It's of him that she thinks

Because the focus is not an NP, it cannot be the OBJ of the copula. Even if we allowed as object all categories that can serve as the complement of a copula in predicative sentences, there are still examples that fall out, e.g. sentence (18) above.

An analysis along the lines of the nominal clefts would not be appropriate either, because the meaning is different. In contrast to the relative clause clefts, the complementizer clefts cannot be rephrased as canonical specificational sentences (19b), even if we transformed the that-clause into a locational free relative (19c). The best rephrase would be the simplex sentence in (19d).

(19) a. Het was in Amsterdam, dat ik hem voor het eerst ontmoette.
it was in Amsterdam that I him for the first met
It was in Amsterdam that I first met him.

b. * Dat ik hem voor het eerst ontmoette was in Amsterdam
that I him for the first met was in Amsterdam

c. * Waar ik hem voor het eerst ontmoette was in Amsterdam
where I him for the first met was in Amsterdam

d. Ik ontmoette hem voor het eerst in Amsterdam
I met him for the first in Amsterdam
I first met him in Amsterdam

So we need two distinct analyses for the two types of clefts. A similar claim has been made for English by Pinkham and Hankamer (1975). They account for the differences between nominal and non-nominal clefts in English on the basis of the dual derivation principle. This principle states that nominal clefts can be base generated, whereas non-nominal clefts have to be derived from the clause. This idea has been incorporated in more recent cleft analyses e.g. (Merchant, 1998). In contrast to the dual derivation analysis, the account presented here is non-derivational. The differences between the two types of clefts are argued to be the result of the difference in argument structure of the copula: in section 2 I argued that the relative clause cleft is a construction with the transitive (specificational) copula. In this section I will proceed to argue that the complementizer clause cleft is not based on the transitive copula, but on the intransitive (existential) copula.

3.2 The intransitive analysis

The complementizer cleft consists of the copula and three constituents: the pronoun *het*, the focus and the final clause. As noted before, the subject *het* cannot be replaced by a demonstrative or any other NP in complementizer clefts, which is the most important test for expletive subjects. It also cannot be stressed and does not support emphatic reflexives, additional tests for expletives (Postal and Pullum, 1988). Conclusion: *het* is an expletive pronoun.

The second constituent is the focus. It cannot be analyzed as the object of the copula, because it is not an NP. But if it is not OBJ, then what is it? In examples like (18), the focus is an argument of the embedded verb, which shows that the constituent is extracted from the that-clause. Extraction can also account for the other examples by mean of adjunct extraction instead of argument extraction. In other words: the focus in itself is not an argument of the matrix verb, but an extracted constituent of the complementizer clause.

The observation that the focus can be associated with an argument of the embedded verb has inspired previous analyses of the cleft construction. Transformationalists derived complementizer clefts (19a) from a canonical sentence (19d) out of which the clefted element was moved (Pinkham and Hankamer, 1975; Emonds, 1976). Pollard and Sag (1994) account for this fact in a non-transformational way. They assume a special lexical entry for *be* for clefts with on the subcategorization list *het*, an XP and a complementizer clause with that XP on slash.

The third and last constituent is the complementizer clause. It is not in a canonical argument position, but in a sentence final position for extraposed constituents. It is not the object of the transitive copula, because the transitive copula needs two referential, non-expletive arguments. This is also illustrated in (20). The example is similar to sentence (1d), but now without extraction of the focus out of the clause, so that it is a regular that-clause object. It is not only syntactically marked, but the meaning is also different from the meaning of the cleft sentence, because the pronoun is interpreted referentially instead of expletive.

(20) ? Het was dat ik hem in Amsterdam voor het eerst ontmoette
it was that I him in Amsterdam for the first met

Alternatively, I analyze the copula in the complementizer clause cleft as the intransitive copula. *Het* is in subject position and maps onto the SUBJ f-structure as dictated by the word order rules for Dutch. It does not contribute anything to the f-structure besides third person singular agreement values, because it is an expletive subject. The complementizer clause (with extraposed focus) is mapped to the same SUBJ slot. This does not lead to a clash with *het*, because it unifies with the only features of the pronoun, the AGR features. Like the expletive pronoun, the complementizer clause is always third person singular, as can be seen in sentences with CPs in canonical subject position (21).

(21) Dat we gewonnen hebben is nog niet zeker
that we have won is still not certain
It is not certain yet that we have won

This gives us a total of three c-structure nodes associated with the SUBJ f-structure slot: *het*, the complementizer clause and the clefted element, which is extracted from the CP. An example c-structure is shown in fig. 5. The corresponding f-structure is in fig. 6.

3.3 Formalization

The c-structure rules for intransitive clefts are given in figure 7. The rules also account for sentences with embedded 'gaps' in the complementizer phrase (22).

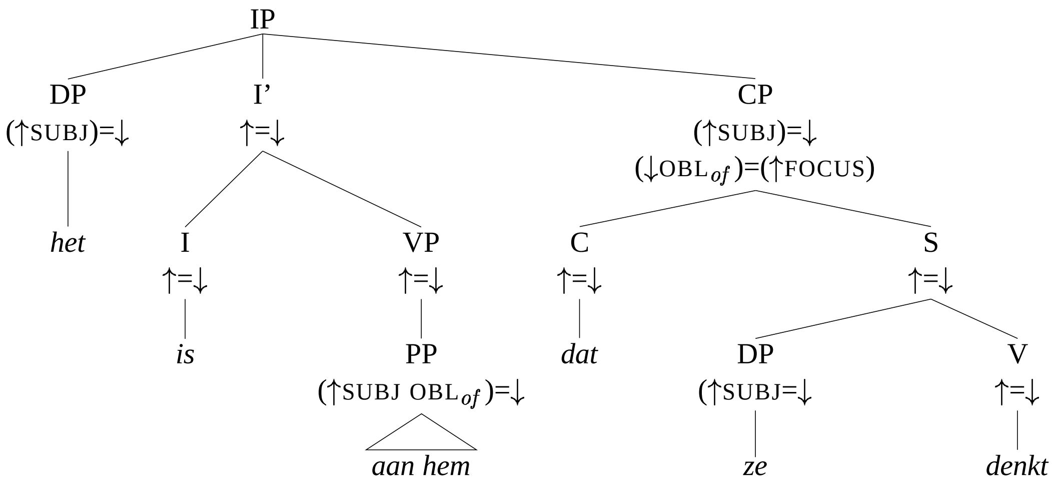

Figure 5: c-structure for 18 *Het is aan hem dat ze denkt*

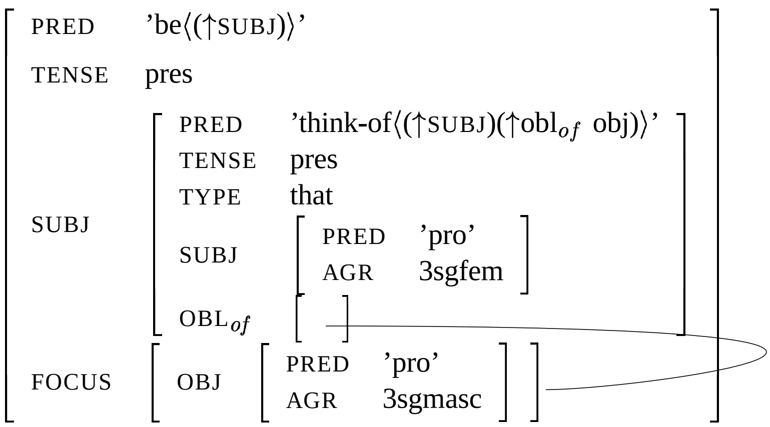

Figure 6: f-structure for 18 *Het is aan hem dat ze denkt*

The clefted element is situated in the canonical object position inside the VP. This is in contrast with analyses that assume the clefted element and the final clause to be one constituent (Merchant, 1998; Rizzi, 1997). However, this assumption does not hold for Dutch clefts, since the verb cluster obligatorily follows the clefted element (23) and thus separates the two phrases.

(22) Het was in Amsterdam dat ze hoopte hem te kunnen ontmoeten
it was in Amsterdam that she hoped him to can meet
It was in Amsterdam that she hoped she could meet him

(23) Het moet in Amsterdam geweest zijn dat ze hem ontmoette
it must in Amsterdam been be that she met him
It must have been in Amsterdam that she met him

The rules do not specify the NP in the canonical subject position. This is not necessary, because the expletive *het* is the only NP that would not lead to a clash in that position: every other NP has a PRED, which cannot possibly unify with the PRED of the complementizer clause because of functional uniqueness. I did not specify the argument function of the focus either, which means that the complementizer clause has to be instantiated to determine the syntactic function of the focus (or the coherence principle is violated).

In section 3.1 I stated that the closest rephrase of the intransitive cleft (19a) is the simplex sentence (19d). This is in line with the analysis presented in this section, which specifies the meaning of the cleft sentence to be the existential assertion of the simplex sentence (with focus on one particular constituent).

Note that the intransitive analysis would be inappropriate for the it-clefts with a relative clause, which I analyzed as transitive copular sentences, because the intransitive analysis crucially depends on the subject being expletive and I showed that this is not the case in relative clause clefts. Furthermore, the relative clause cannot independently function as an argument; it always needs an antecedent (unless it is a free relative). The two distinct analyses are furthermore motivated by the different semantics, informally illustrated by the different rephrases. The two have in common that given information is extraposed to focus new information.

4 Conclusion

I have accounted for the syntactic differences between the Dutch it-cleft with a nominal focus and those with a non-nominal focus by analyzing the first as an

$$
\begin{array}{llllll}
\text{IP} & \Rightarrow & \text{DP} & \text{I'} & \text{(CP)} \\
 & & (\uparrow\textsc{subj}){=}\downarrow & \uparrow{=}\downarrow & (\downarrow\textsc{type}){=}\text{that} \\
 & & & & (\uparrow\textsc{subj}){=}\downarrow \\
 & & & & (\downarrow\text{C}\textsc{Path}){=}(\uparrow\textsc{focus}) \\
 & & & & \\
\text{I'} & \Rightarrow & \text{I} & \text{VP} & \\
 & & \uparrow{=}\downarrow & \uparrow{=}\downarrow & \\
 & & & & \\
\text{VP} & \Rightarrow & \text{(CleftP)} & \text{(V)} & \\
 & & (\uparrow\textsc{focus}){=}\downarrow & \uparrow{=}\downarrow &
\end{array}
$$

$\text{C}\textsc{Path}{=}\textsc{xcomp}{*}\{\textsc{obl}_{\theta}|\textsc{adj}\}$
CleftP=$\{$AP,PP,CP$\}$

Figure 7: C-structure rules for non-nominal clefts

instance of the transitive copula and the second as an instance of the intransitive copula.

I argued for a lexical entry for *het* (it), *dat* (that) and *dit* (this) with optional agreement features. These account for the apparent lack of agreement in copular sentences with two NP arguments. Since the transitive cleft is an instance of such a sentence, I also accounted for the subject verb agreement pattern in this type of cleft. In addition, I accounted for the agreement on the embedded verb and agreement between the relative pronoun and the antecedent by analyzing it as a modifier of the TOPIC. This also explains the often observed givenness constraint in clefts: all the information in the clause has to be given.

In the second type of cleft, the intransitive cleft, all phrases are associated with the subject function of the copula: the focus is analyzed as an extracted constituent of the complementizer clause and both the CP and the expletive pronoun in subject position are unified with the subject function.

I did not have to stipulate construction specific lexical entries for the copula, because I expanded the existing rules for the transitive and intransitive uses of the copula with optional construction specific elements. Both types of clefts involve extraposition of given information in order to focus new information.

Two questions were left unanswered. In the first place, I did not discuss the properties of the NP complement of the copula in the transitive cleft. It is clearly different from regular objects, for example in that it cannot passivize. But is different from predicative complements too, first of all in that it doesn't have to be predicative: proper names are allowed too.

In the second place, I did not account for the fact that the two argument structures that are found in transitive clefts are in complementary distribution: one is used if the focus is pronominal and the other if the focus is a full NP. I leave these questions open for future research.

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SUBJECT AND OBJECT POSITIONS IN SWEDISH

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1. Introduction[1]

The issue of how to analyse so-called verb second languages has received a lot of attention in the recent theoretical literature. In most approaches, the analysis relies heavily on structure for the explanation of the word order phenomena. Starting with den Besten (1983), the finite verb is assumed to head a functional projection, whose specifier position provides the landing site for the sentence initial phrase. The main ideas behind this theoretical approach has been taken up not just within Chomskyan approaches, but can also be said to underlie aspects of Sells' (2001) analysis within LFG. These hierarchically based analyses contrast sharply with the flat analysis in the field approach which is commonly used in standard reference grammars of the Scandinavian languages. Its most well-known formulation can be found in Diderichsen (1946), but there are also more formal implementations of similar ideas by for instance Ahrenberg (1992).

In this paper, we will focus on the part of the clause that follows the finite verb, the so called midfield. We will argue that the flexibility in midfield word order which we find in Swedish as well as in the other Scandinavian languages is best captured by a flat structure and that the approach to c-structure formulated within Lexical Functional Grammar (Bresnan, 2001) is best equipped to capture this. The actual constituent ordering is taken care of by Optimality Theoretic constraints. We will show that the order between the elements results not just from syntactic factors, but that information structure, morphology and prosody play an important role.

2. The flexibility of Swedish clause structure

As is well-known, Swedish is a verb-second language, with the unmarked word order standardly assumed to be as in (1). Examples with subject, object and an adverbial in initial position are provided in (2) and (3). In (2), the clause contains only a lexical verb, whereas (3) also involves an auxiliary verb.

(1) SUBJECT/TOPIC/FOCUS V$_{fin}$ (SUBJECT) ADVERBIALS (REST OF) VP

(2)	a.	Eva	gav	förmodligen	inte	Oscar	några pengar.
		Eva	give.PST	probably	not	Oscar	any money
		SUBJ	V$_{fin}$	ADV	NEG	OBJ$_{ind}$	OBJ$_{dir}$
	b.	Några pengar	gav	Eva	förmodligen	inte	Oscar.
		OBJ$_{dir}$	V$_{fin}$	SUBJ	ADV	NEG	OBJ$_{ind}$
	c.	Förmodligen	gav	Eva	inte	Oscar	några pengar.
		ADV	V$_{fin}$	SUBJ	NEG	OBJ$_{ind}$	OBJ$_{dir}$

(3)	a.	Eva	har	förmodligen	inte	gett	Oscar	några pengar.
		Eva	have.PRS	probably	not	give.PPART	Oscar	any money
		SUBJ	V$_{fin}$	ADV	NEG	V$_{non\text{-}fin}$	OBJ$_{ind}$	OBJ$_{dir}$

[1] We are grateful to colleagues who attended LFG03 and who commented on our ideas either during or after the paper, especially Joan Bresnan, Ron Kaplan and K.P. Mohanan and Peter Sells. KEB also gratefully acknowledges the support of the AHRB through their Matching Leave Scheme.

b. Några pengar har Eva förmodligen inte gett Oscar.
OBJ$_{dir}$ V$_{fin}$ SUBJ ADV NEG V$_{non\text{-}fin}$ OBJ$_{ind}$

c. Förmodligen har Eva inte gett Oscar några pengar.
ADV V$_{fin}$ SUBJ NEG V$_{non\text{-}fin}$ OBJ$_{ind}$ OBJ$_{dir}$

The string between the finite verb and the elements which are usually assumed to belong to the VP is traditionally referred to as the MIDFIELD. Its right edge is standardly assumed to be marked by the position where the negative adverbial *inte* would go (Ahrenberg, 1992, Diderichsen, 1946, Heltoft, 1986, Platzack, 1985). The elements assumed to belong to the midfield are then the subject — when this is not in clause initial position — and adverbials. However, under certain circumstances an unstressed pronominal object can also occur in the midfield, this is so-called OBJECT SHIFT, it is illustrated in (4a). As (4b) and (4c) show, a stressed pronoun cannot occur in this position, but must occur after the negation.[2]

(4) a. Eva gav $_o$honom förmodligen inte några pengar.
Eva give.PST he.ACC probably not any money
SUBJ V$_{fin}$ OBJ$_{ind}$ ADV NEG OBJ$_{dir}$

b. *Eva gav «honom förmodligen inte några pengar.
Eva give.PST he.ACC probably not any money

c. Eva gav förmodligen inte «honom några pengar.
Eva give.PST probably not he.ACC any money

If the subject is also found in the midfield, a shifted weak object pronoun may precede the subject as in (5a); this is usually referred to as LONG OBJECT SHIFT (cf. Josefsson, 1992, Josefsson, 1993). As the grammaticality of (5b) shows, long object shift is optional so that the subject can also occur immediately after the finite verb.

(5) a. Då gav $_o$honom Eva förmodligen inte några pengar.
then give.PST he.ACC Eva probably not any money
ADV V$_{fin}$ OBJ$_{ind}$ SUBJ ADV NEG OBJ$_{dir}$

b. Då gav Eva $_o$honom förmodligen inte några pengar.
ADV V$_{fin}$ SUBJ OBJ$_{ind}$ ADV NEG OBJ$_{dir}$

'Then Eva probably didn't give him any money.'

A central restriction on object shift is that it cannot shift an object in front of the verb of which it is an argument. As (6) and (7) show, when the second position is filled by an auxiliary verb and the lexical verb is found lower down, within the VP, the pronoun must also occur within the VP, to the right of its selecting verb.

[2] We use $_o$ to indicate that the word which follows is unstressed, « to indicate word stress and » for emphatic stress.

(6) a.

*Eva	har	$_{o}$honom	förmodligen	inte	gett	några pengar.
Eva	have.PRS	he.ACC	probably	not	give.PPART	any money
SUBJ	V_{fin}	OBJ_{ind}	ADV	NEG	$V_{non\text{-}fin}$	OBJ_{dir}

b.

* Då	har	$_{o}$honom	Eva	förmodligen	inte	gett	några pengar.
then	have.PRS	he.ACC	Eva	probably	not	give.PPART	any money
ADV	V_{fin}	OBJ_{ind}	SUBJ	ADV	NEG	$V_{non\text{-}fin}$	OBJ_{dir}

(7) a.

Eva	har	förmodligen	inte	gett	$_{o}$honom	några pengar.
Eva	have.PRS	probably	not	give.PPART	he.ACC	any money

b.

Då	har	Eva	förmodligen	inte	gett	$_{o}$honom	några pengar.
then	have.PRS	Eva	probably	not	give.PPART	he.ACC	any money

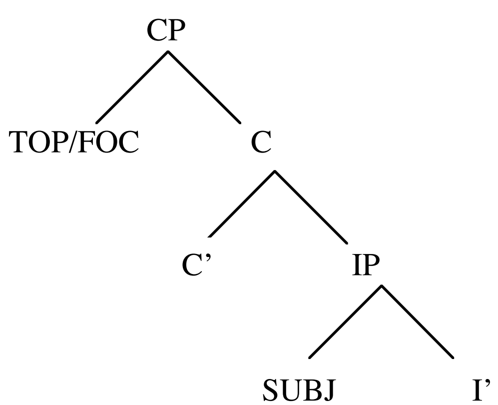
The most influential theoretical work on object shift is due to Holmberg (1986, 1999) and since his first discussion of the phenomenon, many different generative accounts have been proposed, for instance by Collins & Thráinsson (1996), Hellan & Platzack (1995), Josefsson (1992), Kaiser (1997), Sells (2001) and Vikner (1994, 1997).

Even though object shift is a well-described phenomenon, the word order in the midfield is even more flexible than noted in most theoretical approaches. Under certain circumstances we find subjects following adverbials, objects occurring between adverbials — "adverb intermingling" — and under certain specific circumstances — objects preceding the main verb. In this paper we will propose an analysis of Swedish subject and object placement which takes into account morphological, prosodic and information structural constraints. We take our point of departure from Sells (2001).

3. Sells' 2001 LFG-OT analysis of Swedish clause structure

Sells (2001) assumes the structure in (7) for Swedish clauses.

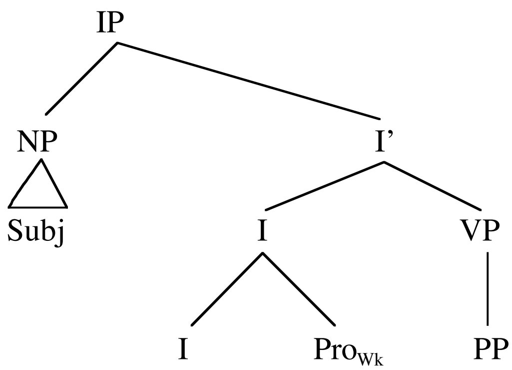
(7)



For the position of TOP/FOC and SUBJ, Sells (2001:6, 16) refers to the Structure-Function Association Principle (SFAP) (cf Bresnan 2001:102), which states that grammaticalised discourse functions (GDFs) like TOP, FOC and SUBJ occur in the specifier position of a functional category. In Sells' analysis, this constraint is not assumed to be part of GEN, but is captured as a violable constraint *GDF-in-VP. However, this constraint is sufficiently highly ranked for the subject always to occur in Spec of IP (or if it is TOP/FOC, in Spec of CP) in winning constructions.

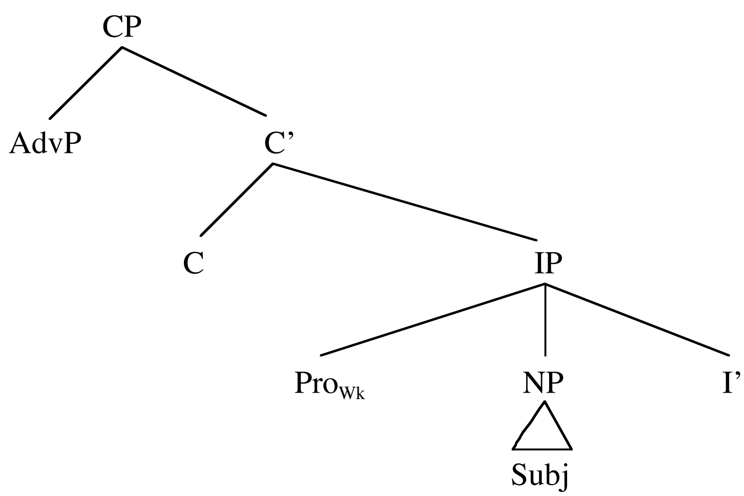
It is then also assumed that the position of Pro_{wk} can be established in relation to the position of the subject. Hence, a weak pronoun is normally found adjoined under I (8a), but when it precedes a lexical subject, as in long object shift, it is assumed to be found under IP, since the subject occupies the Spec-IP position, as illustrated in (8b).

(8) a.



(cf Sells 2001:63)

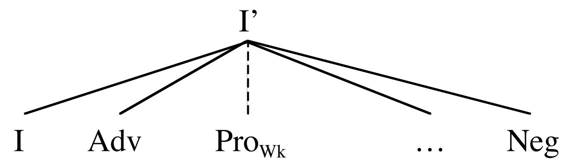
b.



(cf Sells 2001:66)

The adverbials which occur in the midfield show flexibility in ordering and in a striking departure from previous generative work, Sells (2001:56–63) argues convincingly in favour of a flat structure with a multiple branching I' for these elements, using alignment constraints to give the correct linear order. If a weak pronoun occurs between adverbials, then it is found under I', as in (9).

(9)



These rather unorthodox structures involving Pro_{wk} are generated because Pro_{wk} in Sells' approach is of a special category type, X (rather than X^o), which GEN generates in these special structural positions. When an X^o is generated in these positions, it may carry any GF (Sells 2001:117). Given these definitions, GEN drastically overgenerates and the actual distribution and linear order is determined by a family of constraints, *DOM(*element*, *node*), which puts constraint on which node can dominate elements of category X (Sells 2001:117–118). Even though Sells' analysis involves a flat I' structure, his account of the distribution of weak pronouns relies quite heavily on structure.

4. A more radical approach to the midfield

4.1 The basic constraints

Given the flexibility in the positioning of the object illustrated by (4) and (5) above, we will explore an analysis involving a flat midfield, where linear order is determined by OT constraints. The strong association between second position in the clause and the finite verb is usually assumed to result from the presence of a functional category which attracts the finite verb.[3] The specifier position of this functional category then provides the only phrase which can precede the finite verb. This idea goes back to den Besten (1983) and the list of more recent references to such work is almost endless, for Scandinavian languages see for instance Rögnvaldsson and Thráinsson (1990) Holmberg and Platzack (1995), Schwartz and Vikner (1996). Alternative explanations for the second position of the finite verb has been proposed which treat the finite verb much like a clitic (Anderson, 1993, Anderson, 1996, Kaiser, 1997). We shall follow the former line here and assume that there is a clause level functional category F' which hosts a finite verb. However, we depart from some of the previous analyses, including Sells (2001), in that we assume the existence of only one such category. In order to avoid getting caught in the debate about the roles of the two clause level functional categories I and C (see §2.2 in Sells (2001)), we refer to this functional category as F (for finite). The so-called midfield then consists of the daughters of F'. We shall provide evidence in this paper that the subject as well as non-pronominal objects can, under certain circumstances, be part of the midfield and hence should be included under F'. For a detailed discussion of the structure of GEN, we refer to Sells (2001:112–129), our assumptions about the c-structure of Swedish can be illustrated in terms of c-structure rules as in (10).[4]

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[3] We use 'attract' here in a non-technical sense, not necessarily implying movement.

[4] It should be pointed out that the structure we propose here is similar to that which Sells (2001:190–192) sketches for Icelandic.

(10) a. $\mathrm{FP} \rightarrow \underset{\uparrow=\downarrow}{\mathrm{F'}}\ ,\quad \underset{\uparrow\mathrm{GDF}=\downarrow}{\mathrm{NP}}$

b. $\mathrm{F'} \rightarrow \underset{\uparrow=\downarrow}{\mathrm{F}}\ ,\quad \underset{\uparrow\mathrm{SUBJ}=\downarrow}{\mathrm{NP}}\ ,\quad \underset{\uparrow\mathrm{OBJ}=\downarrow}{\mathrm{NP}}\ ,\quad \underset{\uparrow\mathrm{OBJ}_{\theta}=\downarrow}{\mathrm{NP}}\ ,\quad \underset{\uparrow\mathrm{ADJUNCT}=\downarrow}{\mathrm{AdvP}}\ ,\quad \underset{\uparrow=\downarrow}{\mathrm{VP}}\ \ldots$

c. $\mathrm{VP} \rightarrow \underset{\uparrow=\downarrow}{\mathrm{V}}\ ,\quad \underset{\uparrow\mathrm{OBJ}=\downarrow}{\mathrm{NP}}\ ,\quad \underset{\uparrow\mathrm{OBJ}_{\theta}=\downarrow}{\mathrm{NP}}\ ,\quad \ldots$

Within F', OT constraints predict the correct linear order between constituents. We shall assume that there are two major types of constraints.[5]

(i) T-CONSTRAINTS, which determine the typological class of the language, the major ordering between lexical heads and their arguments and between major constituents. These constraints may refer to GFs and DFs (SU<OBJ) or to information structural notions (GROUND<RHEME) and their domain is the clause nucleus.

(ii) A-CONSTRAINTS, which align certain classes of elements within a particular subtree, these constraints determine the placement of elements like for instance weak pronouns, negation and certain scope taking elements. Given that such elements may need to be aligned with respect to GFs, A-CONSTRAINTS may also involve GFs as their parameters.

Given the general ideas underpinning this approach, Lexical-Functional Grammar and its approach to X-bar structure becomes the obvious framework within which to formulate the analysis. The fact that, as will become clear, the order within F' is determined by competing constraints referring not to structure, but to functional, information structural and phonological notions argues for an OT approach. Within the constraint set, it is particular the T-CONSTRAINTS which places this as an LFG-OT analysis; the fact that these constraints refer directly to GFs and DFs means that the ideas could not easily be translated into Minimalist-OT.

Turning now to the basic constraints, we assume that the unmarked word order between grammatical relations of Swedish is due to the constraints in (11), where OBJ generalises over direct and indirect objects, which do not straight forwardly correspond to OBJ and OBJ_{θ}.

(11) SU < OBJ and $\mathrm{OBJ}_{\mathrm{IND}} < \mathrm{OBJ}_{\mathrm{DIR}}$

As the examples in (12) and (13) illustrate, these constraints hold regardless of whether the noun phrases to which the functions correspond are both weak pronouns, full pronouns or lexical noun phrases.

(12) Då såg Maria Oscar. SUBJ < OBJ
then see.PST Maria Oscar
'Then Maria saw Oscar.' NOT 'Then Oscar saw Maria.'

[5] Sells (2001:71) assumes a distinction between two types of constraints which in some ways is similar to the one we make.

(13) a. Då såg $_{o}$han $_{o}$henne inte.
then see.PST he.NOM(Pro_{wk}) she.ACC(Pro_{wk}) not
b. *Då såg $_{o}$henne $_{o}$han inte.
then see.PST she.ACC(Pro_{wk}) he.NOM(Pro_{wk}) not
'Then he didn't see her.'

(14) Oscar gav vargen grodan. $\text{OBJ}_{\text{IND}} < \text{OBJ}_{\text{DIR}}$
Oscar give.PST wolf.DEF frog.DEF
'Oscar gave the wolf the frog.' NOT 'Oscar gave the frog the wolf.'

(15) a. Oscar gav « honom « den.
Oscar give.PST 3SG.MASC.ACC 3SG
b. *Oscar gav « den « honom.
'Oscar gave it to him.'

However, if an object is a TOPIC or FOCUS, it can precede the subject as in (16a), similarly, a direct object can precede an indirect object as in (16b).

(16) a. Den filmen såg Oscar igår.
that film.DEF see.PST Oscar yesterday
'That film, Oscar saw yesterday.'

b. Stekt kyckling gav Oscar hunden ofta.
fried chicken give.PST Oscar dog.DEF often
'It was fried chicken that Oscar often gave to the dog.'

Adding a constraint relating to TOPIC and FOCUS, the constraint ranking in (17) gives us the correct basic word order for Swedish. In what follows, we will abbreviate TOP/FOC-L to TOP-L just to simplify the presentation of the rankings. Also, we shall have little to say about [$\text{OBJ}_{\text{IND}} < \text{OBJ}_{\text{DIR}}$] in what follows and often it will be omitted from rankings.

(17) TOP/FOC-L >> [$\text{OBJ}_{\text{IND}} < \text{OBJ}_{\text{DIR}}$] >> [SU<OBJ]

4.2 Object placement

In standard OT, alignment constraints formally have four parameters: ALIGN(X, L/R; Y, L/R), where X is the element and Y its domain. However, given that we are focusing here on the midfield, i.e. F', the domain in all A-constraints that we discuss will be understood to be F', so that we shall use X-L as an abbreviation for ALIGN(X, L; F', L).[6]

As illustrated by the examples (4) and (5) above, Pro_{wk} (normally) occurs on the left edge of F', immediately following the finite verb, i.e. there is a high ranked alignment constraint PRO_{WK}-L which is, however dominated by HEAD-L. As illustrated by (6) and (7), if there is an auxiliary verb, so that the lexical verb of which Pro_{wk} is a complement is found in the VP, then Pro_{wk} must follow that verb. We represent this as a constraint on verbs and their complements V < COMPL,

[6] The distinction between X and X° which plays a crucial part in Sells' analysis will not be important to us here.

but it is most likely that this is a T-constraint, hence a more general constraint on heads and their complements. V<COMPL must then dominate PRO_{WK}-L.

The data presented so far indicates that the negation always occurs on the right edge of the midfield and we assume a low ranked A-constraint NEG-L. The ranking between the three constraints we have just introduced is then clear, what is not immediately obvious, however, is how these constraints fit into the ranking we established in (17). In particular, the ranking between [SUBJ<OBJ] and PRO_{WK}-L needs to be established. The examples which contain both a non-pronoun subject and a Pro_{WK} object in the midfield are then of special interest, these are the so-called long object shift constructions. As (5) illustrates, the shift is optional in these constructions, but the one where the Pro_{WK} object precedes the subject, i.e. (5a), sounds more marked. There are presumably other factors determining when long object shift applies but until these factors have been established we adopt the constraint ranking in (18).

(18) HEAD-L >> [V < COMPL] >> [SUBJ<OBJ] | PRO_{WK}-L >> NEG-L

The examples in (19) illustrate that this ranking can account for the basic order discussed in §1, including long object shift (19b):

(19) HEAD-L >> PRO_{WK}-L

a. Eva gav $_{o}$honom inte några pengar.
   Eva give.PST he.ACC not any money

SUBJ<OBJ >> PRO_{WK}-L

b. Då gav $_{o}$honom Eva inte några pengar.
   then give.PST he.ACC Eva not any money

c. Då gav Eva $_{o}$honom inte några pengar.
   'Then Eva probably didn't give him any money.'

[V < COMPL] >> PRO_{WK}-L

d. Eva har inte gett $_{o}$honom några pengar.
   Eva have.PRS not give.PPART he.ACC any money

e. * Eva har $_{o}$honom inte gett några pengar.
   Eva have.PRS he.ACC not give.PPART any money
   'Eva hasn't given him any money.'

As a consequence of the c-structure we assume in (10) and the principle of Economy of Expression (Bresnan, 2001:91), whenever F is filled by a main verb, as in (19a,b) there is no VP node, but all elements except the initial one are part of the F' midfield. Only when the lexical verb is not in F will there be a VP. This in turn means that we cannot rely on GEN or hierarchical constraints to predict the correct order in (19a/b). Instead our alignment constraints must be able to account for the order. In particular, the position of the negation in (19a) must be accounted for if there is no VP, since the negation has been assumed to mark the left edge of the VP, or as in Sells' account, the right edge of I'. We shall assume the alignment constraints and raking in (20) to account for the order within F':

(20) SU-L >> NEG-L >> OBJ-L

In fact, NEG in this constraint refers not just to the negation *inte*, but to any phrase carrying a feature [NEG], including full lexical objects. As shown in (21), negation can be expressed either at phrase level, with the adverb *inte*, or with an noun phrase internal negation on the object, either in the form of a determiner *ingen* or as (part of) a pronoun as in (21b).

(21) a. Hon sa inte nånting.
she say.PST not anything
'She didn't say anything.'

b. Hon sa ingenting.
she say.PST nothing
'She said nothing.'

Such a phrase containing a NEG marker must appear under F' (unless it is FOC/TOP) and may not be part of another phrasal projection such as PP or VP. Consequently we only expect the version with clausal negation to be possible in these cases. This contrasts sharply with the constraints which apply to negative phrases in English as (22c) illustrates. The other Scandinavian languages do, however, have constraints similar to Swedish (see Christensen (2003) for an overview of the data and a Minimalist OT analysis).

(22) a. Vi [pratar inte [med nån]$_{PP}$]$_{F'}$.
we talk.FIN not with anyone
'We don't talk to anyone.'

b. *Vi [pratar [med ingen]$_{PP}$]$_{F'}$.
we talk.FIN with no-one

c. We talk to nobody.

Swedish has strategies for getting around the restriction on the distribution of negative elements. Either the clausal negation is used with a positive noun phrase, as in (23a) or with a negative polarity item, as in (23b). Alternatively, a noun phrase with internal negation can be used, but then it has to occur higher up, under F', thus preceding its lexical verb, as illustrated by (23c-d).

(23) a. Jag har inte sett en hund.
I have.PRS not see.PPART a dog
'I haven't seen a dog.'

b. Jag har inte sagt nånting.
I have.PRS not say.PPART nothing
'I haven't said anything.'

c. *Jag har sagt ingenting / sett ingen hund.
I have.PRS say.PPART nothing see.PPART no dog

d. Jag har ingenting sagt / ingen hund sett.
I have.PRS nothing say.PPART no dog see.PPART
'I've said nothing.'

We will not analyse this further here, just note that it provides further support for our proposal that OBJ can be generated under F'.

4.3 The role of morphological marking

The partial ranking in (24) correctly predicts that an object can precede a subject as long as the object is Pro$_{wk}$ and the subject is not. This is borne out by data such as (25).

(24) PRO$_{WK}$-L >> SU-L >> OBJ-L

(25) a. Där mötte $_{o}$honom François Mitterand.
there meet.PST he.ACC FM
'There François Mitterand met him.'

b. *Där mötte $_{o}$honom $_{o}$hon.
there meet.PST he.ACC she.NOM

The pronoun *honom* in (25) shows overt marking for [CASE *acc*]. There are several pronouns in Swedish which do not have overt case distinctions; *den* '3SG.NON-NEUT.NOM/ACC' and *det* '3SG.NEUT.NOM/ACC'. In the spoken language and increasingly also in the written language *dom* '3PL.NOM/ACC' also replaces the two case marked forms *de*'3PL.NOM' / *dem* '3PL.ACC'. When the weak form of the pronouns lacking a case distinction precedes a noun phrase which is not overtly marked for case, then the pronoun will always be interpreted as the subject as indicated by (26). The intuition here is that in order for a non-TOP/FOC object to precede a subject, it must firstly be Pro$_{wk}$ and secondly be explicitly marked as an object.

(26) Där mötte $_{o}$dom François Mitterand.
there meet.PST they.NOM/ACC FM
'There they met François Mitterand.' NOT 'There FM met them.'

Given that lexical noun phrases are not marked for case in Swedish, *dom* could in principle be mapped onto OBJ and François Mitterand to SUBJ in (26). However, assuming that *dom* is unspecified for CASE, the interpretation in which the subject precedes the object in (26) will always win since if the lexical NP is interpreted as the subject, SUBJ-L is violated more than when the pronoun is and SUBJ-L is ranked higher than OBJ-L in (24). On the assumption that subjects are generally non-accusative, if the pronoun has the feature [ACC], as in (25), mapping it to the function SUBJ would incur a PARSE violation. Hence the constraint rankings we have assumed so far predict the correct interpretation of (26).

4.4 The role of scope

As examples like (2b) and (3b) illustrate, adverbials generally follow the subject in F'. If we distinguish between negation and other adverbials, then the adverbials tend to occur immediately before the negation. Like Sells (2001), we assume a family of constraints ADV-L whose members are ranked fairly low (NEG-L can be described as a special case of ADV-L). Given the other constraints we assume, we get the ranking in (27). Examples motivating this order can be found in (28).

(27) PRO$_{WK}$-L >> SU-L >> ADV-L >> NEG-L >> OBJ-L

(28) a. Oscar såg $_{o}$den väl förmodligen inte.
Oscar have.PRS it surely probably not
'I guess Oscar probably didn't seen it.'

b. Då såg Oscar ju troligtvis aldrig filmen.
then see.PST Oscar evidentially probably never film.DEF
'Then Oscar must probably never have seen the film.'

The order between adverbials is generally assumed to be rather fixed, but there is some variation, both with respect to the order between adverbials and arguments and with respect to the ordering between adverbials. Some of this variation can be accounted for in terms of scope (cf Svenonius, 2002: esp §3.1). In particular if the subject is scope sensitive, the order between the adverbials and the subject is sometimes important. This is illustrated by (29).

(29) a. Där vill någon aldrig bo.
there want.PRS someone not live.INF
'There is someone who never wants to live there.'

b. Där vill aldrig någon bo.
there want.PRS not someone live.INF
'No-one ever wants to live there.'

In (29a), the subject precedes the negation and is interpreted as being outside its scope whereas in (29b), the subject is interpreted as being under the scope of negation. We can assume then that there is a constraint requiring a scope taking element to immediately precede the constituent over which it takes scope and that this constraint is ranked above SU-L and ADV-L:

(30) SCOPE >> SU-L >> ADV-L

4.5 The role of information structure

Proper names and definite descriptions are normally not scope sensitive and such subjects may occur on either side of negation. In these cases, the reason behind the ordering has more to do with information structure than with scope, (although sometimes the two interact). In these cases, information structural notions beyond the standardly assumed FOCUS and TOPIC are required. There is evidence from many languages that more subtle information structural distinctions need to be made in order to account for word order (e.g. for general word order in languages such as Finnish (Kaiser, 2000, Vallduví, 1991, Vilkuna, 1989) and for certain phenomena like verb clusters in German (Cook, 2001) and work on a more fine grained i-structure has been done within LFG (Choi, 1997, Choi, 1999, King, 1997)). We do not aim to give a complete account here, but only to indicate some of the distinctions which need to be made. Consider the examples in (31).

(31) a. Då skulle alla grodorna antagligen dö. SUBJ<ADV
then shall.PST all frog.PL presumably die.INF

b. Då skulle antagligen alla grodorna dö. ADV<SUBJ
then shall.PST presumably all frog.PL die.INF

Both orders in (31) are perfectly grammatical, but they would be used in different contexts. The difference between these two examples lies in what is assumed to be already known (ground) and what is new to the hearer, or rhematic (cf. Vallduví, 1991, Vallduví and Engdahl, 1996). In (31a), *alla grodorna* ('all the frogs') is part of the ground, and it is only their presumed dying that is new (or rhematic). In (31b), on the other hand, the information that 'all the frogs might die' is new. There is a general tendency in Swedish for rhematic, i.e. informationally new material to come late in the sentence, preceded by ground (=thematic) material. There are additional factors affecting information structure, such as the placement of the focal accent, which we will not go into here. For now we will just assume a global constraint GROUND < RHEME. This constraint is ranked above SU-L, which means that the language sometimes violates the tendency to have subjects on the left provided that the subject is rhematic. We then get the subhierarchy in (32).

(32) HEAD-L >> [V < COMPL] >> SUBJ<COMPL >> PRO_{WK}-L >> GROUND<RHEME >> SU-L >> NEG-L

Rhematic subjects are normally accented and hence subjects which appear to the right of adverbials cannot usually be unstressed (t.ex. SAG 1999:4:40). Expletives are never accented, as (33a) indicates, hence an expletive subject cannot follow and adverbial as the ungrammaticality of (33b) shows.

(33) a. Här regnar $_{o}$det / *»det aldrig.
here rains it(EXPL) never
'It never rains here.'

b. *Här regnar aldrig $_{o}$det / »det.
here rains never it(EXPL)

If a pronominal subject follows an adverbial, as in (34a), it is interpreted as rhematic and has to be accented.

(34) a. Då kommer $_{0}$vi / »vi tyvärr för sent.
then come we unfortunately late
b. Då kommer tyvärr *$_{0}$vi / »vi försent.
then come unfortunately we late
'In that case **we** will unfortunately be late.'

Before the adverbial, a pronominal subject may be unaccented (ground) or accented (rheme).

The tendency to put rhematic subjects late in the sentence is seen most clearly in presentational constructions as in (35) where what appears to be the logical subject appears after the lexical verb.

(35) Det har ringt en massa människor till dig.
it have.FIN phone.PPART a lot people to you.ACC
'A lot of people have phoned you.'

Lødrup (1999) analyses these as 'agentive objects' but in our approach it is more natural to think of them as highly rhematic subjects.

In (36) we give a ranking of all the constraints we have referred to in this analysis. This ranking is still partial since there are many issues which we have only skimmed the surface of.

(36) TOP-L >> HEAD-L >> [V < COMPL] >> [OBJ_{IND}<OBJ_{DIR}] >> [SUBJ<COMPL] >> PRO_{WK}-L >>
GROUND<RHEME >> SCOPE >> SU-L >> ADV-L >> NEG-L >> OBJ-L

One interesting point to note about this ranking is that the T-constraints, which determine the broad typological status of the language, tend to be ranked higher than the A-constraints, which are responsible for the local ordering facts.

4.6 Conclusions and outstanding issues

We have argued here that the word order flexibility in Swedish midfields is best captured by assuming a flat c-structure with OT constraints determining the linear order between constituents. This way we do not just allow the different orders, we are also able to account for when the different orders are preferred. The constraints which we use refer to syntactic notions, but also to information structural notions and morphological and phonological information. Our approach relies on a number of assumptions within Lexical Functional Grammar; the separation between structure and function, for instance, is essential to our analysis. It is difficult to see how an approach within which functions are defined structurally could capture the spirit of this proposal. Similarly, the approach to X-bar structure which does not require binary branching and which assumes a Principle of Economy such as that assumed within LFG is essential. OT constraints allow us to capture the interaction between different dimensions, such as information structure, syntax and morphology. Our analysis constitutes a departure from many previous LFG approaches in that we do not assume that the Structure Function Association Principle holds absolutely for Swedish. Contrary to Sells (2001), we do not even assume that it should be expressed as a high ranking constraint in Swedish.

The analysis which we have formulated forms a point of departure for some further issues in the syntax of Swedish and Scandinavian in general. In particular, given that the structural assumptions we make for Swedish are very similar to those made by Sells (2001:190–192), for Icelandic, it will be natural to try to account for the differences between these two languages with respect to the midfield word order in terms of constraint reranking. We plan to extend our analysis to Icelandic and the other Scandinavian languages.

The analysis of negative object, which we touched on in Section 2.2, also requires further study. Negative objects can not just occur in the midfield immediately above their selecting verb, they can also "climb" to a higher clause as the examples in (37) show. Our initial sense is that an analysis involving functional uncertainty offers the best option for this data.

(37) a.

Jag	har	ingenting	sagt.
I	have.FIN	nothing	say.PPART

'I have said nothing.'

b.

Jag	har	ingenting	velat	säga.
I	have.FIN	nothing	want.PPART	say.INF

'I haven't wanted to say anything.'

c.

Jag	har	ingenstans	kunnat	sätta	mig.
I	have.FIN	nowhere	can.PPART	sit.INF	me

'I haven't been able to sit myself down anywhere.'

d.

Jag	har	ingenting	velat	be	henne	göra.
I	have.FIN	nothing	want.PPART	ask.INF	her	do.INF

'I haven't wanted to ask her to do anything.'

Our analysis deals with a small subset of properties of Swedish clause structure and leaves many issues — like presentational constructions and negation climbing — open, but to our minds the results so far are encouraging enough for the analysis to be pursued further.

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DOUBLE OBJECT AND SERIAL VERB BENEFACTIVE CONSTRUCTIONS IN CANTONESE

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Abstract

This paper examines a specific kind of syntactic alternation in Cantonese, involving a single verb benefactive construction, and a serial verb benefactive construction. The former is a ditransitive construction with a single predicate and two contiguous objects (double object construction). The latter comprises a verbal complex of two transitive predicates with non-contiguous objects in a monoclausal construction. Despite these differences in syntactic form, some speakers acknowledge that the two types of sentences accomplish the same function of expressing the benefactive. However, a second level of intuition produces some nuances in meaning, such as the ability of the serial verb construction to express the notion of *ultimate source* and *effort of action*. This paper proposes that, in expressing the benefactive, the Cantonese speaker decides between double object constructions and serial verb constructions. For any communication situation, the choice of one over the other depends on what secondary lexical conceptual semantic nuances the speaker intends. An LFG analysis of these two types of constructions is presented, with a proposal for incorporating a conceptual semantic level following Jackendoff (1990b), Butt (1995, 1997), Hellan (1996) and Bodomo (1993, 1997a) in order to handle the conceptual semantic nuances described.

1. INTRODUCTION

Much of syntactic description and theorizing are concerned with the differing perspectives in which events that encode the same predicate-argument structures are rendered by speakers. Such syntactic alternations are handled in most grammatical frameworks, including LFG. Two well-known ones are the active/passive alternation and the dative shift. This paper is concerned with the second of these within the context of serializing languages. In particular, we are concerned with the alternating encoding of benefactive constructions by the use of double object constructions (DOCs) and serial verb constructions (SVCs).

The literature on *double object constructions*, henceforth DOCs (Larson 1988, 1990; Jackendoff 1990a), *dative shift*, the *object condition* (Siewierska 1998) and others related to *ditransitivity* has featured much in theories of syntax and semantics. Issues often addressed include (i) the number of NP arguments involved (monadic, dyadic and triadic predicates), and (ii) the ordering relation of the direct and indirect objects.

While this focus of attention on the arguments has produced a lot of results on the nature of benefactive constructions involving double object constructions, it seems that much examination of the nature of the predicate is still required. An issue to be taken up in this paper is that a single predicate construction (the DOC) and a complex predicate construction (the SVC) alternate in the expression of the same concepts/events encoded by the one predicate-argument structure.

The realization that a complex predicate can head a single predicate argument structure in benefactive constructions throws open a lot of issues: one of them is the problem of accounting for the co-existence of the single predicate benefactive constructions and complex predicate benefactive constructions. When and why do speakers choose one over the other?

This paper examines a specific kind of syntactic alternation in Hong Kong Chinese (Cantonese), involving a single verb benefactive construction, as shown in (1) and a serial verb benefactive construction, as shown in (2)[1]:

(1) *ngo5 bei2-zo2 bun2 syu1 keoi5*[2]
1.SG give-PERF CL book 3.SG
'I have given him/her a book.'

(2) *ngo5 lo2-zo2 bun2 syu1 bei2 keoi5*
1.SG take-PERF CL book give 3.SG
'I have taken a book for him/her.'

In (1) we have a ditransitive construction with a single predicate and two contiguous objects (a DOC). In (2), we have a verbal complex of two transitive predicates with non-contiguous objects in what appears to be a monoclausal construction (an SVC).

While expressing the same notion of transfer of ownership, speakers also note the following interesting nuances in meaning (among others):

(3) i. The book in (1) may belong to the giver but in (2) the book may belong to someone else (the giver may not be the *ultimate source*).
ii. In addition to just expressing the benefactive, the choice of the construction in (2) may emphasize more the *effort* or insistence of the giver.

This paper proposes that, in expressing the benefactive, the Cantonese speaker makes a choice between double object constructions and serial verb constructions (together with other constructions).

The choice depends on what secondary lexical conceptual semantic nuances the speaker intends. Two of these conceptual nuances are the *ultimate source* and the *effort of action*. In the paper we shall be more concerned with the notion of *ultimate source*.

The paper is structured as follows. The syntactic analysis of the two types of constructions is done in section two. In section three, we show how a conceptual structure representation might be incorporated along the lines of Jackendoff (1990b), Butt (1997), Hellan (1996), Bodomo (1997a, 1997b) and with the view to capturing the conceptual semantic nuances that are not encoded in predicate argument structure. Section four concludes the paper with a recapitulation of the issues raised.

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[1] Symbols and abbreviations used in this paper:
* = Ungrammatical; 1 = First Person; 2 = Second Person; 3 = Third Person; Ag = Agent; Ben = Benefactive; CL. = Classifier; DEF = Definite Determiner; NEG = Negation Marker; OBJ = Object; OBJ2 = Secondary Object; PERF = Perfective Aspect; PN = Personal Name; PRED = Predicate; SG = Singular; SUBJ = Subject; Th = Theme.

[2] The romanization scheme adopted in this paper is based on the one developed by The Linguistic Society of Hong Kong (2002). There are altogether six tones in this scheme: 1 = high level; 2 = high rising; 3 = mid level; 4 = low falling; 5 = low rising; 6 = low level. The tone is marked at the end of each romanized character.

2. Syntax

In this section, we shall discuss the syntactic properties of single ditransitive verbs (dative/double object constructions) and serial verb constructions in Cantonese.

2.1 Double Object Constructions (DOCs)

As a first example, (5) is the Cantonese rendition of the English sentence in (4). This is the most typical example of a dative construction in Cantonese but also the most controversial in the language.

English:

(4) *I have given him a book*
SUBJ OBJ2 OBJ

Cantonese:

(5) *ngo5 bei2-zo2 bun2 syu1 keoi5*
1.SG give-PERF CL book 3.SG
SUBJ OBJ OBJ2
'I've given him/her a book'

bei2 <Ag Th Ben>

As can be observed, there is an interesting contrast between the English and Cantonese constructions in terms of the relative positions of OBJ and OBJ2 (the accusative and the dative). Unlike in most languages, the Theme comes before the Dative/Ben, as can be seen in the above sketches of both c- and a-structure encodings.

Other double object constructions in the language, however, have the normal Benefactive/Theme order, as can be seen in (6):

(6) a. *ngo5 ze3zo2 keoi5 sap6 man1*
1.SG lend-PERF 3.SG ten dollars
'I have lent him/her ten dollars.' OR 'I have borrowed ten dollars from him/her.'

b. *keoi5 gaau3 ngo5 jing1man2*
3.SG teach 1.SG English
'S/he teaches me English.'

In (8), we provide a set of descriptive restrictions guiding the well-formedness of double object constructions in the language. The examples in (7) illustrate these restrictions/constraints.

(7) a. *ngo5 bei2-zo2 bun2 hung4sik1ge3 syu1 siu2ming4*
1.SG give.PERF CL red book PN
'I have given a red book to Siu Ming.'

b.	**ngo5*	*bei2-zo2*	*keoi5*	*siu2ming4*		
	1.SG	give.PERF	3.SG	PN		

c.	*ngo5*	*bei2-zo2*	*bun2*	*hung4sik1ge3*	*syu1*	*keoi5*
	1.SG	give.PERF	CL	red	book	3.SG

‘I have given a red book to him.’

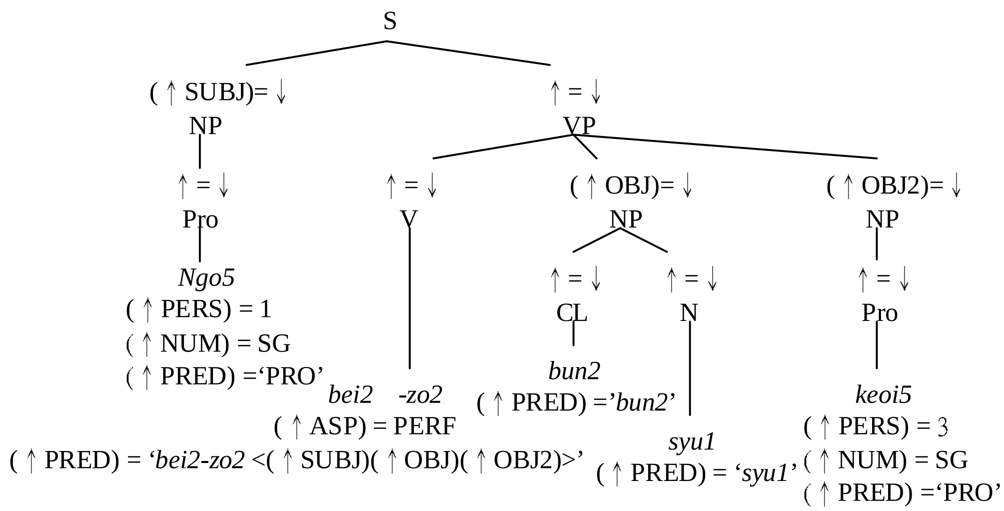
d.	**ngo5*	*bei2-zo2*	*keoi5*	*lei5*
	1.SG	give.PERF	3.SG	2.SG

(8) Restrictions

a. Theme argument cannot be pronomialized (b).
b. Benefactive argument can be pronominalized (c).
c. The two non-Agent arguments cannot be pronominalized at the same time (d).

With these restrictions stated we provide below in (9) more elaborate c- and f-structures of our typical benefactive construction in Cantonese:

(9) a. C-structure:



b. F-structure:

PRED	‘*bei2-zo2* <(↑ SUBJ)(↑ OBJ)(↑ OBJ2)>’	
ASP	PERF	
SUBJ	PERS	1
	NUM	SG
	PRED	‘PRO’
OBJ	CL	‘*bun2*’
	PRED	‘*syu1*’
OBJ2	PERS	3
	NUM	SG
	PRED	‘PRO’

With this brief account of double object benefactive constructions we now turn our attention to a brief description of serial verb benefactive constructions.

2.2 Serial Verb Constructions (SVCs)

Cantonese is a serial verb language (Killingley 1993, Matthews and Yip 1994, Bodomo and Lam 2001 and Luke and Bodomo to appear). Within a clause two or more verbs may be used to express an event or a set of tightly related events. Serial verb benefactive constructions constitute an alternative rendition of benefactive/dative constructions in the language. The following examples illustrate a typical set of SVCs expressing the benefactive:

(10) a.

keoi5	*lo2-zo2*	*bun2*	*syu1*	*bei2*	*ngo5*
3.SG	take-PERF	CL	book	give	1.SG

‘S/he took the book and gave it to me.’

b.

keoi5	*maai3-zo2*	*hou2do1*	*je3*	*bei2*	*ngo5*
3.SG	buy-PERF	many	thing	give	1.SG

‘S/he bought me many things.’

As can be seen, the typical second verb is *bei2*, though other verbs can fit the paradigm, as in (11):

(11)

keoi5	*jung6*	*zi1*	*coeng1*	*zi2zyu6*	*ngo5*	*go3*	*tau4*
3.SG	use	CL	gun	point	1.SG	CL.	head

‘S/he is pointing a gun at my head.’

Some constraints on verb serialization in Cantonese are shown in (12):

(12) Constraints on Serialization (in Cantonese) (Bodomo and Lam 2001):

a. The subject sameness constraint
All the verbs in an SVC must share the same structural or functional subject.

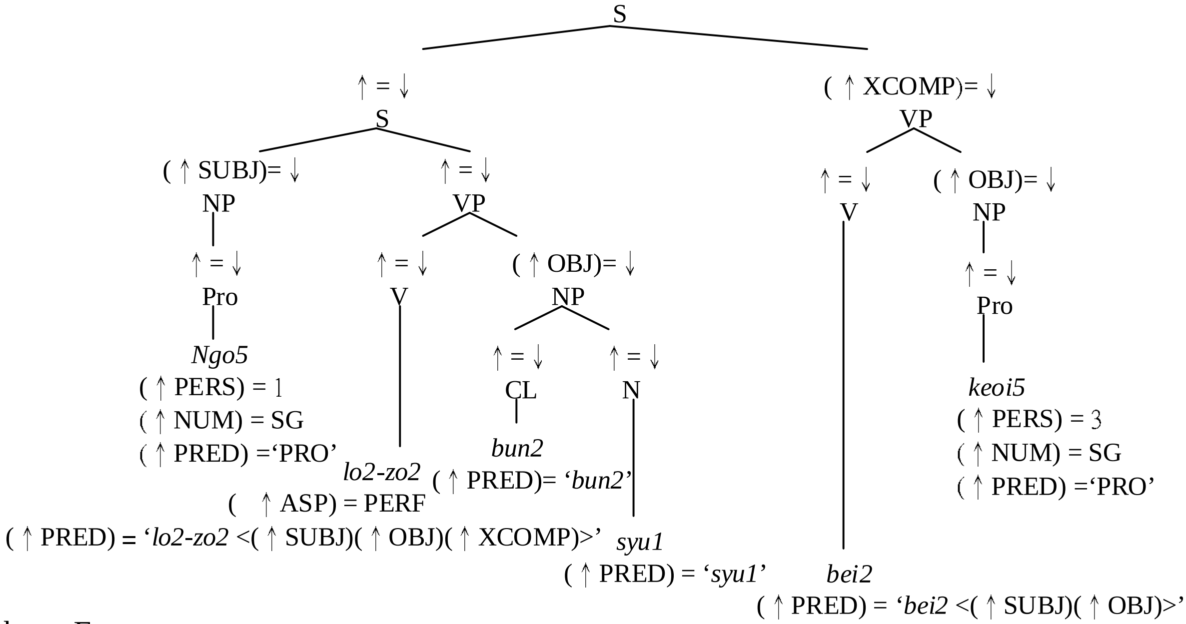
b. The polarity constraint
All of the verbs in an SVC must have the same polarity, i.e. *either* all are understood in the affirmative or in the negative.

c. The connector constraint
There must neither be an overt or covert connector in the construction.

As in other languages, representation of the SVC is not without controversy. In short, it is possible to analyse it as a complementation construction (13), as a coordinate construction (14) or as a complex predicate construction (15).

(13) Complementation

a. C-structure:

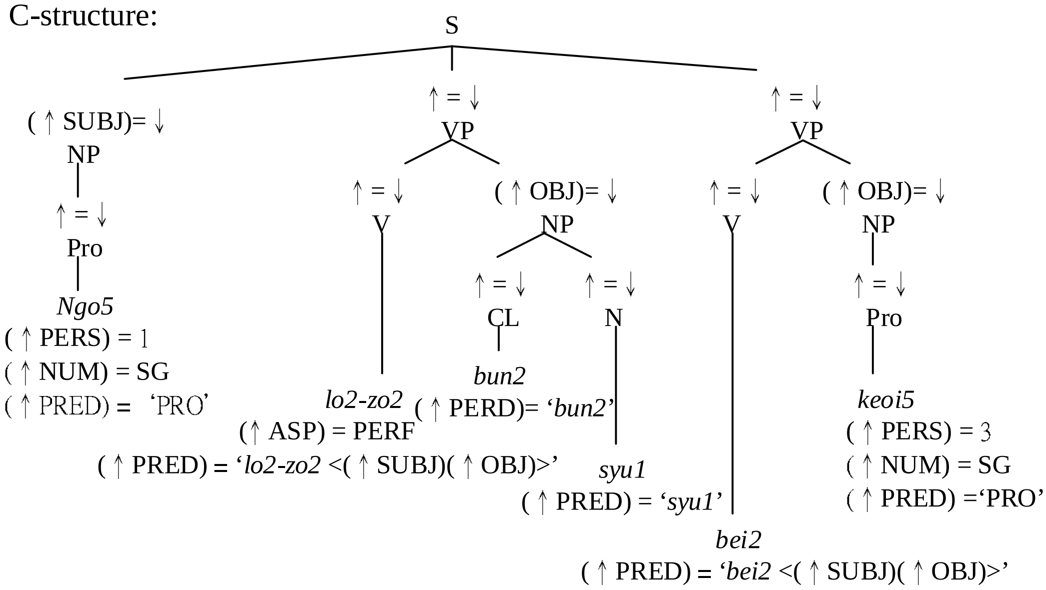


b. F-structure:

$$\left[\begin{array}{ll}
\text{PRED} & \text{‘}\textit{lo2-zo2}\text{ <(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)(}\uparrow\text{XCOMP)>’} \\
\text{ASP} & \text{PERF} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PERS} & 1 \\ \text{NUM} & \text{SG} \\ \text{PRED} & \text{‘PRO’} \end{array}\right] \\
\text{OBJ} & \left[\begin{array}{ll} \text{CL} & \text{‘}\textit{bun2}\text{’} \\ \text{PRED} & \text{‘}\textit{syu1}\text{’} \end{array}\right] \\
\text{XCOMP} & \left[\begin{array}{ll} \text{PRED} & \text{‘}\textit{bei2}\text{ <(}\uparrow\text{SUBJ)(}\uparrow\text{OBJ)>’} \\ \text{SUBJ} & \\ \text{OBJ} & \left[\begin{array}{ll} \text{PERS} & 3 \\ \text{NUM} & \text{SG} \\ \text{PRED} & \text{‘PRO’} \end{array}\right] \end{array}\right]
\end{array}\right]$$

(14) Coordination

a. C-structure:

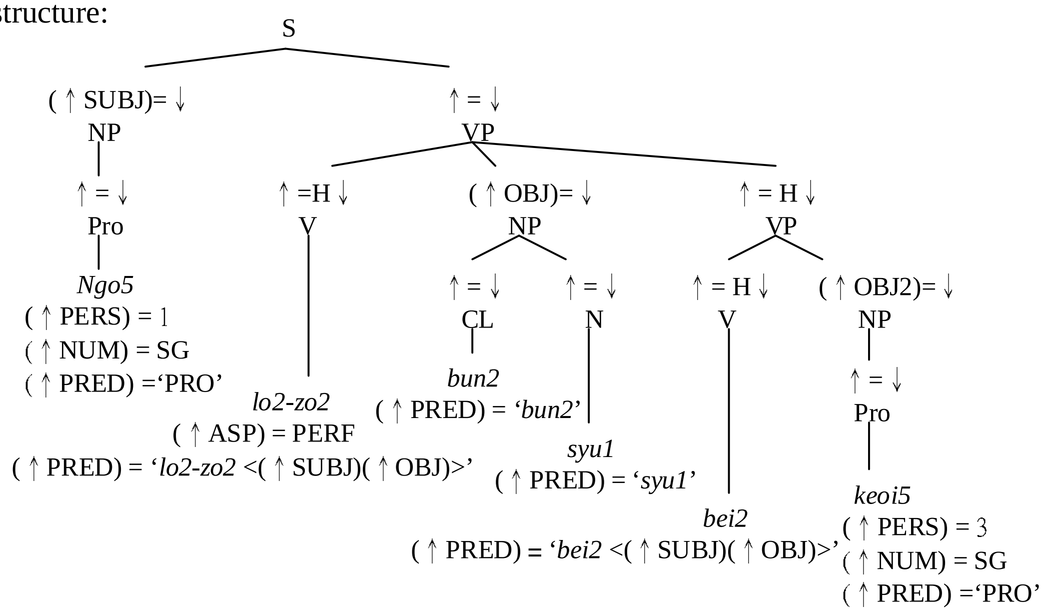


b. F-structure:

$$\left\{ \begin{array}{l} \left[\begin{array}{ll} \text{PRED} & \text{‘}\textit{lo2-zo2}\ \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\ \text{SUBJ} & \left[\begin{array}{ll}\text{PERS} & 1\\ \text{NUM} & \text{SG}\\ \text{PRED} & \text{‘PRO’}\end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll}\text{CL} & \text{‘}\textit{bun2}\text{’}\\ \text{PRED} & \text{‘}\textit{syu1}\text{’}\end{array}\right]\end{array}\right] \\ \text{ASP}\quad \text{PERF} \\ \left[\begin{array}{ll} \text{PRED} & \text{‘}\textit{bei2}\ \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\ \text{SUBJ} & \text{———} \\ \text{OBJ} & \left[\begin{array}{ll}\text{PERS} & 3\\ \text{NUM} & \text{SG}\\ \text{PRED} & \text{‘PRO’}\end{array}\right]\end{array}\right] \end{array}\right\}$$

(15) Complex predicate construction

a. C-structure:



b. F-structure:

$$\left[\begin{array}{ll} \text{PRED(CHAIN)} & \text{‘}\textit{lo2-zo2-bei2}\ \ \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})(\uparrow \text{OBJ2})\rangle\text{’} \\ \text{ASP} & \text{PERF} \\ \text{SUBJ} & \left[\begin{array}{ll}\text{PERS} & 1\\ \text{NUM} & \text{SG}\\ \text{PRED} & \text{‘PRO’}\end{array}\right] \\ \text{OBJ} & \left[\begin{array}{ll}\text{CL} & \text{‘bun2’}\\ \text{PRED} & \text{‘syu1’}\end{array}\right] \\ \text{OBJ2} & \left[\begin{array}{ll}\text{PERS} & 3\\ \text{NUM} & \text{SG}\\ \text{PRED} & \text{‘PRO’}\end{array}\right] \end{array}\right]$$

In this paper we opt for a complex predicate analysis[3]. Even though we are dealing with two verbal forms in benefactive SVC constructions, these verbs do actually undergo syntactic processes as if they were a single predicate item.

2.2.1. Negation in the Cantonese Benefactive Constructions

One piece of evidence for a complex predicate analysis comes from the syntax of negation in the language: the two or more verbs are usually under the scope of the same negative node in SVCs and other complex predicate constructions.

(16) Patterns of negation for single predicate benefactive constructions:

a. *ngo5 mou5 bei2 bun2 syu1 keoi5*
1.SG NEG give CL book 3.SG
' I didn' t give her/him a book.'

b. **ngo5 bei2 mou5 bun2 syu1 keoi5*
1.SG give NEG CL book 3.SG

c. *ngo5 bun2 syu1 mou5 bei2 keoi5*
1.SG CL book NEG give 3.SG
'As for my book, I didn't give it to him/her.'

d. **ngo5 bun2 syu1 bei2 mou5 keoi5*
1.SG CL book give NEG 3.SG

(17) Patterns of negation for complex predicate benefactive constructions:

a. *ngo5 maai5 fan6 lai5mat6 bei2 keoi5*
1.SG buy CL gift give 3.SG
'I buy a gift for him/her.'

b. *ngo5 mou4 maai5 lai5mat6 bei2 keoi5*
1.SG NEG buy gift give 3.SG
'I did not buy any gift for him/her.'

c. **ngo5 maai5 lai5mat6 mou4 bei2 keoi5*
1.SG buy gift NEG give 3.SG

In both types of constructions, (16) and (17), the negative marker cannot come after the verb(s). This could be taken to mean that, for the case of complex predicates, both verbs must behave as a unit with respect to this fact of Cantonese negation marking[4].

---

[3] We would like to thank Joan Bresnan and Miriam Butt for mentioning other alternatives (Butt, King and Maxwell 2003) in the analysis of complex predicates.
[4] Argument structure composition: *lo2* <Ag_i Th_j>; *bei2* <Ag_i, Th_j, Ben> → *lo2..bei2* <Ag, Th, Ben> (argument fusion)

In this section, we have provided a brief description and representation of the two types of syntactic alternations for the expression of basic benefactive constructions. We now turn our attention to the kind of meaning nuances and conceptual structure encodings that underlie the choice of these two syntactic alternations.

3. Conceptual Semantics

We begin this section by drawing a contrast between the two words/predicates and their argument structures for the sentences in (18) and (19):

(18) Give me the salt, please!
give <Ag, Ben, Th>

(19) Pass me the salt, please!
pass <Ag, Ben, Th>

In terms of (classical) argument structure, there is nothing to choose between the two predicates: (i) they are both triadic verbs/three-place predicates, (ii) they have the same thematic roles, and (iii) they have the same thematic role hierarchy following the Thematic Hierarchy (Bresnan 2001:307), stated below in (20):

(20) agent > beneficiary > experiencer/goal > instrument > patient/theme > locative

Yet, in terms of finer conceptual nuances there is a distinction between the two: in the case of the predicate, *pass*, the ultimate source of the salt may not be the overt agent but some other participant(s). It is possible to have the following rough lexical conceptual decomposition for the two lexical items:

(21) a. *give*: [Participant 1 causes Salt to change possession to Participant 2]
b. *pass*: [Participant 1 causes Salt to change possession through some other source to Participant 3]

Intuitively, the pass-salt event potentially involves more participant sources than the give-salt event. It seems clear that when speakers make a choice between these and similar closely related lexical items. They do so based on the finer distinctions between their lexical meanings, and this goes beyond the information categorizations represented in classical predicate argument structures.[5]

We want to claim that just as speakers choose between very closely related items in a lexical semantic paradigm/field based on finer conceptual semantic distinctions, so do they choose between syntactic alternations based on the finer conceptual nuances that such alternations come along with. We have already stated in (1) and (2), repeated below as (22) and (23), that when Cantonese speakers choose between DOCs and SVCs, one of the reasons they do so is to clearly

[5] Speakers have also mentioned other nuances such as politeness and the fact that one involves a gift and the other may not, thereby introducing issues about the nature of the possession.

indicate the possibility of more source-participants in the event lexicalized by complex predicate serial constructions.

(22) *ngo5* *bei2-zo2* *bun2* *syu1* *keoi5*
1.SG give-PERF CL book 3.SG
'I have given him/her a book'

(23) *ngo5* *lo2-zo2* *bun2* *syu1* *bei2* *keoi5*
1.SG take-PERF CL book give 3.SG
'I have taken a book for him/her'

Now, let us consider the following syntactic alternations in Cantonese in (24) and (25):

(24) *ngo5* *ze3-zo2* *keoi5* *sap6man1* DOC
1.SG lend/borrow-PERF 3.SG ten dollars
'I have lent him/her ten dollars.' OR
'I have borrowed ten dollars from him/her.' (Preferred)

(25) *ngo5* *ze3-zo2* *sap6man1* *bei2* *keoi5* SVC
1.SG lend-PERF ten dollars give 3.SG
'I have lent him/her ten dollars.'

In (24), *ze3* is lexically ambiguous: it can mean both 'borrow' and 'lend'. This makes (24) ambiguous, as *ngo5* can be either the Source or Goal/Ben. In (25), however, the lexical item can only have one meaning because the Source is explicitly expressed (with *keoi5* being the Goal, *ngo5* can only be the Source). Notice that the 'borrow' meaning is NOT allowed in (25). We claim therefore that a further reason that Cantonese speakers choose between the two alternations is to disambiguate potentially ambiguous sentences and express the participant roles more explicitly. In this case, the Source role comes out more clearly in the complex predicate benefactive construction than in the single predicate benefactive construction.

3.1 Conceptual Nuances and Levels of Representation

We have seen that beyond argument structure information such as number of arguments, types of arguments, and the order in which they occur, DOCs and SVCs also involve conceptual categorizations that are not represented in classical argument structure. Some of these conceptual nuances include ultimate source, effort of action, accomplishment, politeness … etc. Indeed, in earlier works like Butt (1997), Hellan (1996) and Bodomo (1993, 1997a), other conceptual nuances include aspectual features such as stages of conceptualization with regards to complex predicates in Urdu and Dagaare.

The question now is: how should we represent these obvious cases of lexical conceptual nuances, or rather, at what level should we represent these?

One option is to incorporate these nuances into argument structure as follows:

(26) *lo2…bei2* <Ag, Th, Ben> {+ultimate source, +effort, etc.}

However, obviously, with the very structured nature of classical argument structure one cannot successfully incorporate these extra nuances. The above is simply a contiguous listing, a juxtaposition, of the activated conceptual nuances in the event.

The second option, as Jackendoff (1990b) seems to take, is to abstract a level of conceptual structure in place of argument structure. He divides this level into tiers, the Thematic Tier and the Action Tier. The figure in (27) is an example of Jackendoff's representation of the verb *enter* (Jackendoff 1990:46):

(27)
$$\left[\begin{array}{l} \text{enter} \\ \text{V} \\ \underline{\qquad} \langle NP_j \rangle \\ [_{Event}\ GO\ ([_{Thing}\ \ ]_i, [_{Path}\ TO\ ([_{Place}\ IN\ ([_{Thing}\ \ ]_j)])])] \end{array}\right]$$

This conceptual structure is built around a basic set of "semantic parts of speech" (Jackendoff 1990:43) including Thing (Object), Event, State, Action, Place, Path, Property, and Amount.

Butt (1995, 1997) takes a third approach and that is to place these conceptual nuances (aspectual features) in an "elaborated argument structure" (Butt 1997:129). An example of such a structure is shown in (28) with the verb 'make' in Urdu:

(28)
$$\left[\begin{array}{l} \text{banaa 'make'} \\ \qquad \left[\begin{array}{l} CS\ ([\alpha], BE[\ ]) \\ AFF_{+cc}([\ ]^{\alpha},) \\ ASP\ (\_\_\_) \end{array}\right]_E \end{array}\right]$$

Butt's "elaborated a-structure" as shown above contains Jackendoff's Thematic Tier and Action Tier, the former representing the main semantic content of a lexical item with thematic functions such as GO, BE, CAUSE, etc., and the latter representing thematic/proto-roles (Dowty 1991) such as Proto-Agent and Proto-Patient.

This is understandable because, from an LFG point of view, argument structure is an important level of representation, which is indeed the basis of so many sub-theories with LFG such as the LMT. It would be good to maintain this level in one form or the other and then attempt to incorporate a sub-level of conceptual nuances.

3.2 Conceptual Structure with Argument Roles

In the paper we adopt a level of conceptual structure following Bodomo (1997) that incorporates argument roles. In short, this structure, adopting and adapting ideas from Jackendoff (1990b), Butt (1997) and Hellan (1996), contains a three tiered representation with argument structure as one of the tiers: event tiers, participant tiers, and global tiers, as shown in (29):

(29) *ngo5* *lo2-zo2* *bun2* *syu2* *bei2* *keoi5*
1.SG take.PERF CL book give 3.SG
'I have taken the book for him/her.'

consem structure	GLOBAL	ASP + Perf Ultimate source + Effort of Action +		
	PARTICIPANTS	P1, P2, P3		
	COMPLEX EVENT	Action 1:	X causes Y to be in X's possession	
		Action 2:	X causes Y to Δ position from X to Z	

The Event Tier in our structure is the level at which lexical conceptual decomposition occurs. It is at this level, similar to the Thematic Tier that primary categories inherent in a denotational (dictionary) meaning of a predicate are spelt out. In this case we have a complex event. This tier links up to a complex predicate in the syntax, comprising *lo2* 'take' (X causes Y to be in X's possession) and *bei2* 'give' (X causes Y to change possession from X to Z).
The Participant Tier is where participants in the event are identified and abstracted for the purposes of linking. This plays the role of argument structure, such that all the sub-theories connected to and dependent on argument structure are still applicable here. So information from Event structure can identify P1, P2 and P3 as Ag, Th and Ben, and the LMT can thus apply giving us:

(30) *lo2…bei2* <Ag Th Ben>

$$\begin{array}{ccc} -o & -r & +o \\ | & | & | \\ S & O & O_{\theta} \end{array}$$

The Global Tier is a bit of a pot-pourri, and is important in capturing all the finer conceptual nuances that run over the entire construction, not just at the predicate level alone. This is a construction level description of events, hence the term GLOBAL. The items here such as aspectual features of inception, duration and termination, attitude, hedgings, politeness and such finer role categorizations like ultimate source, nature of possession and types of goals have scope over the entire construction and link up to syntactic level phenomena such as negation, modality, tense and aspect.

3.3 The Ultimate Source

It is precisely at this level that we encode the fact that the complex structure of serial verb benefactive constructions allows the Cantonese speaker to express more conceptual notions, including the *ultimate source* and *effort of action*, which we define as follows:

(31) a. *Ultimate source* - That point of departure from which an entity moves via transmitters/intermediate sources to a goal

b. *Effort of action* - An expression of the persistence with which the actor/agent accomplishes the action

Is there any motivation or necessity for introducing these conceptual nuances and is this the right way to represent these? Both in terms of description and theory, these are motivated. Descriptively, it is clear that speakers do indeed exhibit this notion of differing sources in the *bei2* and *lo2-bei2* events. These ought to be encoded. Theoretically, it is possible to talk of different types of roles (e.g. Jackendoff (1990:261) talks of two types of goals: possessional goals and spatial goals). Jackendoff (1990:46-47) defines Source and Goal respectively as follows: 'the object from which motion proceeds' and 'the object to which motion proceeds'. It doesn't necessarily have to be 'the object' but indeed "objects". In this sense then there is a theoretical possibility to abstract different types of sources, goals and other kinds of thematic roles. There is the need to encode the ultimate source in our grammar.

Is this the right way to represent it? We have in this paper attempted a preliminary sketch by indicating its presence in the form of a feature structure with a positive value. Being in our Global Tier it has a universal presence with regards to the whole complex predicate benefactive construction.

3.4 Cross-linguistic Extrapolations

The observations made in this paper about the choices speakers make between DOC and SVC benefactive constructions also work for a serializing language like Dagaare (Bodomo 2000):

(32) *ǹ dà kò'ó lá à gánè*
1.SG PAST give.3.SG FOC DEF book
'I gave him/her the book.'

(33) *ǹ dà dé lá à gánè kò'ó*
1.SG PAST take FACT DEF book give.3.SG
'I took the book for him/her.' OR 'I gave/donated him/her a book.'

The construction in (32) is a DOC while that in (33) is an SVC in Dagaare. Like their Cantonese counterparts, the construction in (32) expresses the *ultimate source* (in this case, the speaker is likely to be the *ultimate source,* or the owner of the book) while that in (33) is more concerned with the *effort* that the speaker made with respect to the *action* described.

English: In reading the abstract to this paper a reviewer remarked that a language like English also has the same oppositions as the Cantonese and wondered what the point was. That is indeed the point! Usually in linguistics something is observed in English and frantic efforts are then made to obtain cross-linguistic confirmations from other languages. We are happy that the observation, even though made with respect to serialization languages, also seems to work well with a non-serializing language like English, as shown in (34) where the rendition in (34b) behaves more like a serial verb benefactive construction in expressing the ultimate source:

(34) a. She gave me a book.
b. She took a book for me.

The specific observation we have made for Cantonese in this paper with regards to the syntactic alternation between double objects and serial verbs may generalize to the idea that complex predicates and other more complex constructions serve to express various conceptual nuances that their single predicate counterparts could not express. A study of such alternations and choices governing them would be useful towards more finer-grained representations of linguistic categorizations such as source and goal.

4. CONCLUSION

A careful examination of the syntax and semantics of alternating grammatical constructions such as active/passive and dative shift alternants can unearth some interesting conceptual nuances. In this paper, we have examined a particular syntactic alternation expressing the conceptual notion of transfer of ownership/possession. Transfer of ownership or possession in Cantonese can be expressed by two benefactive constructions, one involving a double object construction as in (1) and the other involving a serial verb construction as in (2).

We have discovered that, in addition to expressing the agent/source, theme, and benefactive/goal arguments in the predicate argument structure of benefactive constructions in Cantonese, there are at least two ancillary conceptual notions that also need to be expressed: the *ultimate source* and the *effort of action*. The desire to express ancillary conceptual notions put into question the ability of argument structure to express all necessary conceptual notions relevant to syntax. After brief syntactic descriptions of the two constructions in section two, we addressed this question of how to represent conceptual nuances. Adapting ideas from Jackendoff (1990b), Butt (1997) and Hellan (1996), we proposed a conceptual structure representation as in (29). This conceptual structure representation has room for argument structure, such that all the sub-theories and principles within LFG, such as LMT, that depend on argument structure can still hold at this level and yet allow room for (i) a lexical semantic decomposition of the contributing predicates in an event, and (ii) a representation of conceptual nuances including aspectual properties such as inception and termination, and (iii) finer-grained categorizations of roles such as the ultimate source.

There are several advantages to such an approach. First, syntacticians have often left finer-grained issues like attitudes, politeness, and nuances like hedgings to the arena of pragmatics, discourse analysis and even socio-linguistics. Our approach proposes a lexicalist treatment of these issues. A second advantage of our approach lies in language learning. We suspect that such conceptual nuances and finer-grained categorization of lexical and syntactic notions will pose problems for learners of any language. Such conceptual nuances involving even single predicates like ‘give’ and ‘pass’ and certainly alternating syntactic constructions as we have studied here would be among the last to be acquired by learners. A focus of interest on these issues among syntacticians would provide more insights for language learning.

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OPTIMALITY, COMPLEX PREDICATION, AND PARALLEL STRUCTURES IN ZAPOTEC

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Abstract:
Auxiliary verbs in San Dionicio Ocotepec Zapotec, an Otomanguean language spoken in Oaxaca, are associated with two constituent structure representations: one monoclausal and the other biclausal. The Zapotec auxiliaries show syntactic similarities to causatives in German, Spanish, and French, as well as the Urdu instructive/permissive, where constituency tests also give evidence for two c-structures. Using Optimality-Theoretic LFG, this paper argues that these cases involve predicates with a single f-structure representation where two c-structures emerge as equally optimal under the relevant constraint evaluation. These structures exist in parallel to each other, recalling Goodall's (1987) more general approach to parallel structures in syntax.

1 Introduction[1]

In a number of languages, complex predicates show evidence for two or more distinct constituent structures. For example, McKay's (1985) treatment of German and Goodall's (1987) treatment of French and Spanish argue that the behavior of causatives in these languages is best treated by positing two phrase structure representations – one monoclausal and one biclausal. Similarly, Butt's (1995) treatment of the Urdu instructive and permissive posits two syntactic structures – one in which the permissive/instructive matrix verb and verbal noun form a c-structure V' constituent, and one in which the verbal noun heads a distinct phrase.

This paper will pursue a more general account of parallel syntactic structures and complex predicates. Using Optimality-Theoretic Lexical-Functional Grammar (Bresnan 2000), I will argue that these cases involve predicates with a single f-structure representation where two c-structures emerge as equally optimal under the relevant constraint evaluation. These structures exist in parallel to each other, recalling Goodall's (1987) more general approach to parallel structures in syntax.

The argument is based on the behavior of auxiliary verbs in San Dionicio Ocotepec Zapotec (SDZ), an Otomanguean language spoken in Oaxaca, Mexico. I will show that auxiliary

with two c-structures – one monoclausal and one biclausal.

---

[1] SDZ is an Otomanguean language spoken in San Dionicio Ocotepec, Oaxaca, Mexico by 2,000 - 3,000 people. I thank Pamela Munro and members of the audience at LFG 03 for useful discussion of this material. Special thanks to Luisa Martínez, who provided all the SDZ data.

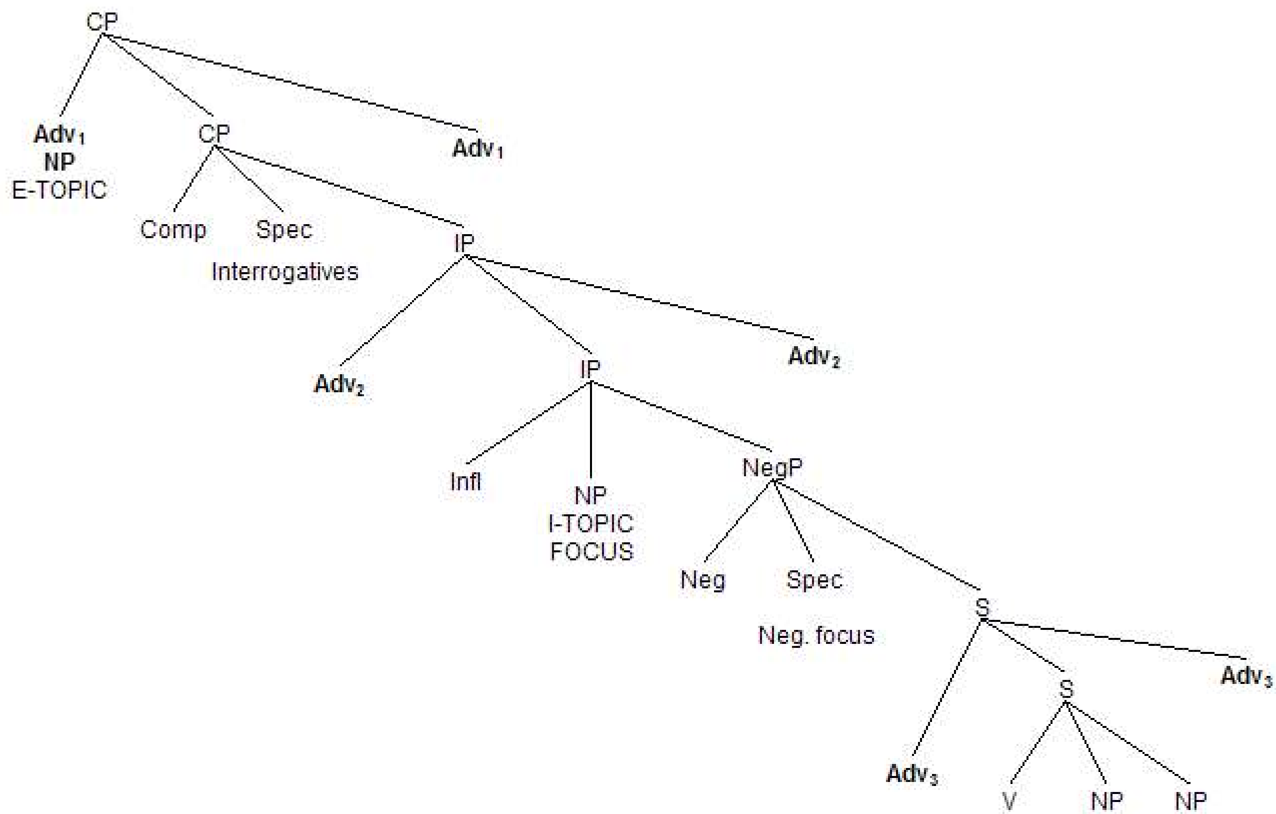
The orthography for SDZ is adapted from the practical orthographies for other Zapotec languages spoken in the Valley of Oaxaca. In the SDZ orthography symbols have their usual phonetic values, with the following exceptions. <x> = /š/ before a vowel and /ž/ before a consonant, <xh> = /š/, <dx> = /dž/, <ch> = /tš/, <c> = /k/ before back vowels, <qu> = /k/ before front vowels, <rr> = trilled /r/, and <eh> = /ɛ/. Doubled vowels are long. SDZ is a language with four contrastive phonation types: breathy <Vj>, creaky <V'V>, checked <V'>, and plain <V>.

Glosses use the following abbreviations: a=animal, aff = affirmative, cer = certainty, com = completive aspect, con = continuative aspect, cs = causative, def = definite future aspect, dem = demonstrative, foc = focus, hab = habitual aspect, neg = negative, p = possessed, plur = plural, pot = potential aspect, q = question, r=respect, ref=reflexive, rel = relative, stat= stative aspect, top=topic.

2 San Dionico Ocotepec Zapotec

2.1 Background

In previous work, I've argued for the following overall syntactic structure for SDZ:



Note in particular that this analysis uses the non-endocentric category S. I reject the widespread assumption in Principles and Parameters theory that VSO order must be derived by V or VP movement (cf. Lee 1999 and Black 2000 on other varieties of Zapotec).

The most neutral word order is VSO:

1) Ù-zìì' Juáàny tòyby xhùmbréhèhjl. VSO
com-buy Juan a hat

'Juan bought a hat.'

In addition to this word, order, SDZ also has several word orders in which one or more constituents with a special discourse function precede the verb. Of these variants, one in which the subject appears in the internal topic position is particularly frequent, yielding SVO order:

2) Juáàny ù-zìì' tòyby xhùmbrèhjl. SVO
Juan com-buy a hat

'Juan bought a hat.'

2.2 Aspect marking

SDZ verbs are preceded by one of six possible aspect markers. The most frequent allomorphs of these aspect markers are shown below, but there is a significant degree of irregularity in the aspect marking system.

3)

completive	(g)u-/be-
continuative	cá(y)-
negative	ni-/ny-
potential	gí-/gú
habitual	r-
definite future	s-/z-

The completive, continuative, habitual, and potential aspect markers are shown for the following fairly regular verb /-ù'ld/ 'to sing':

4) bì-'ld=bí 'S/he sang.'
com-sing=3

cáy-ù'ld=bí 'S/he is singing.'
con-sing=3

r-ù'ld=bí 'S/he sings.'
hab-sing=3

gú-'ld=bí 'S/he will sing.'
pot-sing=3

s-ú'ld=bí 'S/he will sing.'
def-sing=3

The negative aspect does not typically appear in a main clause, but only in the complement to a predicate of negation:

5) Ííty Juáàny ny-ù'ld 'Juan didn't sing.'
not Juan neg-sing

2.3 SDZ auxiliaries[2]

The SDZ auxiliaries under discussion are *ràjc* 'to be possible; can', *byàlòò* 'to stop', and *zéhzàà* 'to continue'. They appear in examples like the following. Note that the main verb matches the auxiliary in aspect.

6) R-àjc r-ù'ld Juáàny
hab-can **hab**-sing Juan

'Juan can sing.'

7) B-yàlòò b-yàjb nìjsgìì.
com-stop **com**-fall rain

'Rain stopped falling.'

8) B-yàlòò ù-dòàb Juáàny gèhjs.
com-stop **com**-smoke Juan cigarette

'Juan stopped smoking.'

The auxiliary *zéhzàà* 'to continue' is irregularly inflected.[3] Its aspectual forms are as follows:

9)	zéhzàà	habitual aspect
	gwììzàà	completive aspect
	chíízàà	potential aspect

Despite the unusual inflection of the auxiliary *zéhzàà* 'to continue', its complement continues to show regularly inflected, matching aspect:

10) Zéhzàà rr-gòàb Juáàny gèhjs.
hab:go **hab**-smoke Juan cigarette

'Juan keeps smoking cigarettes.'

[2] These auxiliaries correspond to what are labeled 'non-modal auxiliaries' in San Lucas Quiaviní Zapotec (Munro and Lopez 1999).

[3] Compare this to the irregular inflection of the verb *zéhéh* 'to go': *zéhéh* habitual aspect, *gwìì* completive aspect, *chíí* potential aspect.

11) Gwììzàà ù-dòàb Juáàny gèhjs.
com:go **com**-smoke Juan cigarette

'Juan kept smoking cigarettes.'

12) Chíízàà cóáb Juáàny gèhjs.
pot:go **pot**:smoke Juan cigarette

'Juan will keep smoking.'

A very distinctive property of auxiliary verbs in SDZ is that they are the only verbs in the language that are not followed by overt subjects:

13) *R-àjc Juáàny r-ù'ld
hab-can Juan hab-sing

'Juan can sing.'

This is very important, since SDZ is not a pro-drop language, and all other verbs are obligatorily followed by overt subjects.

14) a. Ù-zìì' Juáàny tòyby xhùmbréhèhjl.
com-buy Juan a hat

'Juan bought a hat.

b. *Ù-zìì' **Ø** tòyby xhùmbréhèhjl.
com-buy a hat

'Bought a hat.'[4]

In this respect, SDZ is rather like English. It requires a pronominal subject in such instances, which will normally be cliticized to the verb. The pronominal clitic does not co-occur with an overt post-verbal subject:[5]

---

[4] I've included a null symbol Ø in the position of the missing subject purely as an expository device; by this I do not intend to suggest that there is a corresponding empty category in the c-structure representation.

[5] SDZ does have a construction like English left-dislocation ('John, he bought a hat'), but this requires the subject to appear in the external topic position at the left periphery of the clause. See Broadwell (2001) for more discussion

15) a. Ù-zìì'=**éhby** tòyby xhùmbréhèhjl.
com-buy=3 a hat

'He bought a hat.'

b. *Ù-zìì'=**éhby** Juáàny tòyby xhùmbréhèhjl.
com-buy=3 John a hat

'John he bought a hat.'

The fact that auxiliaries are not followed by subjects seems to distinguish them sharply from raising predicates such as *cáàdy* 'still not', which must followed by a subject, which is interpreted as the subject of a following XCOMP:

16) a. Cáàdy Màríí [gí-dòbyá' **Ø**].
still:not Maria pot-worry

'Maria still isn't worrying.'

b. *Cáàdy [gí-dòbyá' Màríí].
still:not pot-worry Maria

Thus, although auxiliaries are frequently treated as raising verbs in syntactic analyses of English and other languages, that is not the correct analysis for Zapotec.

I will argue that sentences containing such auxiliaries form monoclausal f-structures with the main verbs that follow them. But the auxiliary and main verb appear in one of two possible c-structures, approximately as follows:

Figure 2 Two c-structures for auxiliary verbs

The following sections present evidence that there is a single, monoclausal f-structure for auxiliaries, while there are two possible c-structures – one monoclausal and one biclausal.

3 Monoclausality at f-structure

Control and selection facts seem to argue for a monoclausal f-structure, as argued in the following sections.

3.1 Control

Evidence for monoclausality comes from the behavior of auxiliaries when they occur in combination with control verbs.

Like English, SDZ allows to the subject be omitted from c-structure in control contexts. However, SDZ imposes an additional, somewhat unusual, condition on control. A complement clause may have a missing subject only if its antecedent is non-pronominal. Consider the following examples with the control verb *rrcà'z* 'to want' .[6]

18) Rr-cà'z Juáàny [gú-'ld **Ø** gìtàrry].
hab-want Juan pot-play guitar

'Juan wants to play guitar.'

19) Rr-cà'z**=bí** [gú-'ld=**bí** gìtàrry].
hab-want=3 pot-play=3 guitar

'He wants to play guitar.'

20) *Rr-cà'z=**bí** [gú-'ld **Ø** gìtàrry.]
hab-want=3 pot-play guitar

'He wants to play guitar.'

Only a subject may be omitted in a control context; all other arguments of the verb in the complement clause must be overt:

21) a. Rr-cà'z Juáàny [í-chàgí'ld **Ø** Màríí].
hab-want Juan pot-tickle Maria

'Juan wants to tickle Maria.'

b. *Rr-cà'z Juáàny [í-chàgí'ld Màríí **Ø**].
hab-want Juan pot-tickle Maria

[6] The fact that null subjects and pronominal subjects alternate with each other, based on the pronominal status of the antecedent seems to argue that these cases should be treated as anaphoric control, rather than functional control. See Dalrymple (2001:328ff) for discussion of cross-linguistic and/or cross-analytic variation on this point.

('Juan wants Maria to tickle him.')

In that light, consider the following examples:

22) Rr-cà'z Juáàny [í-zálòò gúùny **Ø** yù'.]
hab-want Juan pot-stop pot:do house

'Juan wants to stop (i.e. finish) building the house.'

23) a. Rr-cà'z=**bí** [í-zálòò gúùny=**bí** yù'.]
hab-want Juan pot-stop pot:do=3 house

'Juan wants to stop building the house.'

b. *Rr-cà'z=**bí** [í-zálòò gúùny **Ø** yù'.]
hab-want Juan pot-stop pot:do house

'Juan wants to stop building the house.'

Note that in (22), we see omission of the subject in the lower clause. Furthermore, (23) shows that such omission is only available with a non-pronominal subject of the upper clause. If the syntactic subject of 'finish' were not 'Juan', this would be a puzzling anomaly, since the two subjects would not be coreferential.

However, we can understand this example if we think of 'stop building' as a complex predicate with 'Juan' as its subject, along the following lines:

$$\begin{bmatrix} \text{PRED} & \text{'want < SUBJ, COMP >'} \\ \text{ASP} & \text{HABITUAL} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'Juan'} \end{bmatrix} \\ \text{COMP} & \begin{bmatrix} \text{PRED} & \text{'stop-building < SUBJ, OBJ >'} \\ \text{ASP} & \text{POTENTIAL} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{'house'} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

3.2 Selection

There also seem to be selectional facts that support a monoclausal f-structure. Verbs which select for a lower COMP or XCOMP impose selectional restrictions on the aspect of that clause.

For example, the verb *rr-cà'z* 'to want' requires potential aspect in its COMP :

24) a. Rr-cà'z Juáàny [gú-'ld **Ø** gìtàrry].
hab-want Juan pot-play guitar

'Juan wants to play guitar.'

b. *Rr-cà'z Juáàny [r-ú'ld **Ø** gìtàrry].
hab-want Juan hab-play guitar

'Juan wants to play guitar.'

We could express this in the lexical entry for *rr-cà'z* as follows:

25) *rr-cà'z* V (↑ PRED) = 'want <SUBJ, COMP>'
(↑ COMP SUBJ PRED)= 'PRO'
(↑ COMP ASP) = POTENTIAL

When there is a complex predicate in the COMP of *rr-cà'z,* both verbs must be inflected for potential aspect:

26) Rr-cà'z Juáàny [í-zálòò gúùny **Ø** yù'.]
hab-want Juan **pot**-stop **pot**:do house

'Juan wants to stop building the house.'

There is a similar argument available from the raising predicate *íity* 'not'. This predicate requires that its complement appear in the negative aspect:

27) Íity Juáàny ny-ù'ld 'Juan didn't sing.'
not Juan **neg**-sing

If the complement is an auxiliary + main verb complex predicate, then both verbs appear in the negative aspect. Compare the following two examples:

28) Gàjc cú' bxhùùz=ríí' mììs.
pot:can **pot**:have priest=that mass

'That priest can celebrate the mass.'

29) Íity ny-àjc ní-gú' bxhùùz=ríí' mììs.
not **neg**-can **neg**-have priest=that mass

'That priest cannot celebrate the mass.'

The fact that auxiliary and main verb share the same aspect marking, and that selection of clause aspect by a higher predicate determines the aspect of both verbs seems to argue for a monoclausal f-structure as well.

4 Diagnostics of c-structure monoclausality

The primary diagnostic for c-structure monoclausality comes from the placement of adjuncts. The basic principle of SDZ adjunct placement is that adjuncts adjoin to the S, IP, or CP that they modify. The position of the adjuncts is determined by their scope, and adjuncts fall into three groups, which I have labeled labeled Adv_1, Adv_2, and Adv_3 in Figure 1.[7]

The most informative group of adjuncts for our purposes is Adv_3, which is made up of manner adverbials and instrumental adjuncts. Adjuncts of this class may appear either at the beginning or end of the S constituent, but no higher in the tree.

30) a. [Cùn dè] ù-dì'by Màríí làjdy.
with soap:powder com-wash Maria clothes

b. Ù-dì'by Màríí làjdy [cùn dè]
com-wash Maria clothes with soap:powder

'Maria washed the clothes with soap powder.'

Note that placement of an Adv_3 higher in the tree is ungrammatical or leads to the wrong reading.

31) a. Bì-èhlà'z=á' [ù-dì'by Màríí làjdy [cùn dè]
com-forget=1 com-wash Maria clothes with soap:powder

'I forgot that Maria washed the clothes with soap powder.'

b. *[Cùn dè] bì-èhlà'z=á' [ù-dì'by Màríí làjdy
with soap:powder com-forget=1 com-wash Maria clothes

In sentences which contain an auxiliaries, manner adverbs and instrumental adjuncts freely appear before the auxiliary:

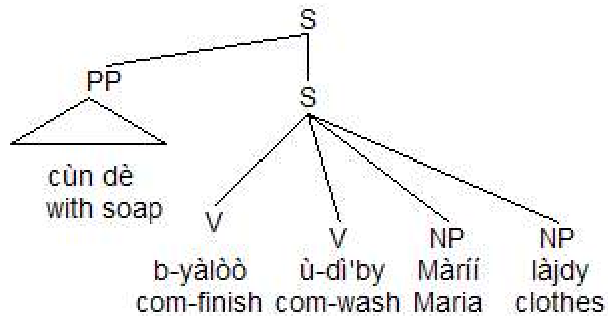
32) a. B-yàlòò ù-dì'by Màríí làjdy [cùn dè].
com-finish com-wash Maria clothes with soap:powder

[7] Principles of adjunct placement and their utility in identifying constituency are discussed in more detail in Broadwell (2001).

b. [Cùn dè] b-yàlòò ù-dì'by Màríí làjdy .
with soap:powder com-finish com-wash Maria clothes

'Maria finished washing the clothes with soap powder.'

This is argues for a monoclausal structure for the auxiliaries. If we assign a c-structure like the following, then the adjunct placement facts make sense:



7 Diagnostics for a biclausal c-structure

There are also phenomena that seem to show the possibility of a biclausal analysis for the auxiliaries.

7.1 Coordination

Consider the following examples of auxiliaries with coordinated complements.

41) Bál chízàà [cóàb Juáàny] [gì'í Juáàny], zùùn=ní máàl lèh'èhby.
if pot:continue pot:smoke Juan pot:drink Juan pot:do=3i harm 3

'If Juan continues smoking and drinking, it will do harm to him.'

Note that in this example, 'continue' is interpreted as taking scope over both verbs. That suggests that *cóàb Juáàny* 'Juan smokes' forms a constituent, contrary to the predictions of the monoclausal analysis.

The following example shows the same thing for the auxiliary *byàlòò*:

42) B-yàlòò [gù' Juáàny] chì'í [ù-dòàb=bí gèhjs].
com-stop com:drink Juan and [com-smoke=3 cigarette

'Juan stopped drinking and smoking cigarettes.'

Since SDZ does not seem to show any other instances of non-constituent coordination, the most straightforward analysis of such examples would suggest that the main verb and subject form a constituent, as follows:

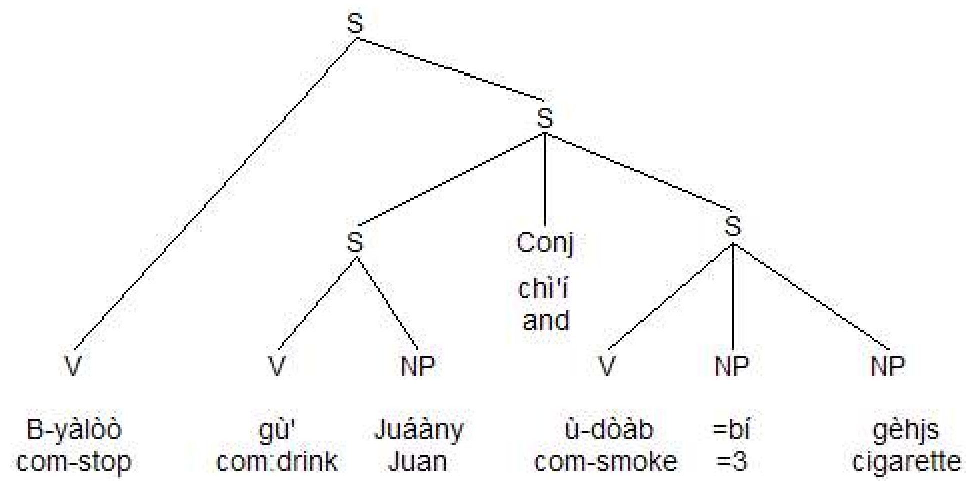


Figure 4 C-structure for example (41)

7.2 Adverb placement

While some adverb placements support the monoclausal structure, others support the biclausal structure. Consider the following examples:

44) Zájc ì-cuá' Màríí gèhèht xîì.
pot:can pot-throw Maria tortilla tomorrow

'Maria can make tortillas tomorrow.'
'Maria puede echar tortillas mañana.'

OK Zájc xîì ì-cuá' Màríí gèhèht.
pot:can tomorrow pot-throw Maria tortilla

45) Ràjc rr-xrù'ny Juáàny ngàngá'.
hab:can hab-run Juan quickly

'Juan can run quickly.'
'Juan puede correr rápido.'

OK Ràjc ngàngá' rr-xrù'ny Juáàny.
hab:can quickly hab-run Juan

These word orders seem to necessitate a biclausal structure. Since in the biclausal structure, there are two S nodes, it should be possible for an adverb of the right type to adjoin to either of these S's. If auxiliaries had a strictly monoclausal representation, it would be very difficult to explain why S-adjoined adverbs should be able to appear inside the S.

The most appropriate c-structure seems to be along the following lines:

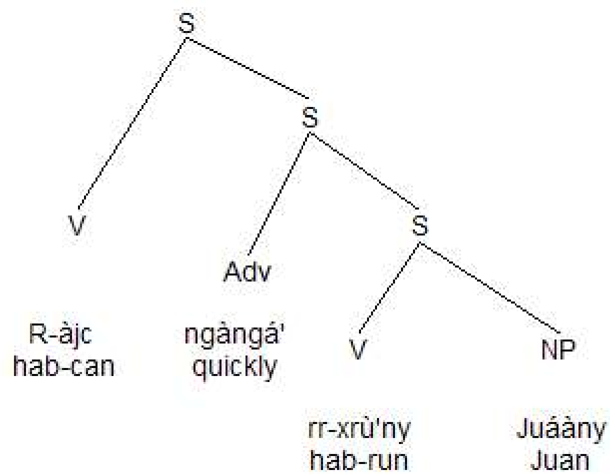


Figure 5 C-structure for (44)

But this c-structure presupposes the possibility of a biclausal representation for the auxiliary + main verb.

9 Toward a general account of parallel structures

I would like to suggest that the tension between monoclausal and biclausal structures arises from the relative ranking of two broad families of constraints: F-C ISOMORPHISM constraints favors candidates in which elements of f-structures correspond directly to elements of c-structures. LCS-C ISOMORPHISM constraints favor candidates in which elements of Lexical-Conceptual Structures (Jackendoff 1990, 1991) correspond to elements of c-structures. I believe that there may be a number of such constraints, depending on which elements of these structures are considered.

The specific constraints that are relevant in this case are the following:

50) LCS (EVENT) = C-STR (CONSTIT)
Lexical-Conceptual Structure Events are in a one-to-one correspondence with C-structure constituents.

51) F-STR (NUCLEUS) = C (CONSTIT)
F-structure nuclei are in a one-to-one correspondence with C-structure constituents.

If we consider an SDZ sentence like (52) containing an auxiliary it will have a biclausal

LCS (shown in simplified form as in figure 6), but a monoclausal f-structure (as in figure 7).[8]

52) B-yàlòò ù-dòàb Juáàny gèhjs.
com-stop **com**-smoke Juan cigarette

'Juan stopped smoking cigarettes.'

$$\left[_{Event}\text{STOP }\left(\left[_{Event}\text{smoke (John, cigarette)}\right]\right)\right]$$

Figure **(6)** Lexical-Conceptual structure for (52)

$$\begin{bmatrix} \text{PRED} & \text{'stop-smoking (SUBJ, OBJ)'} \\ \text{ASP} & \text{completive} \\ \text{SUBJ} & \begin{bmatrix}\text{PRED} & \text{'John'}\end{bmatrix} \\ \text{OBJ} & \begin{bmatrix}\text{PRED} & \text{'cigarette'}\end{bmatrix} \end{bmatrix}$$

Figure **(7)** F-structure for (52)

In a language where F-STR (NUCLEUS) = C (CONSTIT) strictly outranks LCS (EVENT) = C-STR (CONSTIT), c-structures will be uniformly monoclausal, because fidelity to f-structure is more important than fidelity to LCS. In a language where LCS (EVENT) = C-STR (CONSTIT) strictly outranks F-STR (NUCLEUS) = C (CONSTIT), c-structures will be uniformly biclausal.

However, in languages where these two constraints have overlapping strength, we would predict that both monoclausal and biclausal structures would be optimal, and in any particular case would be dependent on the relative strength of the two constraints at instantiation.

We can think of the tableau in the following way, where the input is taken to be the LCS and the candidates are f-str/c-str pairs:

[8] Jackendoff (1991:38) gives a more precise LCS for 'stop', the details of which are not crucial to this argument.

$[_{Event}\text{STOP}\ ([_{Event}\text{smoke (John,cigarette)}])]$ **LCS input**	F-STR (NUCLEUS) = C (CONSTIT)	LCS (EVENT) = C-STR (CONSTIT)
$\left[\begin{array}{ll}\text{PRED} & \text{'stop-smoking (SUBJ,OBJ)'}\\ \text{ASP} & \text{completive}\\ \text{SUBJ} & [\text{PRED}\ \ \text{'John'}]\\ \text{OBJ} & [\text{PRED}\ \ \text{'cigarette'}]\end{array}\right]$ ☞$[_S$ stop smoke John cigarette] (**monoclausal c-structure**)		*
$\left[\begin{array}{ll}\text{PRED} & \text{'stop-smoking (SUBJ,OBJ)'}\\ \text{ASP} & \text{completive}\\ \text{SUBJ} & [\text{PRED}\ \ \text{'John'}]\\ \text{OBJ} & [\text{PRED}\ \ \text{'cigarette'}]\end{array}\right]$ ☞ $[_S$ stop $[_S$ smoke John cigarette]] (**biclausal c-structure**)	*	

More generally, in such an analysis the appearance of parallel structures in French, Spanish, Urdu, and Zapotec is a result of overlapping strength between the constraint that favors LCS -- c-structure isomorphism and the constraint that favors f-structure – c-structure isomorphism. Viewed in this light the emergence of two constituent structures in complex predication is a consequence of the interactions of the constraints that regulate the parallel representations of clause structure.

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Complex Predicates via Restriction

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Abstract

This paper continues the discussion of the RESTRICTION OPERATOR (Kaplan and Wedekind, 1993) and whether it can provide a linguistically adequate solution to the problem posed by syntactic complex predicate formation. The solution introduced here has been implemented as part of an on-going project aimed at the development of a computational grammar for Urdu and can be shown to model the linguistic facts of syntactic complex predicate formation as described by (Alsina, 1996) and (Butt, 1995). This also allows for a straightfoward extension to related phenomena in other languages such as German, Japanese, Norwegian, and French.

1 Introduction

(Alsina, 1996), (Butt, 1995) and (Mohanan, 1994) argue that complex predicate (CP) formation in Romance and Urdu/Hindi,[1] respectively, should take place in the syntax.[2] While the linguistic facts point towards the need to combine two or more predicational elements into one predicational domain within the syntax, a computational treatment which models this theoretical idea has so far proved elusive. (Kaplan and Wedekind, 1993) proposed a solution in terms of a RESTRICTION OPERATOR. However, their solution had the effect of lexically stipulating combinatoric possibilities on a verb-by-verb basis. Given that CP formation is regular and productive, and given that different types of CPs may be stacked, this essentially lexical approach proved to be inadequate.

In this paper, we report on an implementation of CPs for Urdu in the Parallel Grammar (ParGram) project (Butt et al., 1999; Butt et al., 2002) which models the original observations by Alsina and Butt more satisfactorily. The basic tool for analysis remains the restriction operator, but its application has been reformulated to model productive CP formation in the syntax, instead of the within the lexicon.

2 South Asian Complex Predicates

South Asian languages are known for the extensive and productive use of CPs. CPs combine a light verb with a verb, noun, or adjective to produce a new verb. For example, Urdu has a large class of light verbs which combine with verbs to modulate the event predication in terms of aktionsart properties and more subtle semantic effects such as suddenness or forcefulness. Examples are shown in (1b,c) for V-V CPs. (1a) shows a simplex use of the same main verb.[3]

(1) a. nAdyA AyI
Nadya.Nom come.Perf.F.Sg
'Nadya came.'

b. nAdyA A gayI
Nadya.Nom come go.Perf.F.Sg
'Nadya arrived.'

c. nAdyA A paRI
Nadya.Nom come fall.Perf.F.Sg
'Nadya arrived (suddenly, unexpectedly).'

[1]Mohanan discusses N-V complex predicate formation, whereas this paper focuses on V-V complex predicates. We therefore leave aside N-V complex predication for the purposes of this paper.

[2](Frank, 1996) argues against this position and places complex predicate formation within the lexical component. However, while the subcategorization requirements and the restrictions on combinations are specified within the lexical entries (as is done in this paper), her approach must still crucially combine the separate pieces of the complex predicate in the syntax. That is, they are not assumed to be combined within the morphological component.

[3]The transcription here follows the ASCII transcription used for the implementation of the Urdu grammar. This is to allow maximum readability of the c-structure and f-structure output of the grammar, samples of which are to follow. Long vowels are marked with a capital letter, as are retroflex consonants. Nasalization is marked with an N, aspiration with an H.

The semantic effects of the light verbs in combination with a main verb are subtle and have been described in a wealth of literature (see, e.g., (Hook, 1974) for an overview, (Butt, 1995) for an initial analysis within LFG, (Butt and Geuder, 2001) and (Butt and Ramchand, 2003) for more recent work). Within the scope of this paper, only those effects which are necessary for an understanding of the implementation are discussed. We thus simplify the observed semantics somewhat (this is necessary because at this time the Urdu grammar lacks a proper semantic component) and differentiate between two major classes of light verbs: light verbs like 'go' signify the completion of an action, whereas light verbs like 'fall' signify inception. This in line with the observed linguistic facts, though this is not all that the individual light verbs are capable of.

Although these light verbs do not alter the subcategorization frame of the verb, they change the resulting functional structure of the sentence, providing new information about the kind of event/action that is being described. The light verb also determines case marking on the subject: light verbs based on intransitive main verbs like *paR* 'fall' require a nominative subject. Light verbs like *lE* 'take' or *dE* 'give', which are based on (di)transitive main verbs, require an ergative subject. For example, transitive main verbs in the perfect tense usually require an ergative subject, as in (2a). When combined with a light verb like *paR* 'fall', the subject must be nominative as in (2b). Case marking in Urdu is governed by a combination of structural and semantic factors which we do not discuss here (Butt and King, 2001; Butt and King, 2003). The light verb facts present an extension of the basic pattern.

(2) a. nAdyA=nE gAnA gayA
Nadya=Erg song.Nom sing.Perf.M.Sg
'Nadya sang a song.'

b. nAdyA gAnA gA paRI
Nadya.Nom song.Nom sing fall.Perf.F.Sg
'Nadya burst into song.'

c. nAdyA=nE gAnA gA lIyA
Nadya=Erg song.Nom sing take.Perf.M.Sg
'Nadya sang a song (completely).'

As already mentioned, these CPs are very productive in Urdu: most verbal predication involves complex predicate formation of the kind in (1) and (2). A light verb is in principle compatible with any main verb; however, (mostly semantic) selectional restrictions do apply so that some combinations are ruled out completely, whereas others are subject to considerable dialectal variation. Furthermore, the CPs are not formed within the lexicon, but are the result of the *syntactic composition* of two predicational elements (Alsina, 1996; Butt, 1995). Within LFG (as well as other syntactic frameworks), predicational elements play a special role: it is over these that argument saturation is checked. The difficulties involved with CP formation are better illustrated by means of another type of CP, the Urdu permissive, which contriibutes its own arguments to the joint predication (Butt, 1995). The permissive light verb contributes a permitter (agent) which is realized as a subject. The highest argument of the main verb must therefore be realized as a non-subject function: it surfaces as a dative-marked thematic object, as in (3b), cf. (3a).

(3) a. nAdyA sOyI
Nadya.Nom sleep.Perf.F.Sg
'Nadya slept.'

b. yassin=nE nAdyA=kO sOnE dIyA
Yassin=Erg Nadya=Dat sleep.Inf.Obl give.Perf.M.Sg
'Yassin let Nadya sleep.'

Since both types of CPs are productive and occur frequently, an implementation that is both scalable and effi cientis necessary. Most verbs are compatible with several different light verbs and these combinations in turn are compatible with further sets of light verbs. It is therefore not feasible to have multiple lexical entries for each verb depending on which light verb they occur with. This is especially true since the CPs also combine with auxiliaries in predictable ways. The problem to be resolved is thus how two verbs with indepedent predicational information can be combined to form a single predicational domain which can then interact with other elements of the syntax such as auxiliaries in exactly the same manner that a single verb would.

3 The ParGram Project

The ParGram project (Butt et al., 1999; Butt et al., 2002) originally focused on three European languages: English, French, and German. Three other languages were added later: Japanese, Norwegian, and Urdu. The ParGram project uses the XLE parser and grammar development platform (Maxwell and Kaplan, 1993) to develop deep grammars, i.e., grammars which provide an in-depth analysis of a given sentence (as opposed to shallow parsing or chunk parsing, where a relatively rough analysis of a given sentence is returned).

All of the grammars in the ParGram project use the Lexical-Functional Grammar (LFG) formalism. Given that f-structures are assumed to encode a language universal level of analysis, one of the aims of ParGram is to see how far f-structure parallelism can be maintained across languages. In the project, analyses for similar constructions across languages are therefore held as similar as possible and the conventions developed within the ParGram grammars are extensive. The ParGram project dictates not only the form of the features used in the grammars (Butt et al., 2003), but also the types of analyses chosen for constructions. This parallelism requires the formulation of a rigid standard for linguistic analysis. This standardization has the computational advantage that the grammars can be used in similar applications, and it can simplify cross-language applications such as machine translation (Frank, 1999).

4 Implementation

In this section, we discuss the XLE implementation of restriction and how it is used to analyze Urdu complex predicates.

4.1 Without Restriction: Lexical Rules

The XLE implementation in use when Urdu joined ParGram allowed for basic modifi cationsof predicates. In particular, it had an implementation of lexical rules that was suffi cientto handle the English passive: argument grammatical functions could be renamed or deleted.

An example of this is shown in (4) for the Urdu passive; the template is practically identical to that of English. In this template, _SCHEMATA indicates the predicate with grammatical functions of the verb (e.g., for transitive ‘open’: $'$kHOl$<$($\uparrow$SUBJ)($\uparrow$OBJ)$>'$). In the active, nothing happens (left disjunct) except that a PASSIVE $-$ feature is added. In the passive, the object becomes the subject and the original subject is deleted (right disjunct). Example outputs are shown in (5) for the verb $'$kHOl$<$($\uparrow$SUBJ)($\uparrow$OBJ)$>'$.

(4) PASS(_SCHEMATA) =

_SCHEMATA	**or**	_SCHEMATA
($\uparrow$ PASSIVE) = $-$		($\uparrow$ OBJ) $\longrightarrow$ ($\uparrow$ SUBJ)
		($\uparrow$ SUBJ) $\longrightarrow$ NULL
		($\uparrow$ PASSIVE) = +

(5) a. Active:
’kHOl$<$($\uparrow$SUBJ)($\uparrow$OBJ)$>$’
($\uparrow$PASSIVE)=$-$

b. Passive:
’kHOl$<$NULL,($\uparrow$SUBJ)$>$’
($\uparrow$PASSIVE)=$+$

However, this operation over lexical items is not sufficient to cover Urdu CPs since the operations over predicate-argument structure that are necessary cannot be handled within the lexicon. (Kaplan and Wedekind, 1993) proposed that the problem of Urdu CPs is reminiscent of the head-switching type of structural mismatch discussed in the context of machine translation. Here, the predicate that is the head in one language (source language) must be rendered as an adverb or embedded predicate in another language (target language) and a different predicate is "elevated" to play the role of the head. (Kaplan and Wedekind, 1993) proposed that complex predication could be thought of in similar terms: although the main verb of a complex predicate provides the bulk of the predicational infomation, the light verb serves as the syntactic head of the construction in that it inflects for tense, etc. In order to solve the general problems associated with such structural mismatches, (Kaplan and Wedekind, 1993) introduced the notion of RESTRICTION. However, as first formulated for the Urdu permissive, the solution only allowed the application of the restriction operator within the lexicon and thus did not take into account the powerfully recursive nature of complex predication in Urdu, which allows different types of CPs to be stacked (Butt, 1994).

4.2 Restriction

A viable computational treatment of complex predication retreated into the background until the discussion arose again with respect to a special type of Norwegian passive. This brought the issue of complex predication into the forefront of the ParGram project discussions. As part of these, a solution was found in the implementation of restriction within XLE in which the restriction applies as part of the *syntactic composition* of two predicates.

Restriction allows f-structures and predicates to be manipulated in a controlled and detailed fashion. Given an f-structure like (6a), for example, it might be necessary to restrict out the case information (e.g., in order to assign some other case to the f-structure). In this situation, the restriction operator '/' can be applied to the current f-structure (↑/CASE) in order to arrive at the restricted f-structure in (6b). A restricted f-structure is thus identical to the original f-structure except that it does not contain the restricted attribute.

(6) a. $\begin{bmatrix} \text{PRED} & \text{'nAdyA'} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \\ \text{CASE} & \text{erg} \end{bmatrix}$ b. $\begin{bmatrix} \text{PRED} & \text{'nAdyA'} \\ \text{PERS} & 3 \\ \text{NUM} & \text{sg} \end{bmatrix}$

4.3 Event Modulating Complex Predicates

In this section, we discuss the rules necessary to analyze event modulating CPs with restriction in the Urdu grammar. A sample event modulating CP is shown in (7).

(7) nAdyA has paRI
Nadya.Nom laugh fall.Perf.F.Sg
'Nadya laughed (suddenly, unexpectedly).'

With these CPs, the light verb does not contribute an independent argument. Rather, it contributes information which pertains to the manner and type of the event (e.g., inceptive, telic) and which also thereby contributes information about the highest argument of the main verb (e.g., whether the action was deliberate or not) and which thus indirectly influences the case marking on the subject. In the current implementation, such essentially lexical semantic information is coded under the feature LEX-SEM. This feature must be restricted since CP formation can affect its values. Furthermore, the VTYPE must be restricted because the syntax needs to know that the verbal predication is that of a complex predicate, rather than that of a simplex verb.

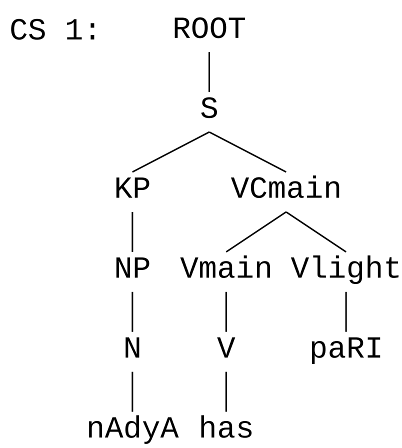
The annotated phrase structure rule for these CPs is shown (8).[4]

(8) $$\text{Vasp} \longrightarrow \underset{\downarrow\text{/VTYPE/LEX-SEM}=\uparrow\text{/VTYPE/LEX-SEM}}{\text{Vmain}} \quad \underset{\downarrow=\uparrow}{\text{Vlight}}$$

The main verb and the light verb are co-heads in this construction: both are annotated ↓=↑. The PRED is provided by the Vmain; Vlights have no PRED in their lexical entry. However, both Vmains and Vlights can have VTYPE values which may conflict. By restricting out the VTYPE, the final f-structure receives a VTYPE `complex-pred` which is provided by the lexical entry of the Vlight. This is shown in the f-structure in (10).

An example of the current analysis of the event modulating CP in (7) is shown in (9) and (10). The c-structure in (9) allows for a verbal complex which expands into a main verb followed by a light verb. There is no compelling evidence that Urdu has a VP (i.e., that a verb and its object are contained under one constituent); hence we do not assume one. Urdu is furthermore a language with fairly free word order, so the trees are quite flat: noun phrases are represented as sisters to one another under S (see the c-structures in (14) and (17)). We do assume KPs (Kase Phrases). Case markers in Urdu act as clitics to NPs (Butt and King, 2003), and as such have their own phrase structure node. In (9) the subject is nominative, which is phonologically null; so the KP has an empty head. A full KP can be seen in the c-structure analysis for the permissive in (14).

(9) C-structure tree for event modulating CP



[4]Some implementational details have been supressed here. For example, a grammar internal feature called CHECK is restricted out; the CHECK feature is used in CPs to make sure that constraining equations for the case markers are satisfied on the final f-structure and not on the restricted one. This can be seen in the sample f-structure in (10).

In addition, the rules are shown in cannonical LFG notation and not in the ASCII friendly XLE notation.

(10) F-structure AVM for event modulating CP

```
"nAdyA has paRI"

   PRED      'has<[0:Nadya]>'
             PRED       'Nadya'
   SUBJ      NTYPE      [PROPER name]
             SEM-PROP   [SPECIFIC +]
            0CASE nom, GEND fem, NUM sg, PERS 3
   CHECK     [_VMORPH [_MTYPE infl]]
   LEX-SEM   [AGENTIVE -]
   TNS-ASP   AKTIONSART [INCEPTIVE +, TELIC +]
             ASPECT perf, MOOD indicative
 19PASSIVE -, STMT-TYPE decl, VTYPE complex-pred

   PRED      'has<[0:Nadya]>'
   SUBJ      [0:Nadya]
   CHECK     [_RESTRICTED +]
   TNS-ASP   [19-TNS-ASP]
 14LEX-SEM unerg, PASSIVE -, STMT-TYPE decl, VFORM bare
```

The top f-structure in (10) represents the final analysis of the CP. The bottom f-structure shows the f-structure of the main verb *has* 'laugh'. The features which have been restricted from the main verb's f-structure are VTYPE and LEX-SEM because these are the features which the light verb can "overwrite". In the case of (10), the VTYPE feature is provided entirely by the light verb. Within the ParGram project, the feature X-TYPE is used to encode distinctions within a given category X which are useful at the f-structure level of analysis. The English grammar, for example, encodes different kinds of adverbs (sentential, degree modifiers, etc.) via the feature ADV-TYPE. In the Urdu grammar, we use the feature VTYPE to register the type of the verbal predication. So, in (10), the final top structure has VTYPE `complex-pred`. The lower structure for the main verb has LEX-SEM `unerg` because *has* 'laugh' by itself is an unergative verb; this is restricted and does not appear in the final CP analysis.

The light verb provides all of the TNS-ASP features in the final f-structure of this example. The AKTIONSART feature contains the information that the event is both inceptive and telic. The general effect of this type of complex predication is the denotation of a result state (a song is in the state of having been sung, a person is in the state of having arrived or having laughed). However, a result state can be interpreted in two differing ways depending on whether one wants to focus on the inception or the completion of the event (the two concepts seem to be orthogonal). The precise interpretation is lexically determined by the light verbs. For the purposes of the Urdu grammar, we mark light verbs like 'go' as signifying completion of an action, whereas light verbs like 'fall' signify inception.

4.4 Permissive Complex Predicates

The restriction operation for permissive CPs is more interesting from a technical point of view because both the verbs contribute participants independently to the overall predicate-argument structure. A sample permissive with an intransitive verb is shown in (11).

(11) yassin=nE nAdyA=kO sOnE dIyA
Yassin=Erg Nadya=Dat sleep.Inf give.Perf.M.Sg
'Yassin let Nadya sleep.'

In this type of CP, the event denotations of the two verbs are not as closely intertwined. In the previous examples, the light verb serves to modulate the event structure of the main verb. In this example, a permissive event contains the information that another event was allowed to take place. In theoretical terms and in terms of our implementation, this can be modeled by specifying that the light verb *dE* has a PRED which takes as its second argument the main verb's PRED. The lexical entry for *dE*'s PRED is shown in (12).

(12) (↑ PRED)='dE<(↑ SUBJ),%PRED2>'

Since both the main verb and the light verb have a PRED, the PRED must be restricted out in the permissive CPs. The basic rule for this is in (13).

(13) V ⟶ V Vlight
↓/PRED/SUBJ/VTYPE/LEX-SEM=↑/PRED/SUBJ/OBJ-GO/VTYPE/LEX-SEM ↑=↓
(↑ PRED ARG2)=(↓ PRED)
(↑ OBJ-GO)=(↓ SUBJ)

First consider the similarities between the rule for the permissive CPs in (13) and that for the event modulating CPs in (8). In both cases, the verbs are co-heads, as indicated by the ↑=↓ annotations. Also, the main verb has the VTYPE and LEX-SEM restricted since the CP as a whole may have a different VTYPE and LEX-SEM than that of the main verb. Next consider the differences between the two rules. In the permissive, both the main verb and the light verb have a PRED. As such, the PRED is restricted out from the main verb. In addition, the SUBJ of the main verb is not the SUBJ of the CP. As such, the SUBJ is also restricted. The two equations under the restriction equation state how the grammatical functions of the main verb map onto the grammatical functions of the CP. First, the PRED of the main verb is assigned to the second argument of the CP. Second, the SUBJ of the main verb is assigned to the OBJ-GO (goal restricted object) of the CP. Any other grammatical functions of the main verb will remain the same in the CP. This will be illustrated below when the main verb is transitive; in this case, the main verb's OBJ is also the OBJ of the CP.

The results of the application of the rule in (13) are shown in the resulting f-structures in (15) for an intransitive main verb and in (18) for a transitive main verb. First consider the structures for the intransitive main verb in (11) which are shown in (14) and (15).

(14) C-structure tree for permissive CP

```
CS 1:    ROOT
          |
          S
   _______|________
  KP     KP     VCmain
 /  \   /  \    /     \
NP  K  NP  K  Vmain  Vlight-prec
|   |  |   |   |        |
N  nE  N  kO   V       dIyA
|      |       |
yassin nAdyA  sOnE
```

(15) F-structure AVM for permissive CP

```
"yassin nE nAdyA kO sOnE dIyA"

   PRED      'dE<[0:Yassin], 'sO<[16:Nadya]>'>'
             PRED      'Yassin'
             NTYPE     [PROPER name]
   SUBJ      SEM-PROP  [SPECIFIC +]
           0 CASE erg, GEND masc, NUM sg, PERS 3
             PRED      'Nadya'
             NTYPE     [PROPER name]
   OBJ-GO    SEM-PROP  [SPECIFIC +]
          16 CASE dat, GEND fem, NUM sg, PERS 3
   CHECK     [_VMORPH [_MTYPE infl]]
   LEX-SEM   [AGENTIVE +, GOAL +]
   TNS-ASP   [ASPECT perf, MOOD indicative]
51 GEND masc, NUM sg, PASSIVE -, PERS 3, STMT-TYPE decl, VTYPE complex-pred

   PRED   'sO<[16:Nadya]>'
   SUBJ   [16:Nadya]
   CHECK  [_NMORPH obl, _RESTRICTED +]
32 GEND masc, LEX-SEM unerg, NUM sg, PASSIVE -, PERS 3, STMT-TYPE decl, VFORM inf
```

Recall that the light verb *dE* 'give' effectively adds a subject argument and demotes the subject of the main verb to an OBJ-GO. Restricting the PRED and SUBJ of the main verb's f-structure allows the final f-structure to assign new grammatical functions when necessary, i.e., to demote the SUBJ Nadya to an OBJ-GO and to inherit any remaining arguments of the main verb. The light verb *dE* 'give' subcategorizes for a subject (the permitter) and a predicate, as seen in the lexical entry in (12). In (15), the PRED feature has the value of a *composite* argument structure, namely a combination of the subcategorization frame of *dE* 'give' (subject and another predicate) and the subcategorization frame of *sO* 'sleep' modulo the operations licensed via the restriction operator.

In (15), the main verb was the intransitive *sO* 'sleep' and so there were no arguments for the CP to inherit other than the demoted subject. The analysis in (18) shows what happens with a transitive main verb like *banA* 'make'.

(16) yassin=nE nAdyA=kO gHar banAnE dIyA
Yassin=Erg Nadya=Dat house.Nom make.Inf give.Perf.M.Sg
'Yassin let Nadya build a house.'

(17) C-structure tree for permissive CP

```
CS 1:       ROOT
             |
             S
   __________|_____________________
  |        |     |                 |
  KP       KP    KP             VCmain
 /  \     /  \   |             /      \
NP   K   NP   K  NP        Vmain    Vlight-pred
|    |   |    |  |           |          |
N   nE   N   kO  N           V         dIyA
|        |       |           |
yassin nAdyA   gHar        banAnE
```

(18) F-structure AVM for permissive CP

```
"yassin nE nAdyA kO gHar banAnE dIyA"

   PRED      'dE<[0:Yassin], 'banA<[16:Nadya], [32:gHar]>'>'
             PRED      'Yassin'
             NTYPE     [PROPER name]
   SUBJ      SEM-PROP  [SPECIFIC +]
            0 CASE erg, GEND masc, NUM sg, PERS 3
             PRED      'Nadya'
             NTYPE     [PROPER name]
   OBJ-GO    SEM-PROP  [SPECIFIC +]
           16 CASE dat, GEND fem, NUM sg, PERS 3
             PRED  'gHar'
   OBJ       NTYPE [GRAIN count]
           32 CASE nom, GEND masc, NUM sg, PERS 3
   CHECK     [_VMORPH [_MTYPE infl]]
   LEX-SEM   [AGENTIVE +, GOAL +]
   TNS-ASP   [ASPECT perf, MOOD indicative]
72 PASSIVE -, PERS 3, STMT-TYPE decl, VTYPE complex-pred
```

```
   PRED     'banA<[16:Nadya], [32:gHar]>'
   SUBJ     [16:Nadya]
   OBJ      [32:gHar]
   CHECK    [_NMORPH obl, _RESTRICTED +]
   LEX-SEM  [AGENTIVE +]
47 PASSIVE -, PERS 3, STMT-TYPE decl, VFORM inf
```

The main verb *banA* ‘make’ has two arguments: a subject and an object. This is indicated in the bottom f-structure in (18). The top f-structure represents the final analysis. Here the SUBJ, PRED, and VTYPE features of the main verb’s f-structure have been restricted. The VTYPE feature now states that this is a `complex-pred`. As in the previous example, the PRED feature has the value of a composite argument structure. This results in an overall three-place CP which subcategorizes for a subject via the subcategorization frame of *dE* ‘give’, a restricted object (OBJ-GO) which is the demoted subject of *banA* ‘make’, and finally an object which is inherited from the subcategorization frame of *banA* ‘make’. Despite the fact that the arguments come from different sources and that the predication is complex (as evidenced by the nesting inside the PRED value in the top f-structure), at the level of f-structure, the arguments function like those of a simplex predicate (cf. Butt 1995).

4.5 Stacked Complex Predicates

One of the main motivations for doing CP formation in the syntax in Urdu was their ability to stack. In particular, a permissive CP can be formed from an event modulating CP. A stacked CP from an intransitive and from a transitive verb are shown in (19).

(19) a. yassin=nE nAdyA=kO sO jAnE dIyA
Yassin=Erg Nadya=Dat sleep go.Inf give.Perf.M.Sg
‘Yassin let Nadya sleep.’

b. yassin=nE nAdyA=kO gHar banA lEnE dIyA
Yassin=Erg Nadya=Dat house.Nom make take.Inf give.Perf.M.Sg
‘Yassin let Nadya build a house.’

These stacked CPs follow straightforwardly from the analyses of the event modulating and permissive CPs. The only change that needs to be made is to allow the permissive to either take a main verb as its complement or an event modulating CP; no new restriction equations need to be applied. The c-structure and f-structure for (19a) are shown in (20) and (21).

(20) C-structure tree for permissive of event modulating CP

```
CS 1:      ROOT
             |
             S
   ----------+-------------
   |         |            |
   KP        KP         VCmain
  /  \      /  \       /      \
 NP   K    NP   K    Vasp    Vlight-prec
 |    |    |    |    /   \        |
 N   nE    N   kO  Vmain Vlight  dIyA
 |         |         |     |
yassin   nAdyA       V    jAnE
                     |
                     sO
```

(21) F-structure AVM for permissive of event modulating CP

"yassin nE nAdyA kO sO jAnE dIyA"

```
   [PRED     'dE<[0:Yassin], 's0<[16:Nadya]>'>'
   |         [PRED      'Yassin'                                   ]
   |SUBJ     |NTYPE     [PROPER name]                              |
   |         |SEM-PROP  [SPECIFIC +]                               |
   |        0[CASE erg, GEND masc, NUM sg, PERS 3                  ]
   |         [PRED      'Nadya'                                    ]
   |OBJ-GO   |NTYPE     [PROPER name]                              |
   |         |SEM-PROP  [SPECIFIC +]                               |
   |       16[CASE dat, GEND fem, NUM sg, PERS 3                   ]
   |CHECK    [_VMORPH [_MTYPE infl]]
   |LEX-SEM  [AGENTIVE +, GOAL +]
   |TNS-ASP  [ASPECT perf, MOOD indicative, TENSE past]
 72[GEND masc, NUM sg, PASSIVE -, PERS 3, STMT-TYPE decl, VTYPE complex-pred]

   [PRED    's0<[16:Nadya]>'
   |SUBJ    [16:Nadya]
   |CHECK   [_RESTRICTED +]
   |TNS-ASP [AKTIONSART [TELIC +]]
 32[GEND masc, LEX-SEM unerg, NUM sg, PASSIVE -, PERS 3, STMT-TYPE decl, VFORM bare]

   [PRED    's0<[16:Nadya]>'
   |SUBJ    [16:Nadya]
   |CHECK   [_NMORPH obl, _RESTRICTED +]
   |LEX-SEM [AGENTIVE -]
   |TNS-ASP [32-TNS-ASP]
 46[GEND masc, NUM sg, PASSIVE -, PERS 3, STMT-TYPE decl, VFORM inf, VTYPE complex-pred]
```

In (21), there are three f-structures. The top f-structure is the final one with the permissive subject Yassin and the thematic goal object Nadya. The bottom two correspond to the main verb and the event modulating complex predicate's f-structures which are restricted.

5 Conclusions

The solution described above in terms of syntactic composition of arguments via the restriction operator allows the manipulation of subcategorization frames outside of the lexicon. This is particularly important as CPs in Urdu/Hindi and other languages are productive and separable in the syntax: they do not present instances of compounding or any other form of lexicalization. A sophisticated manipulation of subcategorization frames outside of the lexicon has not been previously possible, but finds clear applications for CPs crosslinguistically. The Urdu grammar has pioneered the use of restriction in the ParGram project. Since the implementation is recent, the exact details of the CP analysis within the Urdu grammar are subject to change. One issue which remains to be fully resolved is the interaction of different types of light verbs and the modeling of the verbal complex as a whole. Since the verbal complex includes different kinds of auxiliaries (passive, progressive), modals, and light verbs which combine with main verbs, adjectives, and nouns, the collection of interacting phenomena is complex.

A possible immediate application of the restriction operator within the ParGram project would be to the well known problem of *suru* 'do' and other CPs found in Japanese. In addition, the restriction operator opens up an innovative treatment of a subtype of the Norwegian passive, as in (22a), and allows for a potentially more satisfactory treatment of the German *lassen* 'let' construction, as in (22b), and the French causative *faire* 'make', as in (22c).

(22) a. Kniven blir skåret kjøtt med.
the-knife is cut meat with
'The knife cut the meat.'

b. Der Fahrer hat den Traktor reparieren lassen.
the.Nom driver has the.Acc tractor repair let
'The driver had the tractor repaired.'

c. Paul fera passer son examen à Jean.
Paul make.Fut take his exam to Jean
'Paul made Jean take his exam.'

The current ParGram analyses treat these phenomena as instances of basic complement taking verbs, a solution which is not supported by the linguistic evidence and discussions amassed within theoretical linguistics.

In addition, (Wedekind and Ørsnes, 2003) are exploring using restriction as a mechanism for capturing well-formedness conditions on verbal complexes. There have been a number of approaches to this problem in LFG (see (Falk, 2003) for an overview). Analyses have included treating each verb/auxiliary as heading its own XCOMP and having a separate projection in which to state these restrictions. (Wedekind and Ørsnes, 2003) check for the restrictions as the c-structure is built up, but restrict out the features so that the final f-structure is very simple.

Syntactic restriction provides a scalable and efficient solution for the general phenomenon of complex predication in LFG gramamrs. Our implementation makes use of the restriction operator originally proposed by (Kaplan and Wedekind, 1993), but is in line with the original observations (e.g., (Alsina, 1996; Butt, 1995)) as to the nature and function of complex predication.

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Generating LFGs with a MetaGrammar

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Abstract

In this paper, we build up on the work presented in [Clément and Kinyon, 2003b], and [Kinyon and Rambow, 2003b]: we present the notion of MetaGrammar, which was originally successfully used to ease the development and maintenance of large Tree-Adjoining Grammars. We explain how we reuse the notion of MetaGrammar in order to generate LFGs. The main idea is that a compact MetaGrammar hierarchy is hand-crafted, from which large grammars are automatically generated offline. We argue that MetaGrammar hierarchies should abstract as much as possible from any given syntactic framework and machinery, and be closer to "descriptive linguistics" in order to facilitate porting hierarchies from one framework to another framework. We also discuss work in progress such as generating grammars for different languages and frameworks from a single MetaGrammar hierarchy.

1 Introduction

Regardless of the syntactic framework considered, the two most common ways to obtain wide-coverage grammars are either to extract grammars from a treebank, or to hand-craft grammars as is done for LFG in the ParGram project [Butt et al., 2002], for TAG in the Xtag project [XTAG Research Group, 2001], for HPSG in the Matrix [Bender et al., 2002] or even for some application-specific frameworks (e.g. Microsoft WinNLP [Suzuki, 2002]). As discussed in [Kinyon and Prolo, 2002], both approaches have well-known advantages and drawbacks. Here, we propose a "middle-way" between hand-crafted and automatically extracted grammars: the use of a MetaGrammar (MG). The main idea is that a compact MG hierarchy is hand-crafted, from which grammars are automatically generated offline. More specifically, we explain how this MetaGrammar approach, which was successfully used to develop and maintain Tree-Adjoining Grammars, is used to generate Lexical Functional Grammars. Moreover, we focus on crafting MG hierarchies in a framework-neutral manner, which means that we try to remain as close as possible to descriptive linguistics and abstract from the machinery of any given framework in order to facilitate the cross-framework portability of the the grammars we generate.

2 What is a MetaGrammar ?

2.1 Candito's MetaGrammar organization

The notion of MetaGrammar (MG) was originally presented in [Candito, 1996] to automatically generate wide-coverage TAGs for French and Italian[1], using a higher-level and compact layer of linguistic description which imposes a general organization for syntactic information in a three-dimensional hierarchy:

- Dimension 1: initial subcategorization
- Dimension 2: valency alternations and redistribution of functions
- Dimension 3: surface realization of arguments.

[1]A Similar MetaGrammar type of organization for TAGs was independently presented in [Xia, 2001] for English.

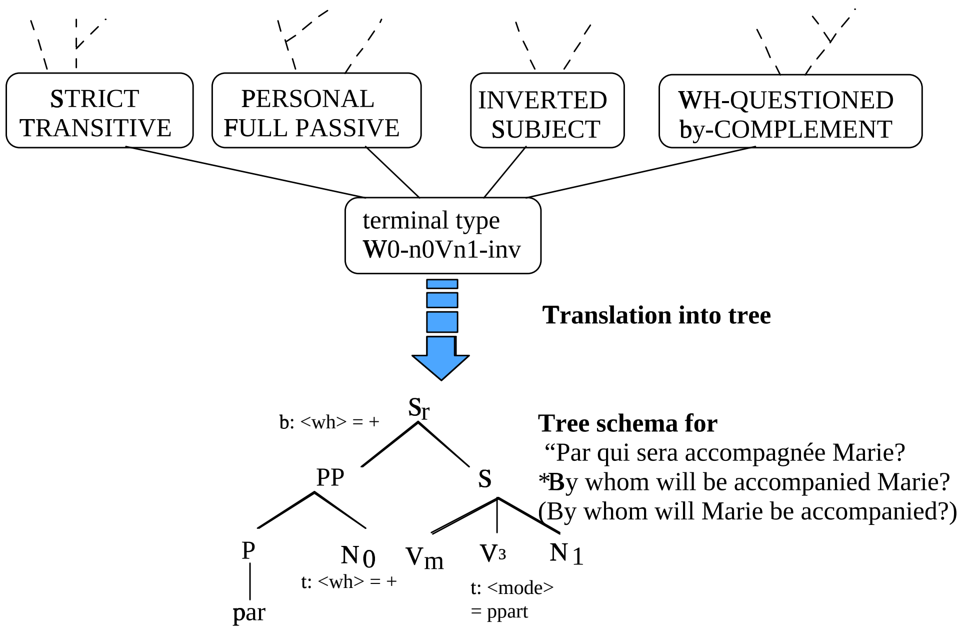

Figure 1: Generation of an elementary tree for “Par qui sera accompagnée Marie”

A MetaGrammar hierarchy is hand-crafted. From this hierarchy, a grammar is generated automatically offline. Each terminal class in dimension 1 encodes an initial subcategorization (i.e. transitive, ditransitive etc...); Each terminal class in dimension 2 encodes a list of valency alternations i.e. a possible change in the initial functions from dimension 1, including the possibility to increase or decrease the number of syntactic functions to be realized (e.g. to add an argument for causatives, to erase one for passive with no agents ...); Each terminal class in dimension 3 encodes the surface realization of a syntactic function i.e. its phrase-structure realization (e.g. declares if a direct-object is pronominalized, wh-extracted, etc.). Each class in the hierarchy is associated to the partial description of a tree, using a first-order logic language described in [Rogers and Vijay-Shanker, 1994]. These partial descriptions of trees, called **Quasi-trees**, encode **father**, **dominance**, **equality** and **precedence** relations between tree nodes. A well-formed tree is generated by inheriting from exactly one terminal class from dimension 1, one terminal class from dimension 2[2], and n terminal classes from dimension 3 (where n is the number of arguments of the TAG elementary tree being generated). For instance, as illustrated in figure 1, the elementary tree - i.e. TAG rule - for *“Par qui sera accompagnée Marie” (“By whom will be accompanied Mary”)* is generated by inheriting from STRICT-TRANSITIVE in dimension 1, from PERSONAL-FULL-PASSIVE in dimension 2 and INVERTED-SUBJECT for its subject and WH-QUESTIONED-BY-COMPLEMENT for its object in dimension 3.[3] This particular tool was used to develop, from a compact hand-crafted hierarchy of a few dozen classes, a wide-coverage TAG for French of 5000

[2]This terminal class may be the result of the crossing of several super-classes, to handle complex phenomena such as *Passive+Causative.*

[3]We thank M.H. Candito for kindly allowing us to reproduce Figure 1 to illustrate her work.

elementary trees [Abeillé et al., 1999], as well as a medium-size TAG for Italian [Candito, 1999]. The compactness of the hierarchy is due to the fact that classes are defined only for **simple** syntactic phenomena: classes for complex syntactic phenomena (e.g. passive-no-agent + dative-shift) are generated by automatic crossings of classes for simple phenomena.

Although we use a different and newer MetaGrammar compiler, we essentially retain the linguistics insight of [Candito, 1996] and retain her three-dimension hierarchy, with a slight rephrasing of dimension 3: in our approach, dimension 3 encodes not only the surface realization of syntactic arguments, but also the surface realization of syntactic heads (including verbs) and of modifiers. It is also worth mentioning that dimension 3 contains in fact several distinct sub-dimensions, namely one sub-dimension for each possible syntactic function (e.g. SubjectRealization, DirObjectRealization, SecondObjRealization, SententialComplementRealization, VerbRealization, ModifiersRealization).

2.2 HyperTags

The grammar rules we generate are sorted by syntactic phenomena, thanks to the notion of *HyperTag*, introduced in [Kinyon, 2000]. HyperTags were inspired by the concept of Supertags, presented in [Joshi and Srinivas, 1994] and [Srinivas, 1997], as well as by Candito's MetaGrammar. Supertagging consists in assigning one or more TAG elementary tree to lexical items, thus providing richer syntactic and morpho-syntactic information than traditional part-of-speech tagging[4]. For example, the TAG elementary from fig. 1 would be a supertag for the verb *"accompagnée"* in *"Par qui sera accompagnée Marie" (By whom will be accompanied M.)*. This supertag informs us not only that the POS is a verb, but also gives us information about the syntactic properties of that verb (It is transitive; Passive with a Wh-extracted by-phrase etc.).

One main problem of supertags though, is that they are framework-dependent (i.e. specific to Tree Adjoining Grammars). Moreover, supertags are dependent on a specific TAG grammar: in figure 1, the supertag has a topology specific to a given grammar. One could associate to the verb *"accompagnée"* a supertag from another grammar, which could be topologically very different (e.g. with branching VP nodes) and yet capture/encode the very same syntactic properties.

Finally, supertags present some readability issues. For instance, the supertag for *"accompagnée"* could be represented using any standard tree notation, such as (S (PP (P par) N0) (S V V N)). Such notation already presents some readability issues. In practice however, esp. when supertagging with a very large grammar, one is more like to use a notation such as *"accompagnée:tree167"*, which is then even less informative than a simple POS tag.

In order to address some of these issues, we proposed in [Kinyon, 2000] the concept of HyperTags. The main idea behind HyperTags is to keep track, when trees (i.e. grammar rules) are generated from a MetaGrammar hierarchy, of which preterminal classes were used for generating the tree. This allows one to obtain a framework-independent feature structure containing the salient syntactic characteristics of each grammar rule. So for instance, the verb "*accompagnée*" from figure 1 in "*Par qui sera accompagnée Marie*" - instead of being assigned a supertag - would be assigned the following HyperTag, which contains a direct projection of the names of the classes in fig. 1:

[4] One main goal of super-tagging is to perform a first-pass disambiguation in linear time w.r.t. a potential input string in order to improve the performance of TAG parsers, but this is orthogonal to our discussion.

$$\begin{bmatrix} \text{Subcat} & \text{Strict-Transitive} \\ \text{Valency alternations} & \text{Personal-Full-Passive} \\ \text{Argument Realization} & \begin{bmatrix} \text{Subject:} & \text{Inverted} \\ \text{Object:} & \text{Wh-Questioned-by-Complement} \end{bmatrix} \end{bmatrix}$$

So, instead of using Candito's MetaGrammar implementation, we retain her linguistic insights (i.e. her three dimensions to model syntax), but use a more recent MetaGrammar tool, which was developed at LORIA, and which explicitly supports the notion of HyperTags.

Although the LORIA tool was also originally designed to generate TAGs, it turned out to be less framework-dependent. Additionally, this tool is monotonic and is more flexible because it does not impose a fixed-number of dimensions or sub-dimensions.[5]

2.3 The LORIA MetaGrammar tool

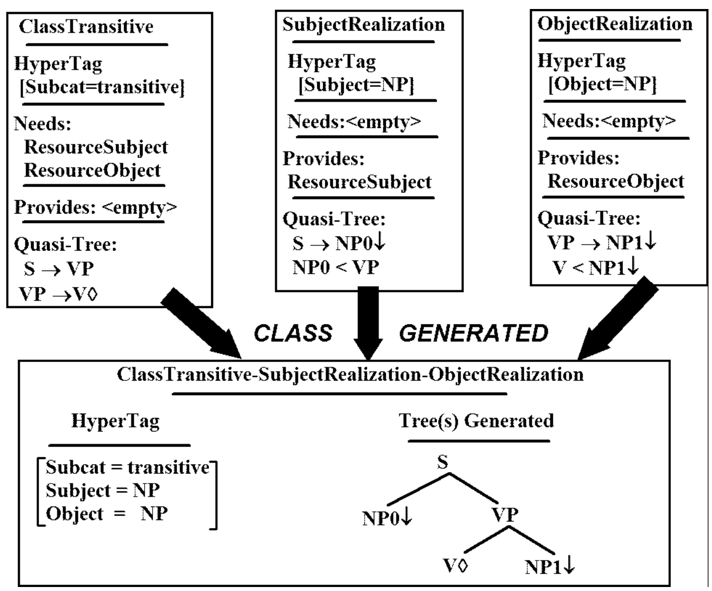

Figure 2: Generation of a simple TAG rule $\rightarrow$ stands for father, $<$ for precedes,$\diamond$ for a lexical anchor and $\downarrow$ for substitution node in the TAG terminology.

To generate TAGs and LFGs, we use a MG compiler developed at LORIA and presented in [Gaiffe et al., 2002] and [Gaiffe et al., 2003]. This compiler is freely available.[6] In the LORIA tool, each class in the MG hierarchy encodes:

- Its SuperClasse(s)[7]
- A HyperTag to capture the main syntactic properties of that class

[5] For example, Candito's compiler did not easily allow one to encode sub-dimensions for Verb-Realizations, or for Modifier-Realizations.

[6] http://www.loria.fr/equipes/led/outils/mgc/mgc.html

[7] Both the LORIA tool and Candito's tool allow multiple inheritance.

- Which resource(s) the class needs and provides
- A Topological content (TC) consisting of:
  - A set of tree nodes
  - Topological relations between those nodes (*father, dominates, precedes, equals*)
  - A function for each node to decorate the tree (e.g. for traditional agreement features and/or LFG functional equations)

The MG tool automatically crosses the classes in the hierarchy, looking to create "balanced" classes, that is classes that do not need nor provide any resource. Then for each balanced terminal class, the HyperTags inherited from its super-classes are unified, and the topological constraints (i.e. quasi-trees) are conjoined; If the HyperTag unification succeeds, one or more minimal satisfying description(s) are computed from the quasi-tree, and one or more <HyperTag, tree> pairs are generated. Figure 2 illustrates the generation of an elementary tree for a canonical transitive ("*J. sees M.*"): CLASSTRANSITIVE needs a ResourceSubject and a ResourceObject, class SUBJECTREALIZATION provides a ResourceSubject, class OBJECTREALIZATION provides a ResourceObject. When these three classes are automatically crossed by the compiler, one obtains a CLASSTRANSITIVE-SUBJECTREALIZATION-OBJECTREALIZATION which is terminal and balanced, i.e. it does not need nor provide any resource. Hence, the HyperTags of the three non terminal classes are unified and a minimal satisfying description is successfully computed for the quasi-tree:
$(S \rightarrow VP) \wedge (VP \rightarrow V) \wedge (S \rightarrow NP0) \wedge (NP0 < VP) \wedge (VP \rightarrow NP1) \wedge (V < NP1)$.

3 Generating LFGs with a MetaGrammar

3.1 Interpretation of the MetaGrammar output

The LORIA MG compiler outputs <HyperTag, tree> pairs. When generating a TAG, $HyperTag$ encodes the main syntactic properties of a TAG elementary tree (i.e. grammar rule), and $tree$ is interpreted as a TAG elementary tree.

When generating an LFG, $HyperTag$ encodes the main syntactic properties of a terminal class, and $tree$ corresponds to one or more LFG rewriting rules.

In order to generate LFGs, we retain (with a few exceptions) the same hierarchy as for TAGs. However, we enrich the topological content of each class in the hierarchy by decorating tree nodes with LFG functional equations.[8] Thus, in a first step the MetaGrammar compiler generates trees which are no longer TAG elementary trees, but rather "hybrid" trees, which are decorated with standard TAG notations (substitution nodes, foot nodes, anchor nodes etc.), but also with standard LFG notations, (in a way which is similar to constituent trees decorated with functional annotation e.g. by [Frank, 2000]). In a second step, these hybrid trees are split on the one hand into one TAG elementary tree and, on the other hand, into a decorated constituent tree which is further broken down into one or more LFG rewriting rule(s).[9] Figure 3 illustrates how a simple decorated tree is generated with the MG compiler, and how the decorated tree is decomposed into one TAG elementary tree and into two LFG rewriting rules for a canonical transitive construction. Note that

[8] These functional equations are attached to quasi-tree nodes using the same mechanism as for traditional feature-structures for agreement.

[9] In a third step, rewriting rules which differ only by the name of their non-terminals are merged, in a manner similar to that of [Hepple and van Genabith, 2000].

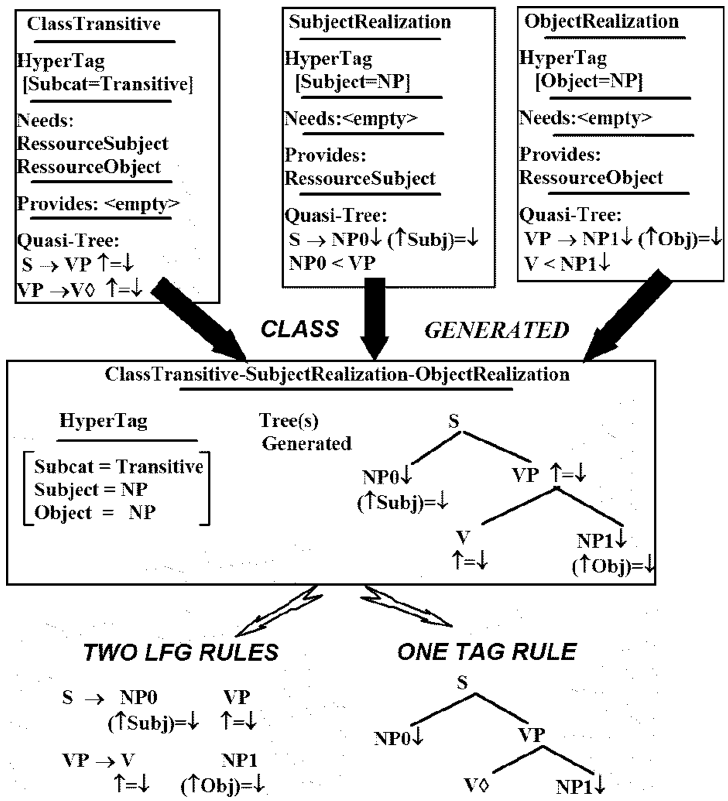

Figure 3: A simple hierarchy which yields one decorated tree, corresponding to one TAG rule and two LFG rules

the only difference between figures 2 and 3 is that in the latter, the tree nodes in the topological content of the classes are decorated with LFG functional equations.

In addition to generating LFG rewriting rules, and in order to ease the grammar-lexicon interface, each decorated tree also yields a LFG lexical template which is generated using the information encoded in the HyperTag: in figure 3, a template for a transitive subcategorization frame SubjObj:V(↑Pred=‘x$<$(↑Subj)(↑Obj)$>$’).

[Clément and Kinyon, 2003b] discuss the motivations for generating trees of depth possibly greater than one, and decomposing these trees into one or more LFG rewriting rules (instead of directly generating trees of depth one i.e. rewriting rules), as well as the motivations for using a MetaGrammar to generate LFGs. Note that a notion of resource-sensitivity similar to the one which is present in the MetaGrammar is found in LFG work on semantics [Dalrymple et al., 1995].

Word order variations are handled by leaving some precedence and/or dominance relations between quasi-tree nodes underspecified. For instance figure 4 illustrates then generation of two decorated trees for handling canonical ditranstitives in French. Contrary to English, both word-orders NP$_{Obj}$-PP$_{SecObj}$ and PP$_{SecObj}$-NP$_{Obj}$ are allowed (eg: *“Jean donne à Marie une pomme/ une pomme à Mary” - J. gives to M. an apple/ an apple to M.*). In the topological content of the classes, the precedence relation between the direct object NP and the second object PP is left underspecified. Hence, two decorated trees are obtained from the quasi-tree description: $(S \rightarrow VP) \wedge (VP \rightarrow V) \wedge (S \rightarrow NP0) \wedge (NP0 < VP) \wedge (VP \rightarrow NP1) \wedge (V < NP1) \wedge (VP \rightarrow PP) \wedge (V < PP)$

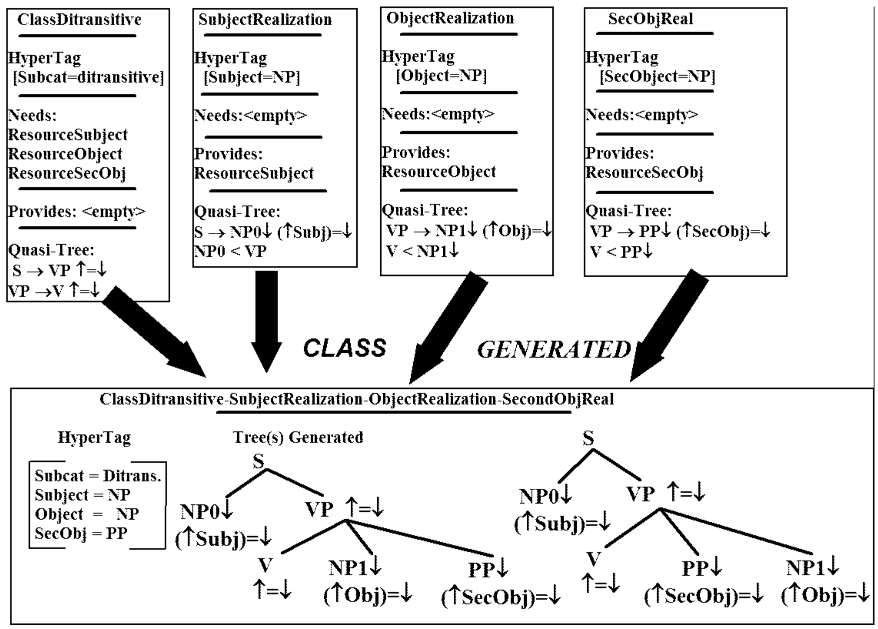

Figure 4: French ditransitives: an example of word-order variations

The LFG rewriting rules we generate from a MG hierarchy contain "standard" LFG notations (i.e. $\uparrow$, $\downarrow$, parenthesis for optionality, Kleene star, constraint equations etc.). However, we do not generate rules containing the additional LFG operators defined in [Kaplan and Maxwell, 1996] (e.g. "shuffle", "ignore or insert"), essentially for two reasons: first, those operators are helpful for developing/maintaining hand-crafted LFGs, but, since our grammars are automatically generated and never edited in a post-generation phase[10], generating rules containing these additional operators would not make much sense. Second, those operators make it possible to express the same rewriting rules in many different ways, which seems to be a not so desirable property. This point is discussed in [Clément and Kinyon, 2003b]. In any event, our decision to generate LFG rules without the [Kaplan and Maxwell, 1996] operators, as well as without lexical rules (see section 4.1 below) has no incidence in interfacing our grammars with existing parsers.[11]

[10] i.e. only the MG hierarchies are edited, never the rules which are automatically generated

[11] So far, we have used the freely available XLFG parser described in [Clément and Kinyon, 2001] and have also experimented with the Medley parser described in [Kaplan and Maxwell, 1996].

3.2 Handling completeness, coherence and uniqueness at the MetaGrammatical level

Linguistic well formedness conditions, such as a “Predicate-Argument Cooccurence Principle” must be defined for TAG elementary trees in order to enforce completeness, coherence and uniqueness constraints, whereas LFG rewriting rules typically do not need to follow such principles. So, still for ditransitives in French, one can have an LFG rewriting rule such as:

VP	$\rightarrow$ V	(NP)	(PP)	(NP)
	$\uparrow=\downarrow$	$(\uparrow$Obj$)=\downarrow$	$(\uparrow$SecondObj$)=\downarrow$	$(\uparrow$Obj$)=\downarrow$

In addition to handling the two word-order variations for canonical ditranstitives, this rule also handles the VP expansion for canonical intransitives, as well as for canonical transitives.

If completeness, coherence or uniqueness constraints are violated (e.g. *“*Mary eats an apple to Peter an apple”*), a C-structure will be built, but no corresponding well-formed F-structure. So, as expected, such an ungrammatical sentence will be rejected.

However, because of the resource-sensitivity of the MetaGrammar, coherence, consistency and uniqueness conditions are intrinsically enforced at the metagrammatical level. For example, we see in fig. 3 that a transitive needs a resourceSubject and a resourceObject and in 4 that a ditransitive needs a resourceSubject, a resourceObject and a resourceSecondObject. Therefore, instead of generating a rewriting rule such as the one above, we quite naturally generate rewriting rules which encode completeness, coherence and uniqueness. Namely, we generate four distinct rewriting rules, rule (1) for canonical intransitives, rule (2) for canonical transitives, rules (3) and (4) for the two word-order variations for canonical ditransitives:

1- VP	$\rightarrow$ V		
	$\uparrow=\downarrow$		
2- VP	$\rightarrow$ V	NP	
	$\uparrow=\downarrow$	$(\uparrow$Obj$)=\downarrow$	
3- VP	$\rightarrow$ V	NP	PP
	$\uparrow=\downarrow$	$(\uparrow$Obj$)=\downarrow$	$(\uparrow$SecondObj$)=\downarrow$
4- VP	$\rightarrow$ V	PP	NP
	$\uparrow=\downarrow$	$(\uparrow$SecondObj$)=\downarrow$	$(\uparrow$Obj$)=\downarrow$

As a consequence, for a similar coverage, the grammars we generate are typically larger than hand-crafted LFGs. However, this is not a major problem in practice because those rules are not manually developed nor maintained, and also because the increase in the number of rules is not such that it affects parsing performance.

Moreover, with such an approach, fewer spurious C-structures are built (i.e. C-structures with no corresponding well-formed F-structure), potentially reducing the search space when computing F-structures. Also one could envision a pruning strategy (similar to what is done with supertagging), where a first pass selects in linear time the rules which are compatible with the selectional restrictions of lexical items in a sentence (e.g. For a sentence containing only a strict transtitive verb, rewriting rules for intransitives and ditransitives will be abandonned), and a second pass combines these rules to create a C-structure. Of course it does not reduce the worst-case parsing complexity but can greatly speed up parsing in practice.[12]

[12] Another option would be to resort to guided-parsing, as described in [Barthélémy et al., 2001].

4 Main differences between TAG and LFG

We have seen in section 2 that MetaGrammars were originally used to generate Tree Adjoining grammars. When using a MG to generate LFGs, one must then be able to handle LFG machinery which does not necessarily exists in TAG. In this section, we discuss each of the three main differences between the two frameworks, which are:

- The LFG dichotomy "rewriting rules" versus "lexical rules" does not exist for TAG.
- Long-distance dependencies are handled differently in the two frameworks.
- Modifiers can be handled in a more flexible manner with LFG than with TAG

4.1 Lexical rules

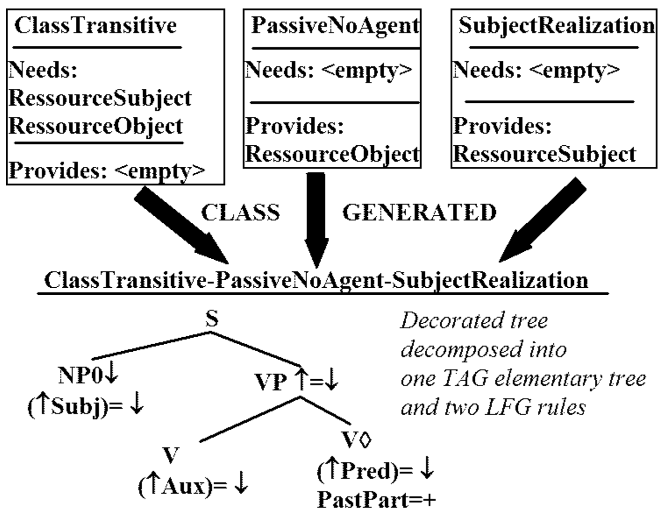

Figure 5: Generating rules for Passive with no agent, without lexical rules

From a linguistic perspective, Candito's dichotomy between "dimension 2" (valency alternations) and "dimension 3" (realization of syntactic functions) amounts to separate what was originally thought of as "syntactic transformations" into two distinct sub-categories: "transformations" where a syntactic function is modified (e.g. passive) versus "transformations" where a syntactic function is not modified (e.g. Wh-movement, cliticization). We were not able to find where this dichotomy originated from. For instance, [Levin, 1993] - who proposes a very extensive and detailed classification of English verbs and their alternations - does not resort to this dichotomy. Our guess is that this distinction between "valency alternations" and "surface realization of syntactic functions" may have been inspired by LFG, partly because it corresponds quite straight-forwardly to the distinction between "lexical rules" and "rewriting rules" in the LFG machinery. Since the distinction is made at the matagrammatical level, there is no need for us to keep - in the grammars we generate - the distinction between lexical rules and rewriting rules. Therefore, we generate LFGs without lexical rules[13] and simply resort to rewriting rules to handle syntactic phenomena

[13]This choice has been made out of linguistic considerations: in practice, the MG compiler could, if we wanted to, generate lexical rules as well.

which are traditionally handled with LFG lexical rules. Figure 5 illustrates the generation of a passive with no agent (ex: *"The apple was eaten"*), which yields two LFG rewriting rules.[14]

Furthermore, LFG lexical rules were to some extent designed to express syntactic generalizations which hold across many subcategorization frames: for instance, the fact that one can passivize transitive verbs, ditransitive verbs, transitive verbs with particles (ex: *''The left-overs were given away to the cats"*) etc. This kind of generalization, which is desirable from a theoretical perspective, but also from a practical perspective to ease grammar development, is already captured by the MetaGrammar. Therefore, if we did generate lexical rules from a MetaGrammar hierarchy, this would amount to express the same kind of linguistic generalization using two distinct mechanisms, which would be redundant.[15]

4.2 Long-distance dependencies

As discussed in [Joshi and Vijay-Shanker, 1989], one major difference between TAG and LFG is the way each of those two frameworks handles long-distance dependencies. To analyze a sentence such as *"Which cat does Mary think that John saw"*, TAG resorts to the extended domain of locality of its elementary trees and to the "adjunction" operation to plug in the elementary tree anchored by *"think"*. This elementary tree anchored by "think" must have a distinguished node, called foot node.[16] The site of the extraction ("*Which cat*") bears no special notation.

To handle the same phenomenon, LFG, resorts to the notion of "functional uncertainty" [Kaplan and Zaenen, 1989]: the node at the site of the extraction must be decorated with a functional uncertainty equation. Figure 6 illustrates the generation of a decorated tree for a Wh-extracted object. The "extracted" tree-node bears a functional uncertainty equation.

4.3 Handling modifiers

With TAG, modifiers are adjoined and therefore modification always yields branching constituent trees. Figure 7 illustrates a simple TAG elementary tree for prenominal adjectives. By adjoining this elementary tree into NP trees, one obtains a constituent structure for e.g. "*Cute little grey kittens*". With LFGs, one can of course obtain such branching structures for modification, but one can also chose - for linguistic reasons - to handle modifiers in a "flatter" manner. For instance, the insertion of modifiers into a VP in French is, contrary to English, very flexible and there is no clear linguistic motivation for handling those VP modifiers in a non flat manner. Figure 8 illustrates how we generate a flat rule for the VP expansion of a ditransitive, which would allow to analyze "*Jean offre chaleureusement un bouquet de fleur chaque matin à Marie avant le départ du train" (lit: J. offers kindly a bouquet of flowers every morning to Mary before the departure of the train)*.[17]

[14]The topological content of the classes are omitted for space reasons.

[15]This argument is clearly visible in the TAG community, where some TAGs are developed using MetaRules - a mechanism similar to LFG lexical rules - whereas some other TAGs are developed using MetaGrammars (c.f. [Kinyon and Prolo, 2002] for a discussion), the main advantages of MG being declarativity and monotonicity.

[16]TAG elementary trees with a foot node are called auxiliary trees

[17]Fig. 8 is simplified for readability. Esp. the topological constraints preventing sequences such as "VP → V Modif1 NP PP Modif2 Modif3" are not shown. The fig simply aims at giving a general idea of how such phenomena are handled using "inheritance chains" in the MG hierarchy.

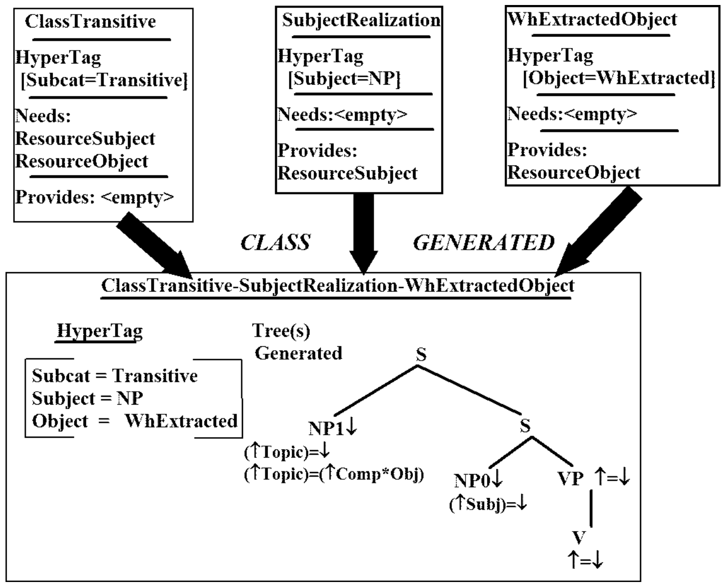

Figure 6: Generating rules with functional uncertainty equations for long distance dependencies

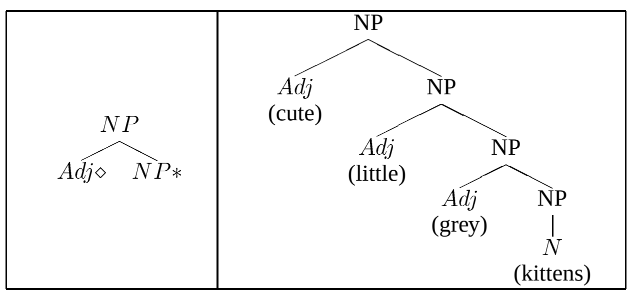

Figure 7: Modifier adjunction yields branching trees.

5 Advantages of the MetaGrammar

A first advantage of using a MetaGrammar, as is detailed in [Kinyon and Prolo, 2002], is that the syntactic phenomena covered are quite systematic: if rules are generated for TRANSITIVE-PASSIVE-WHEXTRACTEDBYPHRASE (e.g. *By whom was the mouse eaten*), and if the hierarchy includes ditransitive verbs, then the automatic crossing of phenomena ensures that rules will be generated for handling DITRANSITIVE-PASSIVE-WHEXTRACTEDBYPHRASE (i.e. *By whom was Peter given a present*). All rules for word order variations are automatically generated by underspecifying relations between quasi-nodes in the MG hierarchy (e.g. precedence relation between first and second object for ditransitives in French as shown in fig. 4). This property proves very useful for encoding in a compact manner MG hierarchies for free word-order languages (e.g. Rus-

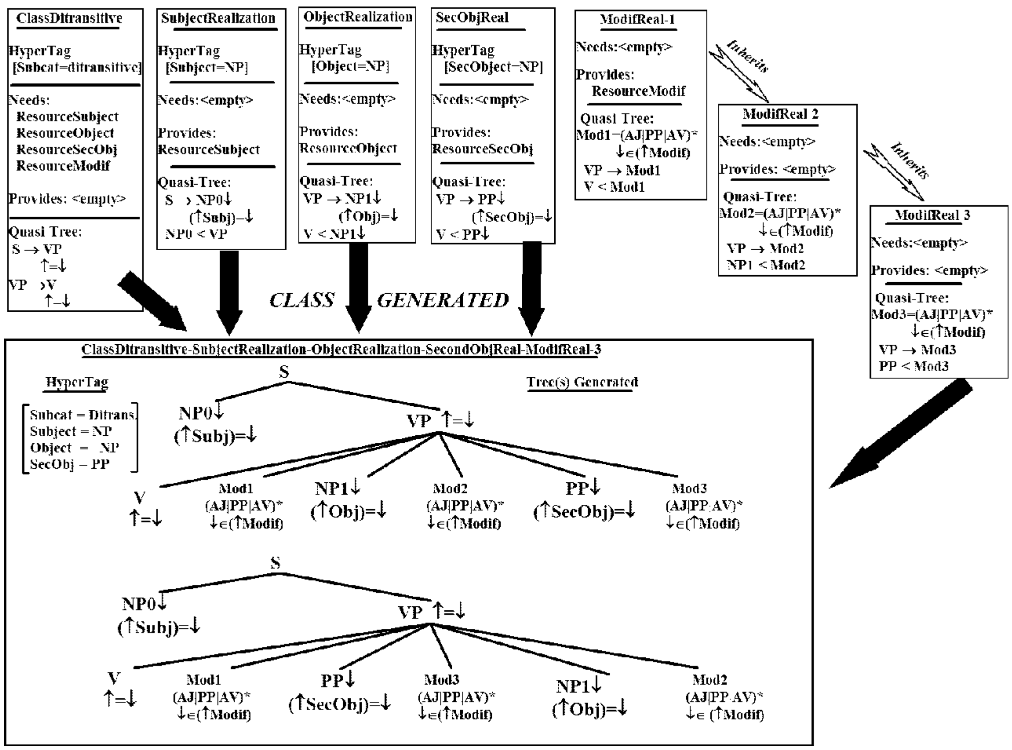

Figure 8: Generating "flat" rules for VP modification

sian, and to some degree German)[18].

A second advantage of the MG is to minimize the need for human intervention in the grammar development process. Humans encode the linguistic knowledge in a compact manner i.e. the MG hierarchy, and then verify the validity of the rules generated. If some grammar rules are missing or incorrect, then changes are made directly in the MG hierarchy and never in the generated rules (esp. "exceptions" are never handled in a post-generation phase) This ensures a homogeneity not necessarily present with traditional hand-crafted grammars.

A third and essential advantage is that it is straightforward to obtain from a single hierarchy parallel multi-lingual grammars similar to the parallel LFG grammars presented in [Butt et al., 1999] and [Butt et al., 2002], but with an explicit sharing of classes in the MetaGrammar hierarchy plus a cross-framework application.[19]

5.1 Handling exceptionality

The MG offers a very convenient way to express generalization. So one question which arises is that of exceptionality, which is of course a major issue in any grammar development effort.

[18] See [Kinyon and Rambow, 2003a] and [Kinyon and Rambow, 2003b] for a discussion.

[19] This sharing of classes in the hierarchy across languages is similar to what is done in the HPSG Matrix project [Bender et al., 2002].

Many syntactic exceptions are lexically determined: a well known example is that of English ditransitives. Some English ditransitives accept both an NP-PP construction and a double NP construction (ex: *"J. gave an apple to M. / J. gave M. an apple"*)[20]. Some ditransitives accept only the double NP construction (ex: *J. tipped the waitress 10 dollars / *10 dollars to the waitress*). Some ditransitives (essentially from Latin origin) accept only the NP-PP construction (ex: *"J. donated a large amount of money to a NGO / *a NGO a large amount of money"*). In the MG, both word-order variations are of course encoded. The appropriate restrictions for a given verb are encoded in its lexical entry. Some other syntactic exceptions are not lexically-driven. Such is the case of the alternation "qui/que" in French when a subject is extracted from a subordinate clause[21]: "que" may be a complementizer, as in (1)[22] or a relative pronoun for an object (2), "qui" is usually never a complementizer, but a relative pronoun for a subject (3) or for an oblique (4). So, when an object is extracted from a subordinate, "que" appears twice: as a complementizer and also as a relative pronoun (5). When an oblique is extracted from a subordinate, "que" appears as a complementizer, and "qui" as a relative pronoun (6). However, when a subject is extracted from a subordinate, then "que" as a complementizer and "qui" as a relative pronoun is ungrammatical (7). Instead, the two are inverted, with "qui" appearing at the site of the complementizer and "que" at the site of relative pronoun (8).

1. *Jean pense que$_c$ Marie viendra / J. thinks that M. will come*
2. *La pomme que$_r$ Marie mange .../The apple which Mary eats*
3. *La femme qui$_r$/*que$_r$ mange des pommes ... / The woman who eats apples ...*
4. *La femme à qui$_r$ J croit que$_c$ Marie donne des fleurs / The woman to whom J. thinks that M. gives flowers*
5. *La pomme que$_r$ Pierre croit que$_c$ Marie mange / The apple that P. believes that M eats*
6. *La femme à qui$_r$ Marie croit que$_c$ Pierre offre des fleurs / The woman to whom M. believes that P. offers flowers*
7. **La femme qui$_r$ Marie pense que$_c$ viendra / The woman who M. thinks that will come*
8. *La femme que$_r$ Marie pense qui$_c$ viendra / The woman that M. thinks who will come*

In practice, the case of a "simple" subject relative (3) will be much more frequent than that of a subject relative extracted from a subordinate (8). Similarly, when a sentential complement is realized, the site of the complementizer "que" will overwhelmingly be filled with "que" (1), rather than "qui". So (8) can be considered to be a syntactic exception.

Nonetheless, when a subject is relativized, we can not know prior to parsing whether it will be extracted from a subordinate (8) or not (3). We never modify rules that have been generated from the MG, because it would potentially jeopardize most of the advantages of a MG approach. So exceptions are encoded at the metagrammatical level. For the "qui/que" alternation, this means that we encode in the MG not only a class for the standard relative pronoun "qui" for subject relatives, but also a class allowing the site of the subject relative pronoun to be "que". Similarly, we also encode a class in which the complementizer site is filled with "qui". Feature clashes will ensure at parse-time that ungrammatical sentences such as (7) and (3-*que) are rejected.

So basically, exceptions are handled in the MetaGrammar in the same manner as they would be handled in any hand-crafted grammar. The MG does not specifically ease the handling of

[20] With of course some animacy restrictions: *J. sent Mary/*London a package* (see [Levin, 1993] p. 46)

[21] This phenomenon is often compared in the linguistic literature, to the "that-trace" phenomenon in English.

[22] Contrary to English, complementizers cannot be omitted in French.

exceptions. However, most importantly, it does not impose any additional burden to handle exceptionality compared to standard hand-crafted grammars.

"Incompatible classes" can be prevented from generating rules in the MG hierarchy with three mechanisms. First, through the resource allocation model: a class A and a class B will not yield a class A-B if A does not need a resource provided by B, or B a resource provided by A. This is not a straight-forward way to encode exceptionality though, because it could be the case that a crossing involving A and B will be created nonetheless[23]. The second mechanism which prevents the generation of invalid rules is if the quasi-tree resulting from a crossing does not yield any tree. For example, if the description associated to a balanced class states that N1 is father of N2, and N2 is father of N1, assuming that the relation "father" is not reflexive, then no tree will be generated. This is also a non practical way to encode exceptionality.[24] The third solution for preventing the generation of rules from incompatible classes is to prevent those classes from crossing by encoding incompatible features in their HyperTags. This is the solution which is used in practice when crafting a MG hierarchy, for instance to prevent a class such as OBJECTRELATIVE-COMPLEMENTIZERISQUI from being created, or more generally to prevent "double extractions" (e.g. WHFRONTEDSUBJECT-WHFRONTEDOBJECT).

5.2 Compactness

Concerning the compactness of MetaGrammar hierarchies w.r.t. the number of grammar rules which will be generated, Candito's implementation - which we have discussed in section 2.1 - assumes by default that classes do cross, and a specific mechanism has to prevent incompatible classes from crossing. The explicit three-dimensional organization makes classes combine in a cross-product manner. If dimension 1, 2 and 3 have respectively i, j and k terminal classes, the number of combinations to generate grammar rules will be $i * j * k$. However, within each dimension, a given number of classes are hand-crafted, and then classes within each dimension are automatically crossed. Assuming dimensions 1, 2 and 3 have respectively m, n, and l hand-crafted classes, the automatic crossing amounts to creating powersets for each of the three dimensions. Hence the grammar generation process is exponential in the number of grammar rules generated from the hand-crafted classes in the MetaGrammar hierarchy, since we have $i = 2^m$, $j = 2^n$ and $k = 2^l$. Similarly, with the LORIA implementation - which is the one we have used - a hierarchy of n terminal classes may yield in the worst case 2^n decorated trees (i.e. a Powerset). This ensures that large grammars can be generated from a small limited number of hand-crafted classes in the hierarchy and also is a promising property for grammar extraction.

6 Some results and work in progress

Researchers from several groups, in particular from INRIA/Rocquencourt, LORIA, University of Paris 7, University of Pennsylvania and Columbia university are working on the MetaGrammar. These groups try to organize informal meetings to discuss potential improvements to the MG tools and resources. A mailing list is also available.[25] Moreover, a project has just started at Columbia

[23] e.g. if A needs R1 and provides R2, C needs R2 and provides R3, B needs R3 and provides R4 and D needs R4 and provides R1, then a class A-B-C-D will eventually be generated

[24] Moreover, different MG compilers (or even different versions of the same compiler) may make slightly different assumptions: e.g. some versions may implement the relation "father" to be reflexive, in which case the description N1 is father of N2 and N2 is father of N1 will yield a node N1=N2.

[25] At the time of this writing: http://www.ps.uni-sb.de/mailman/listinfo/metagrammar

University,to generate, from a single MG hierarchy, grammars for the different dialects of spoken Arabic.

6.1 Linguistic perspectives: multilingual and cross-framework grammars

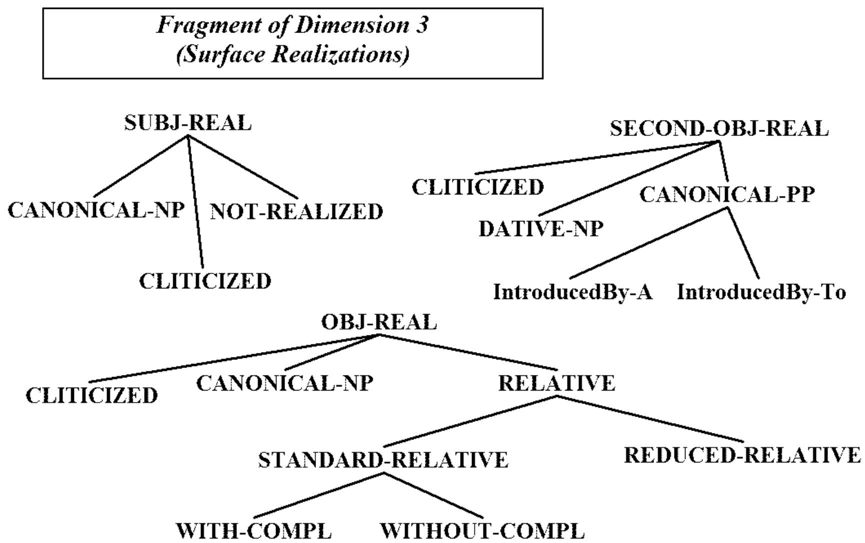

Figure 9: Sharing hierarchy classes for different languages

From a linguistic perspective, work is being conducted on developing MG hierarchies for several languages and frameworks. The hypothesis is that given a framework-neutral MG hierarchy it should be reasonably simple to use that hierarchy to generate new frameworks, and also to re-use as many classes as possible to develop a grammar for a new language. When porting a hierarchy from one framework (e.g. TAG) to another framework (e.g. LFG), one "only" needs to change the topological content of the classes in the hierarchy.[26] When porting a given hierarchy from one language to another language, the assumption is that many classes can be reused for the new language. Of course, the more related the languages are, the more classes will be reusable.

In addition to the TAGs generated for French and Italian [Candito, 1999], Metagrammars - and more specifically the LORIA MG tool - was used at the university of Paris 7 to generate a TAG for German [Gerdes, 2002]. Also at Paris 7, A MG hierarchy is being developed for Korean by Sinwon Yoon. In terms of grammar development, the largest LFG generated with the MG is the grammar for French, which is developed and maintained by Lionel Clément at INRIA. This MG hierarchy for French yields approximately 600 decorated trees, and is also used to generate Range-Concatenation Grammars [Boullier, 1998]. The syntactic phenomena covered by this LFG for French are discussed in [Clément and Kinyon, 2003a].

[26]Of course "only" should be taken with a grain of salt, because if the frameworks are very different and the hierarchy very large, this still involves a substantial amount of work. However, it is still much faster than developing a MG hierarchy or a grammar from scratch.

Concerning parallel multilingual and grammar generation, in addition to proposing a compact representation of syntactic knowledge, [Candito, 1999] explored whether some components of the MG hierarchy could be re-used across similar languages (French and Italian). However, she developed two distinct hierarchies to generate grammars for these two languages and generated only TAG grammars.

We have extended the use of the MetaGrammar to generate LFGs and also have pushed further its cross-language and cross-framework potential by generating parallel TAGs and LFGs for several languages from one single hierarchy: [Clément and Kinyon, 2003b] describe how a single hierarchy yields parallel TAG and LFG grammars for French and English;

[Kinyon and Rambow, 2003b] have used a similar strategy to generate from a single hierarchy cross-framework and cross-language annotated test-suites, including English and German sentences annotated for F-structure, as well as for constituent and dependency structure. Additionally, this line of work was extended in [Kinyon and Rambow, 2003a] to generate in parallel annotated test-suites and LFGs for English, French and German and to discuss the prtability of an existing hierarchy to Russian. When generating grammars for different languages from a single MG hierarchy, a first general tendency is that classes which are higher in the hierarchy are more likely to be shared for several languages, whereas terminal classes (i.e. leaves) are more likely to be language specific. Moreover, as a rule of thumb, more classes in dimension 1 (initial subcategorization) and in dimension 2 (valency alternations) will be shared than classes in dimension 3 (surface realization of syntactic functions). For dimension 1, most languages have subcategorization frames such as intransitive, transitive, ditransitive etc. Of course, even in dimension 1, some classes may be language-specific. For example, the class TRANSITIVEWITHPARTICLE in dimension 1 is valid for English and German (e.g. "*He gave something up*"), but not for French. Similarly, in dimension 2, the class IMPERSONALPASSIVE is valid for German (e.g. *"Es wurde getanzt"*), but not for English nor French (*"Il a été dansé"* with "il" impersonal is at best extremely marginal).

Figure 9 illustrates a (simplified) fragment of dimension 3 of a MG hierarchy which was crafted for English, French and German. The classes CLITICIZED for subject, object and second object realizations are valid only for French. The class STANDARDRELATIVEWITOUTCOMPLEMENTIZER is valid for German and English, but not for French. The class CANONICAL-PP for a second object realization is valid only for English and French, but not for German. Conversely, the class DATIVE-NP is valid for English and German, but not for French which does not allow a double NP construction. Other classes such as STANDARDRELATIVEWITHCOMPLEMENTIZER are shared by all three languages.

Other uses of the MG include a replication of the Xtag grammar for English [Kinyon and Prolo, 2002], [Kinyon, 2003], in order to detect errors in the hand-crafted Xtag and help the maintenance of the grammar, and also in order to systematically compare within the same project a MG development strategy with a MetaRule development strategy [Prolo, 2002]. As a side-effect, using the technique of generating "hybrid trees" described in section 3, in addition of regenerating the English Xtag grammar, we plan to generate, as a side-effect, a parallel LFG grammar for English.

Although the MG automates grammar development, one bottleneck remains: the lexicon. Although we generate lexical templates from our MG hierarchies, therefore addressing to some extent the grammar-lexicon interface, satisfactory lexical coverage still remains a problem. To illustrate this point, FTAG - the TAG grammar for French generated from a hand-crafted MG hierarchy - contains more than 5000 TAG elementary trees but cannot parse newspaper text essentially because of a lack of lexical coverage and maintenance and of a poor interaction between the grammar and the lexicon. By contrast, Xtag for English, which was entirely hand-crafted over more than 15 years, contains only 1200 elementary trees but can parse newspaper text [Prasad and Sarkar, 2000].[27] To remedy this problem, many grammars are extracted from treebanks (esp. from the Penn Treebank) for a variety of frameworks: for LFG [Cahill et al., 2003], for CCG [Hockenmaier et al., 2002], for TAGs [Chiang, 2000], [Chen, 2001], [Xia, 2001]. However, such treebank-extracted grammars yield problems of their own, esp. the lack of portability across frameworks, a potential lack of annotated data, errors and lack of annotation consistency, the risk of extracting rules that are not linguistically sound etc. To remedy some of the problems of treebank extracted grammars while retaining the advantages of an empirical approach, we propose to use the MG as a syntactic interlingua for grammar extraction. From a MG hierarchy automatically extracted from the Penn treebank, the idea is to generate grammars for several frameworks. This work, which is described in detail in [Kinyon, 2003] is a four-step process:

1. Extract HyperTags from the Penn treebank
2. Turn each HyperTag feature into a class in the MG hierarchy
3. Associate a topological content to each class in the hierarchy
4. Generate grammars for several frameworks using and existing MG compiler

6.2 Improving MetaGrammar tools

While extending the use of the MG to generate new frameworks, we have improved the LORIA MG implementation. More specifically, Lionel Clément has implemented a new graphical user interface[28] to ease the development and maintenance of MG hierarchies and a new version of the compiler, which supports the notion of free variables for quasi-tree nodes[29], optional resources, as well as additional relations between tree nodes in the topological content of classes. These additional relations include “sister”, “c-command”, “unequality” and a distinction between reflexive and non reflexive “dominance” and “parenthood”. His implementation also makes it possible to generate sets of rewriting rules (instead of a decorated tree which needs to be broken down in a post-processing phase). We do not further detail these technical points for sake of brevity.

Additionally, yet another version of the MG compiler was implemented by E. de la Clergerie, using the DyAlog programming language (which has similarities with Prolog) [Villemonte de la Clergerie, 2002]. This recent compiler significantly speeds up the grammar generation process.

As the MG is being used by more researchers and to generate frameworks other than TAGs, grammars for more languages etc. there is an increasing need for a standardization effort such as the definition of XML dtds to ease the sharing of MG-related tools. One of the main goals of the MG is to achieve a higher level of consistency in the grammars generated. Of course, it is still a small effort compared e.g. to ParGram. In the long-run, it would be desirable to have better “checking mechanisms” to ensure consistency and help error detection in MG hierarchies - such as typos, misspelled or inconsistent feature names (ex: Gend. versus Gender) etc. - for instance by having a feature declaration mechanism similar to the “feature space” in the ParGram project [Butt et al., 2003].

[27] More than lexical or grammatical coverage, the main problem for the Xtag system is its parser's performance, which cannot handle long sentences from the WSJ. However, contrary to LFG, the worst-case parsing complexity of TAGs is polynomial and much faster TAG parsers have been developed, such as [Barthélémy et al., 2001]. Unfortunately, integrating parser-grammar-lexicon from those different sources has not been done at this time.

[28] http://atoll.inria.fr/∼ lclement/

[29] This feature makes rules for clitic ordering easier to encode in a compact manner

7 Conclusion and future work

We have presented the notion of MetaGrammar - which was originally designed to develop and maintain Tree-Adjoining Grammars, and have explained how we have used it to generate LFGs. The main idea is that a compact MG hierarchy is handcrafted. From this hierarchy, grammars are generated automatically offline. We focus on crafting hierarchies that are as framework-neutral and close to descriptive linguistics as possible, in order to ease grammar portability. We also try to maximize cross-language sharing by generating, from a single MetaGrammar hierarchy, grammars for more than one language.

In order to further support our claim that the MetaGrammar is framework-independent, we hope to generate in future work grammars for additional frameworks, such as CCG or HPSG.[30]

We keep expanding our MG hierarchy in order to broaden the coverage of our grammars (in particular for French) and are also trying - in collaboration with other research groups - to improve existing MG tools (GUIs, editors, compilers etc.) Moreover, we are focussing on using the MetaGrammar as a syntactic Interlingua for Grammar extraction [Kinyon, 2003], the idea being to extract a MG from the Penn-Treebank, and then generating grammars for several frameworks, including LFG. In particular, we hope to compare LFGs extracted via a MG approach with the LFGs directly extracted from the Penn Treebank e.g. by [Cahill et al., 2003]. Finally, based on the work of [Kameyama, 1986] and on the "hybrid" TAG-LFG trees we generate with the MG, we are investigating whether a framework such as Lexical-Functional-Tree-Adjoining-Grammar (LFTAG) could have interesting properties, both from a theoretical and practical perspective.

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[30] the latter being more challenging, since HPSG is head-driven and already relies on a "built-in" hierarchical organization [Flickinger, 1987].

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SOMETIMES IT'S HARD TO BE COHERENT

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Abstract

The paper provides an analysis of the construction in Hungarian known as *focus raising*, illustrated below.

János-t mond-t-am hogy jön
John-ACC say-PAST-1SG that come.3SG
'It is John that I said is coming.'

In focus raising, the focus of the matrix clause is identified with a grammatical function in the embedded clause. Focus raising is particularly interesting because of the case marking on focus-raised subjects. Rather than having nominative case (unmarked), they appear suffixed by the accusative marker, *-t*, as shown in the example. This fact is analyzed in the paper as follows.

- Accusative NPs such as *Jánost* in the example function as objects; this is evidenced by verb-object definiteness agreement, and the possibility of a reflexive pronoun in the same position.
- On the other hand, the object function is argued not to be thematic (i.e., semantically selected by the matrix predicate), based on its ability to be realized as an expletive pronoun, and the long-distance nature of focus raising.

A pattern of variation among Hungarian speakers observed by Gervain (2002) shows that this athematic object function may host either functional or anaphoric binders for the embedded clause subject. Anaphoric binding from an athematic position leads to a violation of the semantic Coherence condition (Dalrymple 2001, p. 243), but this condition still appears to apply in other cases. Therefore, an Optimality-Theoretic treatment is proposed, in which the semantic Coherence condition is a violable constraint.

Focus raising: *wh-* movment without the *wh-*

In Hungarian, just as in English, question *wh-* phrases such as *mikor* ‘when’ are normally fronted to the left periphery of the sentence, as in (1). Unlike in English, non-*wh-* phrases like *holnap* ‘tomorrow’ may front to the same position, as shown in (2).[1] (The fronted constituent is indicated in bold face.)

(1) **Mikor** mond-ott, hogy jön?
when say-PAST.3SG that come.3SG
‘When did he say he would come?’

(2) **Holnap** mond-ott, hogy jön.
tomorrow say-PAST.3SG that come.3SG
‘He said that he would come *tomorrow*’

(3) *Tomorrow did he say that he would come.

The phenomenon shown in (2) is often called *focus raising*, and has been analyzed in numerous works, including Zolnay (1926), Marácz (1989), É. Kiss (1987, 1990), Kenesei (1994), Horvath (1986, 1995, 1998), Lipták (2001), and perhaps most recently, (Gervain, 2002).

The focus-raising construction shares many properties with the *wh-* question construction in Hungarian. In both constructions, the fronted element is expressed in the focus position of the matrix clause, immediately preceding the verb. In addition, the extraction path may cross several finite clause boundaries, as exemplified in (4), where *ket dolgot* ‘two things’ fronts across two CPs (É. Kiss, 1987, p. 125).

(4) **Két dolgot** hallottam, [$_{CP}$ hogy János megígért Máriának, [$_{CP}$ hogy megtesz]]
two thing.ACC hear.PAST.1.SG. that John promised Mary.DAT that does
‘It was two things that I heard that John promised Mary that he would do.’

Moreover, when the matrix predicate in a focus-raising or question construction is a verb, it must be a *bridge verb*, such as the translational equivalents of *want* and *say*; as shown in (6), extraction may not cross the complement to a non-bridge verb such as *figyel* ‘warn’ (É. Kiss, 2002).[2]

(6) *A kollégáim **egy diák** figyelmeztettek hogy keres-ett
the my:colleagues a student.NOM warned:me.3PL that seek.3SG-PAST
‘My colleagues warned me that a student was looking for me.’

Finally, focus raising, like question formation, is sensitive to island constraints, such as the Complex Noun Phrase Constraint (É. Kiss, 1987). For example, (7b) is ungrammatical because extraction may not cross the complex noun phrase *azt, hogy érkezik* ‘it, that he would arrive’.

(7) a. János mondta [azt, [hogy holnap érkezik]]
John said it-ACC that tomorrow arrives
‘It John who said it, that he would arrive tomorrow.’

[1] David Beaver (p.c.) points out that *Tomorrow, he said that he would come* is, on the other hand, grammatical, so English does have a type of long-distance focus movement. My point is not to compare Hungarian and English in this paper, but the fact remains that Hungarian and English differ in that long-distance focus-movement and question formation have identical syntax in Hungarian, but not in English.

[2] Focus-raising may also cross adjectival predicates with clausal complements, however (Kenesei, 1994, p. 317):

(5) **Emmá-t** fontos hogy megl´atogas-s-ad
Emma-ACC important that visit-SBJ-2SGDEF
‘It is Emma whom it is important that you visit.’

b. *János **holnap** mondta [azt, [hogy érkezik]]
John tomorrow said it-ACC that arrives
'It was tomorrow that John said it, that he would arrive.'

These parallelisms indicate that Hungarian focus-raising and question formation instantiate a unified phenomenon.

NPs bearing a variety of grammatical functions in an embedded clause may undergo focus raising, as shown in (8), where a dative argument, an inessive adjunct, and a direct object, respectively, are shown fronted via focus-raising.

(8) a. Mária **János-nak** akarta, hogy a csomag-ot kézbesítsék
Mary John-DAT wanted that the parcel-ACC deliver.3PL
'As for Mary, it was John that she wanted the parcel to be delivered to.'

b. Legjobban **eb-ben a kérdes-ben** szeretném, hogy megegyezz-ünk
most this-in the question-in would:like.1SG that agree.SBJ-1PL
'It is on this question that I would like most that we agree.'

c. Mindenki **Máriá-t** várta, hogy megválasztják
everyone Mary-ACC waited that elect.3PL
'It was Mary that everybody expected that they elect.'

Usually, the fronted element bears the morphological case that it would bear if it were expressed in the lower clause. Thus, the non-fronted version of (8a) is as in (9), where the dative noun phrase *Jánosnak* still bears dative case.

(9) Mária akarta, hogy a csomagot **János-nak** kézbesitsék.
Mary wanted that the parcel.ACC John-DAT deliver.3PL
'As for Mary, it was John that she wanted the parcel to be delivered to.'

However, there is one class of exceptions to this general pattern, both in focus-raising and in question formation. When the subject of the embedded clause raises to the matrix focus position, the fronted phrase often (optionally for some speakers, obligatorily for others) bears accusative case:

(10) **Péter-t** mond-t-a, hogy jön
Péter-ACC say-PAST-1SG.DEF that come.3SG
'It is Peter who he/she said is coming.'

Péter would of course get nominative, not accusative, downstairs:

(11) János mond-t-a, hogy **Péter** jön
I say-PAST-1SG.DEF that Peter.NOM come.3SG
'John said that Peter is coming'

It is this accusative marking that I seek to explain here.

§1 is devoted to determining whether, and in what sense accusative-marked, focus-raised elements originating from subject position (henceforth, *Pétert*) are objects, as the case-marking suggests. I will conclude that while *Pétert* is in fact an object of the matrix clause, it is an athematic object.[3] In §2, I will argue for one dialect of Hungarian that this athematic object position is anaphorically, rather than functionally, identified with the embedded clause subject. This implies that the phenomenon is a raising construction with anaphoric control, a possibility that is predicted typologically, but unattested.

[3]An athematic GF is one that is not semantically selected by the PRED that governs it; notationally, an athematic GF does not appear inside the angle brackets enclosing the argument list of a PRED.

1 Objecthood and selection

The accusative case marking on *Pétert* in (10) indicates that it functions as a (direct) object (OBJ), since OBJs normally go with accusative case in Hungarian. That hypothesis is shown schematically in (i). If that were true, this construction would exemplify a mismatch of function and meaning; even if *Péter* is functionally the OBJ of the matrix clause, intuitively it is semantically interpreted only as the subject of the embedded clause (Judit Gervain, p.c.). The alternative proposal would be that *Péter* is not functionally an OBJ, even though it formally bears accusative case, as shown schematically in (ii).

(12) (i) $\begin{bmatrix} \text{FOC} & \begin{bmatrix}\text{CASE} & \text{ACC}\end{bmatrix} \\ \text{OBJ} & \\ \text{PRED} & \text{`say\ldots OBJ\ldots'} \end{bmatrix}$ (ii) $\begin{bmatrix} \text{FOC} & \begin{bmatrix}\text{CASE} & \text{ACC}\end{bmatrix} \\ \text{PRED} & \text{`say\ldots'} \end{bmatrix}$

Even if *Pétert* functions syntactically as an argument in the matrix clause, we are not obligated to consider it a semantic argument of the verb. Assuming that it is functionally an object is consistent with an analysis conforming to schema (i) below, where the verb syntactically and semantically selects an object (i.e., the object is thematic). That assumption would also be consistent with an analysis like (ii), where the verb syntactically but not semantically selects an object (i.e., the object is athematic).

(13) (i) $\begin{bmatrix} \text{OBJ} & \begin{bmatrix}\text{CASE} & \text{ACC}\end{bmatrix} \\ \text{PRED} & \text{`say}\Big\langle\ldots\text{OBJ}\ldots\Big\rangle\text{'} \end{bmatrix}$ (ii) $\begin{bmatrix} \text{OBJ} & \begin{bmatrix}\text{CASE} & \text{ACC}\end{bmatrix} \\ \text{PRED} & \text{`say}\Big\langle\ldots\Big\rangle\text{OBJ'} \end{bmatrix}$

I will argue in favor of analysis (ii) in (13), in which the accusative-marked, focus-raised element functions syntactically as an argument of the matrix clause, but is not a semantic argument of the verb.

1.1 Objecthood

1.1.1 Definiteness agreement

Patterns of definiteness agreement suggest that *Pétert* is indeed an object of the matrix verb. In Hungarian, verbs agree in definiteness with their direct object.[4] Thus, the verb form of *lát* 'see' is different in *I saw a bird*, as in (15) from what it is in *I saw the bird*, as in (14).

(14) Lát-om a madar-at
see-1.SG.DEF the bird-ACC
'I see the bird'

(15) Lát-ok egy madar-at
see-1.SG.INDEF an bird-ACC
'I see an bird'

(The indefinite conjugation is also used when the verb has no object.)

When a definite NP such as the proper name *Péter* (accusative *Péter-t*) focus-raises, the matrix verb appears in the definite conjugation (*mond-t-a* 'say-PAST-3SG.DEF'), as in (10). Noun phrases with plural numeric determiners such as *két fiu-t* in (16) and question words such as *ki-t* in (17) are indefinite, so the matrix verb goes in the indefinite conjugation (*mond-ott* 'say-3SG.PAST.INDEF') in these cases.

[4]See Bartos (1997) for discussion of the precise semantic characterization of the agreement; semantic definiteness is not obviously sufficient.

(16)	**Két fiu-t**	mond-ott	hogy	jön.
	two boy-ACC	say-3SG.INDEF.PAST	that	come.3SG

‘It was two boys that he/she said were coming.’

(17)	**Ki-t**	mond-ott,	hogy	jön?
	who-ACC	say-3SG.INDEF.PAST	that	come.3SG

‘Who did he/she say is coming?’

If the choice between the definite and indefinite conjugation for a verb is based on the properties of its object, as is normally assumed, then these accusative NPs are objects.

1.1.2 Reflexives

Another argument for the objecthood of accusative-case marked, focus-raised objects is the fact that reflexive pronouns coreferential with the matrix subject may appear in this position, as in (18).

(18)	Önmagá-t$_i$	mondta	Péter$_i$	hogy	szeret-i	Mari-t
	themself-ACC	say-PAST-3SGDEF	Peter.NOM	that	love-3SG.DEF	Mary-ACC

‘It is himself$_i$ that Peter$_i$ said loves Mary.’

(This example is well-formed only as an answer to the Hungarian equivalent of the question, “Who did Peter say loves Mary?”, or as a correction to an assertion that Peter said someone else loves Mary.) As I will argue, the reflexive pronoun *önmagá(t)* must be bound by a syntactic coargument; an argument function syntactically selected by the same PRED. Therefore, the accusative NP in (18) occupies an argument function.

Under the non-object analysis of accusative marked focus raised subjects schematized in (ii) of (12), the reflexive pronoun in (18) is the embedded clause subject, bound by the subject of the matrix clause. If *önmagát* could be bound by the subject of a higher clause, we would predict ambiguity in (19); the reflexive anaphor should be able to take either *János* or *Mari* as an antecedent. (Note that pronouns in Hungarian are not specified for gender.)

(19)	János$_j$	mond-t-a	hogy	önmagát$_{i,*j}$	szeret-i	Mari$_i$
	John.NOM	mond-PAST-3SG.DEF	that	themself	love-3SG.DEF	Mary.NOM

‘John said that Mary loves herself.’
‘*John said that Mary loves himself.’

In fact, in this case *önmagát* may only refer to *Mari*, the potential binder that is a coargument.

Towards the same point, if the non-object analysis were right, then the matrix subject should be able to bind a reflexive pronoun in the subject of the embedded clause, even if focus raising has not taken place. There is a nominative reflexive pronoun in Hungarian (*önmaga*), and this pronoun cannot be bound by the subject of the matrix clause either, as in (20).

(20)	*János	mond-t-a	hogy	önmaga	szeret-i	Mari-t
	John	say-PAST-3SG.DEF	that	themself	love-3SG.DEF	Mary-ACC

‘It is John who said that himself loves Mary.’

Thus, the reflexive pronoun must be bound within its clause. Example (18) therefore provides evidence that accusative-marked focus raised subjects have a grammatical function in the matrix clause.[5]

[5]Thanks to Amy Dahlstrom for suggesting this avenue of inquiry. Thanks also to Agnes Mihalik for providing these native speaker judgments.

1.2 Semantic selection

Again, if accusative-marked focus-raised embedded-clause subjects such as *Pétert* in (10) are objects, they are not necessarily semantically selected objects. Indeed, I will argue that they are not.[6]

1.2.1 Dependency is not lexically enforced

First, let us suppose the alternative: accusative-marked fronted subjects are semantically selected. Then we have a lexical entry for bridge verbs such as *mond* 'say' that includes the following lexical specification:

(21) $(\uparrow \text{PRED})=\text{`say}\langle \text{SUBJ OBJ COMP}\rangle\text{'}$

Supposing this were the lexical entry, we would predict (22) to be possible, in the absence of any other mechanism for ruling it out. (22) is ungrammatical because the matrix object function cannot be identified functionally or anaphorically with any participant in the embedded clause.

(22) *Péter-t mond-t-am, hogy János jön
Péter-ACC say-PAST-1SG that John.NOM come.3SG
'[roughly] Peter did I say that John is coming'

The putative lexical entry in (21) is like the lexical entry for an equi control verb, which by definition thematically selects the controller along with a complement clause (normally XCOMP). An equi verb such as *try* enforces identity between the controller and the controllee through a stipulation of referential equality between the matrix controller and the SUBJ of the embedded clause, in the verb's lexical entry (Dalrymple, 2001). This precise solution will not do for us, because focus-raising is possible over long distances, as exemplified earlier in (4). Thus, the identity stipulation would have to involve a functional uncertainty equation allowing the controllee to be embedded within multiple COMPs. However, the possible extraction paths for focus-raising mirror precisely the possible extraction paths for *wh*- questions. For example, it is not possible to focus-raise out of a complex noun phrase, as demonstrated earlier in (7b). This parallelism shows that the range of dependencies in focus-raising constructions is not determined lexically, by bridge verbs, but by the aspect of the grammar that regulates long-distance dependencies. Supposing that bridge verbs semantically select for accusative-marked focus-raised subjects prevents us from making use of the grammar to derive the constraints on extraction.

In contrast, if we assume that accusative-marked fronted subjects are not semantically selected by the verb, then we can use the grammar to impose identity between the higher-clause object and an embedded subject. If the object is athematic, then the representation for (10) will consist at least of (23).

(23)
$$\begin{bmatrix} \text{PRED} & \text{`say}\left\langle \text{SUBJ COMP} \right\rangle \text{OBJ'} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`John'} \end{bmatrix} \\ \text{COMP} & \begin{bmatrix} & \\ \text{PRED} & \text{`come}\left\langle \text{SUBJ} \right\rangle\text{'} \end{bmatrix} \end{bmatrix}$$

If OBJ is not functionally identified with any function that is semantically selected, then the condition in (24) will be violated.

[6] I assume with little argument that these accusative-marked elements are indeed subcategorized for by the verb if they are objects. However, an analysis using nonsubcategorized objects may be correct for the cognate object construction (e.g. *Suzy smiled a pretty smile*) as well as certain objectlike temporal adverbials (e.g. *I slept two hours*), so it may be fruitful to explore that possibility.

(24) *Semantic Coherence* (Dalrymple, 2001, p. 243)
A meaning derivation for an utterance is semantically coherent if the meaning derivation produces a meaning for the utterance with no additional unused premises remaining.

This principle is independently motivated as a means of ruling out examples like (25).[7,8]

(25) a. *John rained.

b. *John seems that Mary is nice.

For simplicity of exposition, we may obtain the effect of the semantic coherence condition for our purposes without using glue semantics, if we assume that every instance of a PRED attribute corresponds to a glue semantic resource, and that semantic government corresponds to the using up of premises. Using this correspondence, we may state the semantic Coherence condition as follows:

(26) *Semantic Coherence* (non-glue version):
Every governable function containing a PRED value must be semantically governed.

(27) *Semantic government* (for our purposes)
f is semantically governed iff f is functionally linked to a position inside the angle brackets in the semantic form value of a PRED attribute.

In the examples in (25), the SUBJ function contains a PRED attribute, yet is not semantically governed. In this way, examples (25) fail to satisfy (26).[9]

We can use this principle to make it necessary that the athematic object in (10) *János-t* 'John-ACC' is linked to some function of the embedded clause in the following way. If, as in (22), the athematic object is not linked to any participant in the embedded clause, the semantic Coherence condition is violated.

The possibility of identifying the matrix focus with the embedded subject also follows from independent principles of the grammar. We may assume a rule for regular question formation whereby an element from a possibly embedded clause raises to the preverbal focus position, such as the following:[10]

(28) FP $\rightarrow$ (NP) F′
($\uparrow$FOCUS)=$\downarrow$ $\uparrow$=$\downarrow$
($\uparrow$COMP* GF)=$\downarrow$

Thus, principles of the grammar (the semantic Coherence condition and the regular rule of question formation) can be made responsible for the identification between the matrix focus and some embedded function.

In fact, these principles alone are insufficient for deriving an f-structure representation of (10) in which the matrix FOC, the matrix OBJ, and the embedded SUBJ are all functionally identified with one another.

[7]Under usual assumptions about the lexical entry for *seem*, the examples in (25) are also ruled out by the requirement that the PRONFORM attribute have the value IT. So, the semantic Coherence condition technically isn't needed to rule these out. However, supposing that a more principled theory of the distribution of *it* vs. *there* were to replace this lexical stipulation, the semantic Coherence condition would be needed in order to rule that sentence out.

[8]It appeared to me at first that the English "copy raising" construction represented below involves an athematic subject that is merely anaphorically integrated: *Richard seems like he's in trouble* (Potsdam and Runner, 2001). Asudeh (2002) gives an analysis of the copy-raising construction in LFG, in which the subject is in fact governed by *like*, so there is no semantic Coherence violation in this type of example according to that analysis.

[9]The semantic Coherence condition may be generalizable in such a way that it applies to discourse functions TOPIC and FOCUS. In fact, such a condition is proposed in Falk (2001), under the name of the Extended Coherence Condition: "All functions in an f-structure must be incorporated into the semantics. Argument funcitons are subject to the Coherence Condition. Overlay functions [incl. focus –EEC] must be identified with arguments or adjuncts; adjuncts must be in f-structures containing PREDs."

[10]See Szendrői (2001) for a good argument for a focus projection, as well as Brody (1990, 1995) for the original suggestion that Hungarian uses a focus projection.

The rule given in (28) allows *either* the embedded subect to be identified with the matrix focus (in which case the functional uncertainty path is instantiated as: COMP SUBJ), *or* the matrix object (in which case the functional uncertainty path is instantiated as: OBJ). If we link the embedded SUBJ to the matrix FOC, another equation is necessary for linking the matrix OBJ into the functional "chain" if you will, either by equating it with the matrix FOC or by equating it with the embedded SUBJ. To allow this, I propose the additional annotation on the focus position in (29).

(29) FP $\rightarrow$ (NP) F′
(↓CASE)=ACC⇒ (↑OBJ)=↓

In other words, if any constituent is accusative-marked in the focus position of a clause, then it is interpreted as the object of that clause, whether or not it is also interpreted as the object of another clause. This will link the matrix OBJ into the functional chain, even if the focus rule is used to link the embedded subject with the matrix focus, instead of the matrix object.

Independent evidence for this solution comes from the fact that definiteness agreement in focus-raising is not limited to embedded-clause subjects. Any focus-raised phrase with accusative case triggers definiteness agreement with the matrix verb. Thus, phrases corresponding to embedded-clause objects, which retain their definiteness marking from the embedded clause, also trigger definiteness agreement in the matrix clause, as shown in the contrast between (30a) and (30b).

(30) a. Csak ez-t akar-om/*-ok hogy el-mond-j-ad (Kenesei, 1994)
only this-ACC want-1SG.DEF/1SG.INDEF that out-say-SBJ-2SG.DEF
'It's only this that I want you to say.'

b. Csak két dolg-ot akar-ok/*-om hogy el-mond-j-ál
only two thing-ACC want-1SG.INDEF/1SG.DEF that out-say-SUBJUNCTIVE-2SG.INDEF
'There's only two things that I want you to say.'

In (30a), the focus-raised element *ezt* 'this' is definite, so the verb *akarom* 'want' is as well. In (30b), the numerically-quantified NP *két dolgot* 'two things' is indefinite, and so is the matrix verb *akarok* 'want'. If definiteness agreement is sufficient evidence for objecthood, then it appears that embedded clause objects become matrix clause objects when they focus raise as well as embedded clause subjects.

1.3 Expletive construction

If the matrix verb has an athematic object, then that object position should be able to be filled with an expletive. Indeed, that is what we find in examples like (31), I would like to claim.

(31) Azt lát-om, hogy Péter jön
it.ACC see-1.SG.DEF that Peter.NOM come.3.SG
'I see that Peter is coming.'

I will argue that in this construction, the accusative pronoun *azt* is an expletive, filling the athematic OBJ position.

Following Berman (2003) in her analysis of similar constructions in German, I will refer to the construction instantiated in (31) as the "correlative" construction. For such constructions, there are two potential analyses, corresponding to two different types of lexical entries for bridge verbs.

(32) a. Extraposition analysis
The accusative pronoun is the head of the object selected by the verb, and the clause

is contained within the OBJ as a complement to the pronoun, or related to it through apposition or adjunct modification. This analysis may be schematized thus:

$$\left[\begin{array}{ll} \mathrm{PRED} & \text{‘say}\left\langle \mathrm{SUBJ\ OBJ} \right\rangle\text{’} \\ \mathrm{OBJ} & \left[\begin{array}{ll} \text{“azt”} & \\ \mathrm{GF} & \left[\text{“hogy Péter jön”}\right] \end{array}\right] \end{array}\right]$$

b. Expletive analysis
The accusative pronoun is an athematic object, and the clause is the direct complement of the verb. It is schematized thus:

$$\left[\begin{array}{ll} \mathrm{PRED} & \text{‘say}\left\langle \mathrm{SUBJ\ COMP} \right\rangle\mathrm{OBJ}\text{’} \\ \mathrm{OBJ} & \left[\text{“azt”}\right] \\ \mathrm{COMP} & \left[\text{“hogy Péter jön”}\right] \end{array}\right]$$

(The extraposition analysis is the LFG equivalent of the analysis of correlative constructions given by É. Kiss (1990), wherein the clause is extraposed, leaving a trace within the object NP; the expletive analysis is more like the analysis given by Kenesei (1994), in which the accusative pronoun is an expletive and the clause is a direct complement of the matrix verb.) For a summary of the possibilities, either the accusative pronoun (32a) or the clause (32b) is semantically selected by the matrix verb. I offer two arguments for the expletive analysis, wherein the clause is semantically selected.

1.3.1 Possibility of extraction

Kenesei (1994) argues for the expletive analysis on the basis of the focus-raising construction itself, which clearly shows that there must be at least some lexical entry for bridge verbs in which the complement is directly selected by the verb. His argument is as follows. Extraction is not possible from complex noun phrases, or adjunct phrases, and yet it is possible in examples like (2) and (10). If extraction is possible only from argument clauses, then the CP in (10) must be an argument of the verb, not a right-dislocated subconstituent of a complex noun phrase object.

Further evidence against the analysis involving extraposition from a complex noun phrase comes from the complementary distribution of focus-raising constructions with the accusative pronoun. Under the extraposition analysis of (31), the CP *[hogy érkezik]* is a subordinate part of a complex noun phrase even in focus-raising constructions, so an example like (2) has the analysis in (33), with a silent pronoun heading the noun phrase complement of the verb.

(33) János holnap mond-t-a [$_{NP}$ [$_{CP}$ hogy érkezik]]
John tomorrow say-PAST-3.SGDEF that arrives
‘It was tomorrow that John said it that he would arrive.’

But the silent head of the putative complex noun phrase cannot be spelled out:[11]

[11] É. Kiss (1990) maintains that the extraposition analysis is correct even for focus-raising cases, and proposes to deal with the ungrammaticality of *azt* in (34) in the following way.

> Owing to the Visibility Condition [Chomsky (1981)], sentential arguments are assigned case. A CP category, however, cannot bear case – therefore, it must be formally subordinated to an NP. It is the complex NP that functions as the argument of the V, picking up its case and theta-role. The case will be borne by the pronominal head of the

(34) *János holnap mond-t-a azt hogy érkezik
John tomorrow say-PAST-3SG.DEF it-ACC that arrives
'It was tomorrow that John said it that he would arrive.'

This evidence shows that there is a structural difference between extraposed clauses and clauses from which focus-raising may take place, and therefore suggests that bridge verbs directly select for their clausal complements, rather than being indirectly related to them as in the extraposition analysis.

1.3.2 Lack of direct object NPs

An empirical problem for the extraposition analysis of correlative constructions such as (31) is that it overgenerates direct objects. Because OBJ is a thematic argument of the verb in that analysis, the verb is predicted to be able to take a simple direct object, but normally, this is impossible:

(35) *A hír-t mond-t-a
the news-ACC say-PAST-3SG.DEF
'He said the news.'

The only elements that can appear as the sole noun phrase complement to bridge verbs are the pronouns *az-t* 'that-ACC' and *mi-t* 'what-ACC'.

(36) a. Azt mondta. 'He said it.'
b. Mit mondott? 'What did he say?'

In fact, proper names may appear as the sole overt argument to a bridge verb, as in (37),

(37) János-t mond-t-a.
John-ACC say-PAST-3SGDEF
'He said John.'

but this example has an "elliptical character" and can only be used when the context specifies the content of the elided clausal complement (Katalin Kiss, p.c.).[12]

We can explain the grammaticality of the examples in (36) with the following assumptions: the pronouns *az-t* 'that-ACC' and *mi-t* 'what-ACC' operate as expletives in (36), and their associated clauses undergo CP deletion. The idea that *mit* can operate as an expletive is supported by the "scope-marking" construction, illustrated in (39).

NP. Since the pronominal head is a semantically empty dummy NP, the theta-role will be borne by the clause. The clause inside the NP is formally an adjunct to the pronominal head; consequently, its CP boundary is a blocking category and a barrier for its constituents. The NP dominating the CP inherits barrierhood; thus extraction from the CP is prevented. *If the pronominal head is phonologically empty, it becomes transparent, presumably because* pro, *recoverable from the verbal suffix, is deleted, and the NP projection, having lost its head, is pruned. This way the CP is directly governed by the V.* [Italics mine]

Kenesei (1994) argues against this analysis on the basis that it violates the Projection Principle: "if the verb is subcategorized for a noun phrase at one level of structure, it cannot have a clausal complement at another" (Kenesei, 1994, pp. 312–313). In LFG, the Visibility Condition is built into the very framework; a verb cannot subcategorize for one grammatical function at one level of representation and a different grammatical function at another, because there is only one level of representation at which grammtical functions are represented, namely f-structure. Thus, this explanation is out of the question for an LFG analysis.

[12] There are other genuine examples of noun phrase complements to bridge verbs, such as (38), where the direct object is a complex noun phrase headed by a pronoun, containing a clause.

(38) Mond-t-ál [$_{NP}$ az-t [$_{CP}$ hogy János jön]]
say-PAST-2SG.DEF it-ACC that John come.3SG
'I said it that John is coming.'

Assuming that indeed this example contains a complex noun phrase, we may be forced to assume that matrix verbs allow OBJ complements. I am not able to determine whether or not we are forced to do so at this point.

(39) Mi-t mond-ott, hogy mikor jön?
what-ACC say-3SG.INDEF that when come.3SG
'When did he/she say that he/she would come?'

See Horvath (1995) for an extensive set of arguments that *mit* is behaving as an expletive in the scope marking construction.

Furthermore, although the pronoun *azt* cannot be present in the matrix clause when focus-raising or question formation takes place, it is possible to relativize out of the complement to a bridge verb when the expletive is present. (These were found using Google, but a native Hungarian speaker informant confirms the grammaticality of these examples.)

(40) Az egyik dolog, **amiben**$_i$ azt gondolom, hogy jobbak vagyunk t_i, mint mások ...
the primary thing in which it-ACC think-1SG that better be.1PL than others
'The primary thing in which I think (it) that we are better than others. . . '
`www.hte.hu/kiadvanyok/hirlev2002/ hirlevel_2002jan01.html`

(41) egy optimális cél, **amivel**$_i$ azt hiszem, hogy mindenki egyetért t_i, ...
an optimistic goal with which it-ACC think-1SG that everyone agrees
'an optimistic goal, with which I think (it) that everyone agrees'
`www.mkogy.hu/naplo34/143/1430020.html`

Similarly, a dative possessor in the embedded clause may also raise past the expletive into the higher clause, as shown in (42a). This is not be possible with complex noun phrases, for example as in (42b).

(42) a. **En-nek**$_i$ is az-t hiszem, hogy [t_i a legfontosabb tulajdonsága] a folytonosság.
this-DAT FOC it-ACC think-1SG that the most_important property the continutity
'I think that the most important property of this is continuity.'

b. ***Ennek**$_i$ is hallot-t-am az ötlet-et, hogy [t_i a legfontosabb tulajdonsága] a folytonosság.
this-DAT FOC hear-PAST-1SG the idea-ACC that the most_important property the continuity
'I heard the idea that the most important property of this is continuity.'

If the correlative construction had the same structure as a complex noun phrase, as the extraposition analysis claims, then (42a) should be just as bad as (42b). The difference in grammaticality suggests a structural difference between the two constructions. Only the expletive analysis contains such a distinction. Hence, the construction in (31) reflects the expletive pronoun that we would expect under the athematic object analysis of *Pétert* in (10).

2 Functional and anaphoric control

In the previous section, I concluded that accusative-marked focus-raised subjects such as *Pétert* in (10) are athematic objects, based on both the long-distance and island-sensitive nature of focus-raising and the the expletive construction. In this respect, the focus-raising construction is like raising rather than equi. As laid out by Bresnan (1982), raising constructions involve functional control, while equi involves anaphoric control. So it makes sense as a default assumption at this point that the focus-raising construction under consideration involves functional control. In fact, I have already implicitly proposed that the identification is functional.

However, Kroeger (1993) documents a type of equi with functional control, in Tagalog, showing that the distinction between raising and equi is orthogonal to the distinction between functional and anaphoric control. This carves out the typological possibility of a raising construction with anaphoric control. In this section, I will argue that the predicted but unattested raising with anaphoric control is in fact attested in one dialect of Hungarian.

2.1 Gervain's observation

As noticed by Gervain (2002), there is some disagreement in the literature on focus-raising as to the obligatoriness of the accusative marker *-t* on the focussed constituent in examples like (10). For some speakers, *Péter* can appear in nominative case with the same interpretation as in (10), shown in (43).

(43) Péter mond-t-am, hogy jön
Péter.NOM say-PAST-1SG that come.3SG
'It is Peter that I said is coming.'

The speakers who allow (43) also allow (10). Yet, the speakers who allow only (10) are more liberal than the others in a different respect: they don't require that the embedded verb (*jön* 'come') agree in number with the focussed constituent in certain cases, whereas the others do. This difference can be observed when a semantically plural, but syntactically singular phrase such as *az összes lány* 'every girl' in (44) is raised. That *az összes lány* is grammatically singular is evident from its nominal morphology, which is singular, and the fact that it agrees with a singular verb, as shown in (44).

(44) Az összes lány jön/*jön-nek.
the all girl come.3SG/come-3PL
'All the girls are coming.'

Az összes lány obviously picks out a plurality of girls and is in that sense semantically plural; for further evidence, the plural personal pronoun *ők* 'they' could later be used to refer back to it, as the subject of the next sentence, for example.

When *az összes lány* is focus-raised, there are, in principle, four different possible outcomes, depending on two binary choices. The raised phrase may have nominative case, as in (45), or accusative case, as in (46). Next, the embedded verb 'come' may be either plural, as in the (b) examples of (45) and (46), or singular, as in the (a) examples. As Gervain (2002) shows, not all possibilities are grammatical, and there is some disagreement among Hungarian speakers as to which of them are. In her study, Hungarian speakers fell into two groups (A and B); their judgements for each sentence are represented in the righthand columns in (45)–(46).

(45) NOMinative-marking

a. Az összes **lány** mond-t-ad, hogy **jön** ✓A *B
the all girl.NOM say-PAST-2SG that come.3SG

b. Az összes **lány** mond-t-ad, hogy **jön-nek** *A *B
the all girl.NOM say-PAST-2SG that come-3PL

(46) ACCusative-marking

a. Az összes **lány-t** mond-t-ad, hogy **jön** ✓A ✓B
the all girl-ACC say-PAST-2SG that come-3SG

b. Az összes **lány-t** mond-t-ad, hogy **jön-nek** *A ✓B
the all girl-ACC say-PAST-2SG that come-3PL

For Group A, both nominative and accusative case are allowed on the focus-raised element, and number agreement between the focus-raised element and the embedded verb is required. For Group B, only accusative case is allowed on the focus-raised element, but number agreement is not required; Group B accepts

(46b), in which the embedded verb is plural but the focus-raised element *az összes lány* is grammatically, though not semantically, singular.[13] The pattern is summarized below.

(47)

	accusative-marking	agreement (embedded verb is singular)
Group A	optional	required
Group B	required	optional

2.2 Functional and anaphoric control

This pattern suggests that while Group A uses functional identification between the matrix focus and the embedded subject as discussed in the previous section, Group B uses anaphoric identification. The Group A pattern can be accounted for under the assumption of functional identification as follows. The examples with number disagreement, (45b) and (46b) are ruled out because the matrix focus is functionally identified with the embedded subject, so the number features will clash. (46a) has an analysis very similar to the one given for (10), ignoring the representation of the quantifier.

(48)

$$\left[\begin{array}{ll}
\text{PRED} & \text{‘say}\left\langle\text{SUBJ COMP}\right\rangle\text{OBJ’} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PERS} & 2 \\ \text{NUM} & \text{SG} \\ \text{PRED} & \text{‘pro’} \end{array}\right] \\
\text{OBJ} & [\,] \\
\text{FOCUS} & \left[\begin{array}{ll} \text{PRED} & \text{‘every-girl’} \\ \text{CASE} & \text{ACC} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \end{array}\right] \\
\text{COMP} & \left[\begin{array}{ll} \text{PRED} & \text{‘come}\left\langle\text{SUBJ}\right\rangle\text{’} \\ \text{SUBJ} & [\,] \end{array}\right]
\end{array}\right]$$

For Group B, the possibility of non-agreement between the raised accusative element and the embedded subject in (46b) suggests that the identification is, by contrast, anaphoric, for that group.

Under these assumptions, here is an analysis of (46a):

[13] In fact, the judgments were given on a 5-point scale; I have simplified ‘?’ to unmarked, and ’???’ to ‘*’. The average judgments for each group were not all stars or “perfect” marks; it remains an open question how to account for the more subtle aspects of the pattern. See Gervain (2002, 2003) for discussion.

(49)
$$\left[\begin{array}{ll}
\text{PRED} & \text{`say}\langle\text{SUBJ COMP}\rangle\text{OBJ'} \\
\text{SUBJ} & \left[\begin{array}{ll}\text{PERS} & 2 \\ \text{NUM} & \text{SG} \\ \text{PRED} & \text{`pro'}\end{array}\right] \\
\text{OBJ} & [\,] \\
\text{FOCUS} & \left[\begin{array}{ll}\text{PRED} & \text{`every-girl'} \\ \text{CASE} & \text{ACC} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \\ \text{INDEX} & [\,]\end{array}\right] \\
\text{COMP} & \left[\begin{array}{ll}\text{PRED} & \text{`come}\langle\text{SUBJ}\rangle\text{'} \\ \text{SUBJ} & \left[\begin{array}{ll}\text{PRED} & \text{`pro'} \\ \text{INDEX} & [\,]\end{array}\right]\end{array}\right]
\end{array}\right]$$

Gervain (2002) proposes an analogous analysis in Minimalist style. She argues that Group B uses a "resumptive strategy", that is, they use a resumptive pronoun in the embedded clause, whereas Group A uses regular *wh*-movement. This explains the fact that both plural and singular agreement are possible for Group B. Anaphors with semantically plural antecedents may be either plural or singular, giving rise to a collective or distributive interpretation respectively. Thus the singular pronoun *őt* in (50a) has a distributive interpretation, and the plural pronoun *őket* in (50b) has a plural interpretation.

(50) a. Két fiú$_i$ hiszi azt, hogy Mária szereti (őt$_i$)
two boy.SG think.3SG it that Mary love.3SG him
'There are two boys each of whom thinks that Mary loves him.'

b. Két fiú$_i$ hiszi azt, hogy Mária szereti őket$_i$
two boy.SG think.3SG it that Mary love.3SG them
'Two boys think that Mary loves them.'

As Gervain points out, the idea that Group B uses a pronoun in the embedded clause is also supported by the fact that Group B does not rule out focus-raising out of complex noun phrases:

(51) Az elnököt mondtad, hogy hallottad a hírt, hogy megérkezett (ok for Group B only)
the president.ACC said.2SG that heard.2SG the news that arrived.3SG
'You said you heard the news that *the president* had arrived.'

whereas Group A does. This is in line with the fact that movement out of complex noun phrases is impossible, but anaphoric binding into them is possible, as shown in (52).

(52) No man$_i$ asked whether or not he$_i$ would be fired.
(cf. **Who*$_i$ *asked whether or not t*$_i$ *would be fired?*)

In LFG terms, the movement/resumption distinction may be interpreted using the functional/anaphoric identification distinction.

However, supposing that Group B uses anaphoric identification does not explain why Group B, unlike Group A, does not tolerate nominative case on the focus-raised element, as shown in (45a). To explain this, I would like to propose that the complementizer *hogy*, for Group B, has a specification similar to that which Falk (2001) gives of English *that*, in order to explain the *that*-trace effect:[14]

(55) *hogy* C $(\uparrow \text{SUBJ}) \neq ((\text{GF}^{+} \uparrow)\ \text{GF})$

This solution echoes the explanation given by Gervain (2002) for the impossibility of nominative case: she writes, "I assume that it is the nature of the complementizer *hogy* 'that' that is parametrically different in the two dialects. In the movement dialect, the complementizer allows the raised operator to properly govern its trace, thus complying with the ECP. In the other dialect, however, the complementizer is 'opaque' and does not allow proper government. Thus resumption is needed to save the sentence from the resulting ECP violation" (Gervain, 2002, p. 77). The difference here is that the idea of the "Last Resort" is being modelled with an OT constraint violation.

This constraint prevents subject extraction, thereby preventing nominative focus-marked constituents. At the same time, it motivates the possibility of anaphoric identification between the raised element and the embedded subject.

Notice that in (49), there is an athematic object that is not functionally integrated, so the semantic Coherence condition is violated: there is a PRED inside a governable function that is not semantically selected. This particular violation of the semantic Coherence condition does not make us want to suppose that the semantic Coherence condition does not hold; it is still important for ruling out the Hungarian equivalent of examples like **John rained*. Rather, the semantic Coherence condition can be violated only in a limited range of cases. In particular, the semantic coherence condition can be violated when a violation of the constraint in (55) would be incurred to satisfy it. Thus, the constraint in (55) outranks the semantic Coherence condition, in the OT sense.

Let us label the semantic Coherence condition SEMANTIC-COHERENCE, and the constraint in (55), *SUBJECT-EXTRACTION. With these constraints, it is possible succinctly to describe the pattern associated with both groups as follows: Group A uses the constraint subhierarchy (56); Group B uses (57).

(56) SEMANTIC-COHERENCE $\gg$ *SUBJECT-EXTRACTION

(57) *SUBJECT-EXTRACTION $\gg$ SEMANTIC-COHERENCE

Hypothesizing these constraints thus allows us to explain both of the differences between Group A and Group B as consequences of a single difference in constraint ranking.[15]

[14]The presence of this constraint in Hungarian is ironic, because as É. Kiss (1987) points out, on the surface Hungarian has the opposite of the English *that*-trace effect:

(53) a. Kit mondtam, hogy jön?

b. *Kit mondtam, jön?

(54) a. *Who did you say that is coming?

b. Who did you say is coming?

[15]These are not all the constraints that are relevant. Now that the semantic Coherence condition is violable, a constraint is needed to rule out (22), which is ungrammatical in both dialects. To account for this, I might propose that the Extended Coherence condition, a more specific condition than semantic Coherence, is highly-ranked for both Group A and Group B.

(58) Extended Coherence: FOCUS and TOPIC must be linked to the semantic predicate argument structure of the sentence in which they occur, either by functionally or by anaphorically binding an argument. Bresnan and Mchombo (1987)

Alternatively, the Extended Coherence Condition may be a by-product of GEN; if the OT-LFG Input is semantically well-formed, it is even difficult to imagine a function producing candidate f-structures from the input that violate the Extended Coherence Condition.

Also, as was pointed out by Peter Sells at the LFG03 conference, another constraint to the effect, FOCUS-RAISE!, needs to be among those relevant for evaluation.

Conclusions

I have argued that accusative-marked focus raised subject such as *Pétert* in (10) occupy an athematic object function. Further, depending on dialect, this function may host either functional or anaphoric binders for the embedded subject. If this analysis is correct, then the semantic Coherence condition is violable. This violability may be exploitable in the explanation of other intrusive pronoun phenomena, such as resumptive pronouns.[16]

The analysis has certain typological implications as well. First, if it is true that the accusative-marked focus-raised phrases are objects, then they represent long-distance (A′) movement to an argument (A) position, which is not usually assumed to exist. Second, if the analysis is correct, then Hungarian fills out a typological paradigm slot that is predicted to exist, but not yet attested: raising with anaphoric control.

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[16]Copy-raising constructions like *Richard seems like he's in trouble* (Potsdam and Runner, 2001) seem like good candidates, because the controller appears to be in an argument slot that is not thematic. However, Asudeh (2002) analyzes these nicely as involving assignment of a thematic role to the controller by the preposition *like*. If we take his analysis, then the semantic Coherence condition is not violated in copy-raising constructions.

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FOCUS CONSTRUCTIONS IN MESKWAKI (FOX)

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Focus constructions in Meskwaki (Fox)

Abstract

In this paper I examine types of focus in the nonconfigurational language Meskwaki (Fox), using as a framework for description Lambrecht's configurational approach to information structure, particularly his three-way typology of predicate-focus, argument-focus, and sentence-focus. This typology of focus sheds light on the role played by various word order patterns in Meskwaki, but presents some challenges for recent proposals regarding an i-structure projection within an LFG model.

1 Introduction[1]

Analyses within the LFG tradition have long emphasized the role played by discourse functions in syntax. F-structure representations include the grammaticalized discourse functions of TOPIC, FOCUS, and SUBJ, exploited, for example, in Bresnan and Mchombo (1987)'s demonstration that Chichewa object markers are anaphoric to TOPIC. In addition to the grammaticalized discourse functions of f-structure, it was suggested as early as Kaplan (1987) that a separate projection of discourse structure be included in the model, a suggestion developed in recent work by King, Butt, and Choi under the label of information structure, or i-structure (King 1995, 1997, Butt and King 1996, 2000, Choi 1997, 1999, 2001). An example which reveals the need for i-structure analysis may be found in Chichewa Locative Inversion, which Bresnan and Kanerva (1989) have shown is only possible when the theme argument of an intransitive verb is in presentational focus. Presentational focus cannot be equated with the grammaticalized discourse function FOCUS in f-structure, as Bresnan and Kanerva show; instead, it is the sort of information structure relation which belongs in an i-structure projection.

In this paper I examine presentational focus and other types of focus in the nonconfigurational Algonquian language Meskwaki, also known as Fox, using as a framework for description Lambrecht's constructional approach to information structure (Lambrecht 1994, 2000, 2001). In previous work (Dahlstrom 1993, 1995) I have proposed the word order template in (1), in which clause structure is flat, except for an external topic position:

(1) $[_{S'}$ TOPIC $[_{S}$ NEG FOCUS OBL V {S, O, O2, COMP}]]

Also to the left of the verb are a Negative position, a Focus (i.e. argument-focus) position, and the unmarked position for Oblique arguments of the verb. In contrast to the well defined ordering of elements to the left of the verb, this template has little to say

[1] Abbreviations in the examples: AOR = aorist prefix, DIM = diminutive, EMPH = emphatic, FUT = future, INAN = inanimate, LOC = locative, O = object, O2 = second object, OBV = obviative, PL = plural, QUOT = quotative, REDUP = reduplication, S = subject, SG = singular, X = unspecified subject. Boundary symbols: '=' clitic boundary, '-' morpheme boundary, '—' preverb-verb boundary. Textual abbreviations: C= Kiyana (1996 [1912]), J= Jones (1907), M= Kiyana (1912), O= Kiyana (1914), R= Michelson (1925), W = Kiyana (1913). Examples with no textual citation are elicited examples.

about material to the right, only that post-verbal position is the unmarked choice for subjects, objects, second objects, and complement clauses which are neither topic nor argument-focus. The present paper, however, sheds more light on the roles played by the post-verbal elements in the template, and, in the final section, touches upon some theoretical questions of i-structure representation.

2 Lambrecht on focus constructions

Lambrecht (1994, 2000, 2001) has developed a constructional approach to information structure which includes the fundamental concepts defined in (2):

(2) a. PRAGMATIC PRESUPPOSITION:
The set of propositions lexico-grammatically evoked in a sentence that the speaker assumes the hearer already knows or believes or is ready to take for granted at the time the sentence is uttered.

b. PRAGMATIC ASSERTION:
The proposition expressed by a sentence that the speaker expects the hearer to know or believe or take for granted as a result of hearing the utterance.

c. FOCUS:
That component of a pragmatically structured proposition whereby the pragmatic assertion differs from the presupposition. The focus component is by definition an unpredictable part of the proposition.
[Lambrecht 2001:474]

Every utterance is considered to have a focus component in its information structure, though, as will be seen below in the discussion of thetic sentences, not all utterances include a pragmatic presupposition.

In saying that focus is the unpredictable part of the utterance, it is important to distinguish focus from the separate question of the given vs. new status of discourse entities. For example, if a question is asked "Who wants ice cream?" and I answer "I do!", the first person pronoun is necessarily given or active in the speech situation; it is also here functioning as focus, since the identification of 'I' with 'one who wants ice cream' is the unpredictable and informative part of the utterance. Similarly, in (3) from Lambrecht (2001:477), the fact that Austin, Texas, is hot in the summer is surely known to both speakers: what is unpredictable is that it is this particular property of Austin that bothers speaker B.

(3) One Austinite to another:
A: What bothers you about Austin?
B: What bothers me is that it's so hot in the summer. [Lambrecht (2001:477)]

According to Lambrecht, focus is expressed crosslinguistically in three main types of constructions: predicate-focus, argument-focus, and sentence-focus. The three types are exemplified in (4)-(6), taken from Lambrecht (1994), with sample sentences from English, Italian, spoken French, and Japanese. The small caps indicate prosodic prominence.

(4) [context: What happened to your car?]
a. My car/It broke DOWN. predicate-focus structure
b. (La mia macchina) si è ROTTA.
c. (Ma voiture) elle est en PANNE.
d. (Kuruma wa) KOSHOO-shi-ta.

(5) [context: I heard your motorcycle broke down?]
a. My CAR broke down. argument-focus structure
b. Si è rotta la mia MACCHINA.
/E la mia MACCHINA che si è rotta.
c. C'est ma VOITURE qui est en panne.
d. KURUMA ga koshoo-shi-ta.

(6) [context: What happened?]
a. My CAR broke down. sentence-focus structure
b. Mi si è rotta (ROTTA) la MACCHINA.
c. J'ai ma VOITURE qui est en PANNE.
d. KURUMA ga KOSHOO-shi-ta.
[Lambrecht (1994:223)]

Predicate-focus, as in (4), is the unmarked articulation of information structure in any language, according to Lambrecht; the subject of the sentence corresponds to the topic and the remainder, the VP, is a comment on that topic. As a topical subject, the NP is not surprisingly often pronominal or null, as shown in (4). From an LFG perspective, this characterization of predicate-focus fits perfectly with the assumption that the grammaticalized discourse function SUBJ is the default topic (cf. Bresnan (2001:98) and references there).

The argument-focus construction, exemplified in (5), is the one most often discussed in treatments of "focus": the domain of focus is a single constituent (here the subject) and the remainder is an open, presupposed proposition. Strategies for expressing argument-focus vary across languages, including shifting the stress, as in English, inversion, as in the first Italian strategy, clefts, as in French and the second Italian strategy, and in Japanese, the use of *ga* rather than *wa* with a subject in argument-focus.

Finally, the sentence-focus construction, seen in (6), need not have any presupposed material at all. Both the subject and the predicate are included in the focus, distinguishing sentence-focus both from predicate-focus, where the subject is a topic and not part of the focus, and from argument-focus, where the predicate is part of the presupposed open proposition and hence not part of the focus. Sentence-focus constructions have been widely discussed under the label of 'thetic constructions' (Kuroda 1972, Sasse 1987, inter alia), and include existential and presentational sentences.

The schemas in (7-9) from Lambrecht (1994) summarize the information structure of each construction, using the English version in the (a) sentences above as illustrations:

(7) predicate-focus

Sentence:	*My car broke* DOWN.
Presupposition:	"speaker's car is a topic for comment x"
Focus:	"broke down"
Assertion:	"x = broke down"

(8) argument-focus

Sentence:	*My* CAR *broke down*.
Presupposition:	"speaker's x broke down"
Focus:	"car"
Assertion:	"x = car"

(9) sentence-focus

Sentence:	*My* CAR *broke down*.
Presupposition:	---
Focus:	"speaker's car broke down"
Assertion:	"speaker's car broke down"

[Lambrecht (1994:226, 228, 233); cf. Lambrecht (2001:475)]

3 Meskwaki word order

I now turn to a consideration of some of the major Meskwaki word order patterns from the point of view of Lambrecht's typology. Before looking at specific examples, however, a little background information about the workings of the language is in order.[2]

3.1 Background facts

Meskwaki verbs are inflected for features of both subject and object, in one of more than twenty paradigms of verb inflection. The choice of inflectional paradigm is sensitive to syntactic, semantic, and pragmatic factors, such as main vs. subordinate clause, negation, aspect, and evidentiality. In the glosses below I will largely ignore this aspect of Meskwaki morphology, indicating only the agreement features for subject and object.[3]

Regarding the syntax of verb inflection, we can begin by observing that first and second person inflection on verbs always functions as subject or object; that is, as incorporated pronouns. Independent pronouns such as *ni·na* 'I' or *ki·na* 'you (sg.)' are used for shifting topic or for (argument-) focus, not as ordinary subjects or objects. Third person inflection, on the other hand, may function as agreement with a lexical subject or object; in the absence of such external arguments the third person morphemes also take

[2] In the present paper I will unfortunately not address the important issue of Meskwaki prosody and how it contributes to the identification of information structure components. See Goddard (1991) for an overview of Meskwaki stress and intonation, and Goddard (2003) for intriguing examples regarding contrastive focus in yes-no questions.

[3] Note too that where contraction has obscured the boundary between stem and affix no effort has been made to indicate the underlying forms of the stem and affix, in order to keep the examples as uncluttered as possible. For example, *nepi·ki* 'in the water' is segmented as *nepi·-ki* (water-loc), rather than /*nepy-eki*/.

on a pronominal interpretation. (In other words, the third person forms include the optional equation of PRED = 'pro'.)

Within third person Meskwaki and the other Algonquian languages make a distinction between the most central third person in the discourse, known as PROXIMATE and expressed by unmarked third person forms, and other, more peripheral third persons, expressed by marked OBVIATIVE forms.

(10) *metemo·h-e·h-a* *e·h-neškim-a·či* *i·n-ini* *ihkwe·w-ani*
old.woman-DIM-SG AOR-scold-3S:3OBVO that-OBV woman-OBV
'The little old lady (proximate) scolded that woman (obviative)' [W31C]

In (10) the (topical) subject, 'little old woman' is proximate and is inflected with an unmarked third person suffix. The object, 'that woman', is obviative, marked by obviative suffixes on the demonstrative and on the noun. The verb is inflected with a suffix indicating that a third person singular proximate subject is acting upon a third person obviative object.

Among the grammatical functions of Meskwaki, it is worth noting that OBL$_{\Theta}$ plays an especially prominent role. The unmarked position for an oblique argument is immediately to the left of the verb, as seen in the following examples illustrating obliques of goal, stationary location, source, and manner :

(11) *wi·sahke·h-eki* *k-i·h-iši—mawi—wi·seni-pwa* **Obl$_{\mathbf{goal}}$ V**
W-LOC 2-FUT-thither—go—eat-2PL
'You (plural) should go to Wi·sahke·ha's place to eat' [W258A]

(12) *i·nahi* *net-apih-api* **Obl$_{\mathbf{loc}}$ V**
there 1-REDUP-sit
'I was sitting there' [Dahlstrom 2003b:15O]

(13) *wa·wi·tawiškwa·te* *e·h-oči—nowi·-wa·či* *neswi* *neniw-aki*
doors.on.both.ends AOR-from—go.out-3PL 3 man-PL
Obl$_{\mathbf{source}}$ V S
'Three men went out from the doors on both ends' [W163K]

(14) *wi·h-koči—nes-a·wa·či* *e·h-inowe·-wa·či.* **Obl$_{\mathbf{manner}}$ V**
FUT-try—kill-3PLS:3OBVO AOR-declare.thus-3PL
'They declared that they would try to kill him' [Dahlstrom 2003a:16M]

The manner type of oblique is especially frequent in Meskwaki because all direct and indirect quotes are oblique arguments of the quoting verbs. (Note, by the way, that the long dashes indicate phonological word boundaries between a preverb and a verb, while the short hyphens indicate morpheme boundaries.)

Besides the familiar types of obliques seen in (11-14), however, Meskwaki has more exotic varieties as well, including an oblique type expressing number or quantity, which will be seen in section 3.4, one for spatial or temporal length, one for height or depth, one for size, and another for all other scalar notions such as age, weight, speed, or strength. The latter is illustrated in (15):

(15)	*a·wasi·mehi*	*e·h-ahpi·hčiki-či*	*kwi·yese·h-a,*	**Obl$_{extent}$ V S**
	a.little.more	AOR-be.so.old-3	boy-SG	
	iškwe·se·h-a	*atena·wi*		**Foc Obl$_{extent}$**
	girl-SG	less		
	'The boy was a little older, the girl younger' [O58B]			

3.2 Predicate-focus

According to Lambrecht, the predicate-focus construction is the unmarked articulation of information structure, where the focus is a comment on an already given topic. In Meskwaki, as in many other languages, new or shifted topics appear utterance-initially, as seen in (16) and (17):

(16)	*wi·sahke·h-a=ke·hi*	*wa·natohka=meko*	*e·h-kehči—nepa·-či*	**Top Adj V**
	W-SG=and	peacefully=EMPH	AOR-greatly—sleep-3	
	'As for Wi·sahke·ha, he was peacefully sound asleep.' [W163P]			

(17)	*ni·na='yo*	*a·kwi*	*kosetaw-akini*	*ke-meso·ta·n-aki*	**Top Neg V O**
	I=of.course	not	fear-1S:3(PL)O	your-parent-PL	
	'As for me, I'm not afraid of your parents' [R312:34]				

(16) shows that both the overt topic and the first word of the comment can be hosts for second position enclitics: this is one piece of evidence for a topic position outside of the core clause. In (17), note that the topic precedes the negative word *a·kwi* 'not'.

In texts one finds long sequences of clauses in which a continuing topic is coreferential to one of the arguments of the clause, nearly always the subject. The subject is thus expressed only by the inflection on the verb, here functioning as an incorporated pronoun. For example, consider the textual excerpt given in (18). A new topic is introduced in line (a) with an overt NP, 'that young teenage boy', and the boy continues as topic throughout lines (b) through (e). The context here is that the boy is living apart from his family as he fasts for a vision; his father comes every day to check on him. The previous topic was the father, when the narrator explained that the father made his son fast all the time.

(18) [text excerpt from Dahlstrom (1996:130)]

a. *o·ni·='na*	*oškinawe·h-e·h-a*	**Top**
and.then=that	young.man-DIM-SG	
'And then that young teenage boy,		

b. *“nahi, natawi-po·ni-mahkate·wi·-no,”* *e·h-in-eči* *e·h-ina·hpawa·-či*
okay, time.to-stop-fast-2/IMPERATIVE AOR-say.thus.to-X:3 AOR-dream.thus-3
[Obl V]$_{\textbf{Obl}}$ V
“Okay, it’s time for you to stop fasting,” he dreamed that he was told.

c. *“wi·kiya·p-eki=meko* *pe·hki* *k-i·h-awi,”* *e·h-in-eči* **Obl V**
house-LOC=EMPH really 2-FUT-be.[there] AOR-say.thus.to-X:3
“You should be in the main house,” he was told.

d. *pye·ya·-niči* *o·s-ani,* **V S**
come-3OBV his.father-OBV
When his father came,

e. *e·h-a·čimoh-a·či* *e·na·hpawa·či.* **V Comp**
AOR-tell-3S:3OBVO how.he.dreamed
he told him what he had dreamed.’

In line (b) the rightmost verb is the matrix verb, with a subject coreferential to the overt topic of line (a). The matrix verb in (b) takes a clausal oblique argument to its left; the verb of that clause also takes an oblique argument, which is the quoted material. In line (c) the matrix verb is again rightmost in the clause, taking the preceding quoted material as an oblique. The matrix verb in (c) is inflected for an unspecified subject acting on a third person object. Here the argument coreferential to the overt topic of line (a) is syntactically an object, not a subject. However, since the topical third person object is the most prominent argument in the clause, we can still consider this clause an example of “predicate-focus”. Line (d), with the boy’s father as subject, is an adverbial clause identifying the time of the following matrix clause in (e), which is again a predicate-focus construction providing information about the overt topic of line (a).

In (18) the new topic is proximate when first mentioned, and remains proximate throughout. Another pattern is to introduce the new topic in relation to the previous topic, which requires the new topic to be obviative on first mention. In subsequent clauses, however, the new topic gains proximate status:

(19) [text excerpt from Dahlstrom (2003b:7F-H)]

a. *i·ni=ke·hi='pi·='na* *o·s-ani* *e·h-a·nawapwi·h-ekoči.* **Top V**
then=and=QUOT=that his.father-OBV AOR-fail.to.wait.for-3obvS:3O
‘And then, it's said, that [boy]'s father got tired of waiting for him.

b. *i·tepi* *e·h-a·-či.* **Obl V**
there AOR-go-3
He went there.

c. *e·h-anemi–=meko* *–a·hkwe·wite·he·či,* **V**
AOR-away–=EMPH –feel.angry-3
He went off feeling angry,

d. *"ne·w-ake, n-i·h-kehči–neškim-a·wa," e·h-in-a·či ow-i·w-ani.*
see 1S:3O 1-FUT-greatly–scold 1S:3O aor-say.thus.to-3S:3OBVO his-wife-OBV
telling his wife, "When I see him, I'm really going to scold him."' **Obl V O**

3.3 Argument-focus

We now turn to the argument-focus construction, in which the focal constituent fills in the gap of a presupposed open proposition. In Meskwaki, argument-focus may be expressed by putting the focal element in Focus position, or by using a cleft. In clefts, the focal element may also be analyzed as appearing in the Focus position, equated to a following headless relative clause. Meskwaki has a zero copula for equational sentences.

The minimal pair in (20) and (21) illustrates the difference between a shifted overt topic and an element in focus position:

(20) *ni·na a·kwi wi·h-na·kwa·-ya·nini* **Top Neg V**
I not FUT-leave-1
'As for me, I'm not leaving'

(21) *a·kwi ni·na wi·h-na·kwa·-ya·nini* **Neg Foc V**
not I FUT-leave-1
'I'M not leaving; it's not me who's leaving'

In (20), the pronoun *ni·na* 'I' is in topic position; the comment about this topic is that the speaker is not leaving. There is no presupposition that anyone else is leaving. In (21) the pronoun is in the focus position, to the right of the negative. Here there is a presupposition that someone is leaving, but the assertion is that it is not the speaker who is leaving.

In the remainder of this section I give a brief overview of the various types of argument-focus constructions in Meskwaki.

3.3.1. Argument-focus expressing contrast. As (21) shows, a common function of the argument-focus construction is to express contrast between the focal argument and other possible candidates for that role. Another example of this contrastive function may be seen in (22):

(22) *a·kwi=na·hkači* [*ni·na nešihka*] *ota·hi·nemi-ya·nini* **Neg Foc V**
not=also I alone possess.O2-1SG

[*ki·na e·ye·ki*] *ke-tepe·net-a* **Foc V**
you also 2-own-INAN.O
'I do not possess them alone, you also own them' [W244NO]

Again, the argument-focus in the first clause of (22) follows the negative word *a·kwi*, as schematized in the template of (1).

3.3.2. Argument-focus with 'only', 'even,' etc. Argument-focus constructions are also frequently used with adverbs such as 'only' and 'even':

(23)	*a·kwi*	[*mo·hči*	*nekoti*]	*nes-akečini*	**Neg Foc V**
	not	even	one	kill-1PLS:3O	
	'We didn't kill even one' [Dahlstrom 2003b:24B]				

(24)	*a·kwi*	[*še·ški*	*wi·h-taneneko-ya·ni*]	*wi·to·hkaw-ičini*	**Neg Foc V**
	not	only	FUT-play-1SG	allow-3S:1O	
	'She [speaker's mother] didn't allow me to just loaf' [R298.34]				

In (24) the argument in focus is the complement clause of 'allow'. Clauses bearing the Comp GF are otherwise to the right of the matrix verb, as in (25):

(25)	*a·kwi*	*wi·to·hkaw-ičini*	*wi·h-mawi—wa·pake·-ya·ni*	**Neg V Comp**
	not	allow-3S:1O	FUT-go—look.on-1	
	'He didn't allow me to go to watch [dances]' [R322:8]			

3.3.3. Unexpected information. Another type of argument-focus construction is motivated by a contrast between what might be expected given knowledge about the world and what is actually found. The following example is from a story about the culture hero and trickster, *Wi·sahke·ha*:

(26)	*ke·htena=meko*	*ašewa·pikone·h-i*	*e·h-no·ša·t-aki*	**Adj Foc V**
	surely=EMPH	little.squash-SG	AOR-give.birth.to-3S:INANO	
	'Surely she [the trickster's wife] gave birth to a little squash.' [W923]			

3.3.4. Question words, answers, quantifiers. Question word questions in Meskwaki appear in cleft or noncleft argument-focus constructions depending on the choice of question word. The question words beginning in *k* (*kaši* 'how?', *ke·swi* 'how many?', and *ke·senwi* 'how many times?') generally appear in nonclefted argument-focus constructions, while the other question words, such as *we·ne·ha* 'who?', *we·kone·hi* 'what?', *ta·ni* 'where?' must appear as the focus of a cleft:

(27)	*ke·swi=ča·hi*	*i·nahi*	*awi-waki?*	**Foc Obl V**
	how.many=so	there	be.[there]-3PL	
	'How many [people] were there?'			

(28)	*kaši=ya·pi*	*išiso-waki*	*k-o·šisem-aki?*	**Foc V S**
	how=may.I.ask	be.thus.named-3PL	your-grandchild-PL	
	'What are your grandchildren's names?' [W573]			

Notice that the non-focused arguments of (27) and (28) appear in their unmarked positions: to the left of the verb for obliques and to the right of the verb for subjects.

For clefted questions, the question word can again be analyzed as being in the Focus position. The brackets below indicate the headless relative clause which functions as the righthand portion of the equational sentence:

(29)	*we·ne·h=ča·h*	[*ne·sa·ta*	*neto·kima·mena·n-an*]?	**Cleft**
	who=so	one.who.killed.him	our.chief-OBV	
	‘Who is the one who killed our chief?’ [J26.13]			

The answers to question word questions are also in argument-focus:

(30)	*mana=ča·h*	*n-i·hka·n-a*	[*ne·sa·ta*]	**Cleft**
	this=so	my-friend-SG	one.who.killed.him	
	‘This friend of mine is the one who killed him’ [J26.17]			

Like question words, operators which are quantifiers also are commonly found in the argument-focus position in Meskwaki:

(31)	*ka·ta=ke·h=na·hkači*	*owiye·ha*	*a·čimoh-iye·kani*	**Neg Foc V**
	don’t=and=also	someone	tell-2S:3O	
	‘And don’t tell anyone else.’ [W37G]			

(32)	*kekimesi=meko*	*e·h-anemo·m-a·wa·či*	*apahkway-ahi*	**Foc V O**
	everyone=EMPH	AOR-carry.on.back-3PLS:3OBVO	mat-OBV.PL	
	‘Everyone carried mats on their backs’ [Dahlstrom 2003a:4F]			

3.3.5. Sub-constituent focus. A final type of argument-focus construction in Meskwaki puts only part of the argument in the focus position: only the modifier which is being contrasted or questioned, leaving the head of the argument in the unmarked, post-verbal position:

(33)	*ke·swi=ya·pi*	*i·ni*	*e·h-ketemino·-hki*	*maneto·w-aki?*	**Foc$_i$ Adj V S$_i$**
	how.many=may.I.ask	then	AOR-bless-3(PL)S:2O	spirit-PL	
	‘How many spirits blessed you then?’ [C1K]				

(34)	*kotak-a=či·h=meko*	*ne-kehkahama·-ko·pi*	*oškinawe·h-a*	
	other-SG=EXCL=EMPH	1-designate.O2.for-X:1	young.man-SG	
	wi·h-ona·pe·mi-ya·ni			**Foc$_i$ V S$_i$ Comp**
	FUT-have.O2.as.husband-1			

‘It turned out another young man had been designated for me to marry!’ [R310.28] [context: speaker was describing the young man she loved]

The appearance of only the modifier in argument-focus position thus produces a discontinuous NP.

3.4 Sentence-focus

Turning now to Lambrecht's third type of focus construction, sentence-focus, we should first of all note that little has been said in the description of Meskwaki or other Algonquian languages regarding the expression of such constructions. These are the constructions which function to introduce a new referent into the discourse or report on an event. The verb involved is typically intransitive, with a nonagentive subject.

In this section, like the preceding, I present a brief overview of types of sentence-focus constructions in Meskwaki. In terms of word order, we can observe that subjects in such sentences are expressed by lexical NPs to the right of the verb, as opposed to the topical subjects of predicate-focus constructions or the focal argument in argument-focus constructions.

3.4.1. Weather/temporal verbs. In many languages, descriptions of the weather are sentence-focus constructions, such as the Russian example in (35), taken from King (1995):

(35) *Šel dožd'.*
go rain
'Rain was falling.' [Russian: King (1995:97)]

In Meskwaki, however, weather reports are expressed with simply an intransitive verb, inflected for an impersonal inanimate singular subject. No external NP subject is possible with such verbs, so the word order pattern is trivial: simply a verb.[4]

(36)	a.	*kemiya·-wi* rain-INAN.SG	'It's raining'	**V**
	b.	*mehpo-wi* snow-INAN.SG	'It's snowing'	**V**
	c.	*ni·pen-wi* be.midsummer-INAN.SG	'It's midsummer'	**V**

Impersonal verbs are similarly used to specify times of the day or seasons of the year, as in (36c).

3.4.2. Predicating number. Turning now to more interesting cases, we can note that a predication of existence is often accomplished with one of a set of verbs expressing the number of the subject:

(37)	a.	*nekoti·hi-*	'be one [diminutive]'
	b.	*ni·ši-*	'be two'
	c.	*nesi-*	'be three'
	d.	*nye·wi-*	'be four'

[4] Cf. Lambrecht (2000:619), who points out that such verbs without lexical subjects should not be classified as sentence-focus in his terms.

e.	*meta·ši-*	'be ten'		
f.	*taši-*	'be so many'	[for other numbers; the number is an OBL]	
g.	*ma·ne·-*	'be many'		

Indeed, one of the main functions of the verbs of number is to express existence. If one wants to say, for example, 'there are three young women here' the construction is literally "young women are three here":

(38) *ayo·hi=ya·pi* *nesi-waki* *še·škesi·h-aki* **Adj V S**
here=may.I.say be.three-3PL young.woman-PL
'There are three young women here.' [J52.10]

(39) *e·h-nye·wi-nič* *o-ni·ča·nes-ahi* **V S**
AOR-be.four-3OBV his-child-OBV.PL
'His children are four' [i.e., he has four children] [J234.22]

(40) *e·h-ma·ne·-niči='yo=ke·hi* *ketiw-ahi* **V S**
AOR-be.many-3OBV=of.course=and eagle-OBV.PL
'There were, of course, many eagles.' [W1F]

In (38-40), the subject of the existential verb occurs to the right of the verb. This accords with the observation by Lambrecht (2000:622) that the subject in a sentence-focus construction must be marked as non-topical. In (39) the subject of the existential verb is possessed, so a more idiomatic gloss in English is with a verb of possession.

3.4.3. Expressing location. Another typical sentence-focus construction is one in which the existence of the subject is predicated relative to a location. In Meskwaki this may be expressed with a simple locative verb, as in (41), or with a verb specifying the posture of the subject (that is, standing, sitting, lying, etc.), as in (42). All such verbs are subcategorized for a subject and an oblique of stationary location.

(41) *nepi·-ki=koh* *awi-wa* *ne-mise·h-a* **Obl V S**
water-LOC=certainly be.[there]-3 my-elder.sister-SG
'My elder sister is in the water' [J108.5]

(42) *ahkwič* *asen* *e·h-či·tapi-niči* *wi·sahke·h-ani* **Obl V S**
on.top rock AOR-sit.upright-3OBV W-OBV
'On top of a rock sat Wisahkeha.' [J332.12]

3.4.4. Verbs of emerging. The emergence of a new character onto the scene is also accomplished by a sentence-focus construction using the verb (or preverb) 'come'. In (43), the subject NP 'his cousin' is the first mention of this character in the story:

(43) *o·ni='pi* *nye·wokonakateniki* *e·h-pya·-niči* *o-to·te·m-ani*
&.then=QUOT when.it.was.4.days AOR-come-3OBV his-cousin-OBV
'And then, it's said, four days later his cousin came.' [W37K] **Adj V S**

(44)	*e·h-pye·či—pi·tike·-niči*	*o·hkomese·hwa·w-ani*	**V S**
	AOR-come—enter-3OBV	their.grandmother-OBV	
	‘Their grandmother came inside.’ [W233H]		

The directional preverb *pye·či* ‘come’ in (44) indicates that the deictic center is inside the house, the location of the main characters, who are the source of point of view here.

3.4.5. Setting a scene. A narrative might begin by presenting a scene using the V S order of the sentence-focus construction:[5]

(45)	*nekotenwi*	*e·h-nakiška·ti·-wa·č*	*ke·ka·nwikaše·w-a*	
	once	AOR-meet.each.other-3PL	grizzly.bear-SG	
	na·hka	*šeka·kw-a*		**Adj V S**
	and	skunk-SG		
	‘Once a grizzly bear and a skunk met each other.’ [J112:7]			

3.4.6. Reporting an event. Sentence-focus constructions may also report an event at any point in a narrative, not just at the beginning of a story:

(46)	*o·ni*	*kapo·twe*	*e·h-we·pi—pehki·nawi-či*	*wi·čawiwaka*
	and.then	at.some.point	AOR-begin—act.differently-3	one.who.I.live.with
	‘Then soon my husband began to act differently.’ [R320.2]			**Adj V S**
	[previous context: speaker’s experiences in childbirth]			

(47)	*po·hkwi*	*neme·siwi-wa*	*ne-sese·h-a*	**Adj V S**
	half	be.fish-3	my-elder.brother-SG	
	‘My elder brother turned into a half-fish’ [C4N]			

3.4.7. Locative/emergence verbs can also occur in argument-focus constructions. The verbs of location and emergence do not, of course, occur only in sentence-focus constructions. They may also be found in argument-focus constructions, with the subject in argument-focus position to the left of the verb. In (48) the context is that two boys see the tracks of a raccoon in the snow, leading to a tree. One boy climbs the tree to get the raccoon:

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[5] However, many other Meskwaki stories begin with a sentence using SV order, as in (i), or even SOV order, as in (ii):

(i)	*našawaye*	*neno·te·w-a*	*e·h-ma·-mahkate·wi·-či*
	long.ago	Indian-SG	AOR- REDUP-fast-3
	‘Long ago an Indian was fasting.’ [M1A]		

(ii)	*našawaye*	*nekoti*	*neniw-a*	*o-kwis-ani*	*e·h-mahkate·wi·n-a·či*
	long.ago	one	man-SG	his-son-OBV	AOR- make.fast-3S:3OBVO
	‘Long ago a certain man made his son fast’ [Dahlstrom 1996:129.1]				

(48) *i·ya·hi e·h-pye·ta·si·-či,* **Obl V**
there AOR-come.climbing-3

kaši, mya·nahiw-ani=či·hi i·nahi e·h-šekiši-niči! **Foc Obl V**
why, catfish-OBV=exclam there AOR-lie-3OBV
'When he came climbing up there,
why, there was a catfish lying there!' [C2IJ]

In (48) there was an expectation that a raccoon would be in the tree; instead, the boy finds a catfish. This contrast motivates the use of an argument-focus construction, in which the focal element, the catfish, is in Focus position to the left of the verb and to the left of the oblique argument

The textual passage in (49) also illustrates the difference between sentence-focus and argument-focus. The context here is that a bear has killed the fasting boy of example (18) above, and no one has been able to kill that bear. Finally a boy nicknamed Lazybones declares he can kill it, and specifies the time and place. In the sentence preceding the one in (49) the other people of the tribe appear as an overt proximate topic; they build fires outside to watch for the boy and the bear:

(49) [text excerpt from Dahlstrom 1996:153]

a. *aškači e·nemi—meškošawe·-niči ki·šeso·-ni,* **V S**
later become—glow.red-3OBV sun-OBV
'Later when the sun started to glow red,

b. *e·h-pye·či—keta·ška·-niči mahkw-ani,* **V S**
AOR-come—run.out-3OBV bear-OBV
the bear came running out into view,

c. *ahkowi-·me·h=meko pačan-ani e·h-pye·či—keta·ška·-niči,*
behind-DIM=EMPH Lazybones-OBV AOR-come—run.out-3OBV
Adj S V
and Lazybones came running out into view just a little ways behind,

d. *e·h-wa·pam-a·wa·či.* **V**
AOR-look.at-3PLS:3OBVO
and they [the other people] watched them.'

Compare (49b) and (49c): in (b) the emergence of the bear is reported with sentence-focus, while in (c) the additional, contrasting information that Lazybones ran out is expressed with argument-focus.

We may sum up the findings regarding focus constructions in Meskwaki as follows. Overt topics are utterance initial; there is a separate position for argument-focus to the left of the verb (and to the left of oblique arguments). NPs to the right of the verb may be part of predicate-focus, or a subject in the sentence-focus construction, or may be part of the presupposed portion of the argument-focus construction. The verb itself is part of the focus in the predicate-focus and sentence-focus constructions, but is part of the presupposed material in the argument-focus construction.

4 I-structure representation

With the above summary of Meskwaki word order patterns in mind, let us now turn to the question of how the encoding of information structure relations might be represented formally. Space does not permit a full examination of the issues involved in formalizing all the Meskwaki constructions presented above. I would instead like to concentrate on a single construction, the sentence-focus construction. How can we ensure that both the verb and the subject in this construction are in the scope of focus?

Recent work in LFG has proposed a variety of ways to represent discourse functions and information structure. King (1995), on Russian, and Butt and King (1996), on Turkish and Urdu, locate discourse information within f-structure, adding new DFs to the familiar TOPIC and FOCUS. Specifically, King (1995) uses E(xternal)-TOP, (internal) TOP, C(ontrastive)-FOC, Q-FOC, and FOC (new information focus), while Butt and King (1996) use TOP, FOC, BACK (background information), and COMPLETIVE. However, King (1997) shows convincingly that such enhanced f-structures run into a number of scoping problems. That is, if a discourse function such as contrastive focus is assigned to an f-structure head, the wrong scope results (e.g. the whole clause is focused, not just the verb). Moreover, the scope of focus may be the verb plus its object, which is not a constituent in f-structure. King (1997) concludes that a separate projection of i-structure is needed, in which predicates are represented without their argument structure, avoiding at least some of the scoping problems encountered in f-structure.

Butt and King (2000), on Hindi/Urdu, present one possible realization of i-structure. They take the four DFs that they had posited in Butt and King (1996) (TOP, FOC, BACKGROUND, and COMPLETIVE INFORMATION) and represent them in a separate attribute-value matrix, similar to that of f-structure. For example, the two Urdu sentences in (50) have an i-structure representation as in (51):[6]

(50) a.

[mãĩ]	bais	barf=se	yahãã	rah	rah-aa	hũ
I.NOM	twenty-two	winter=from	here	live	Stat=MSG	be.PRST.1.SG

‘I_{topic} have been living here for 22 years.’

b.

rozaanaa	is	hii	sarak=se	guzar-taa	hũ
daily	this	EMPH	street.F=from	pass-IMPF.MSG	be.PRST.1.SG

‘Daily ($I_{cont\cdot topic}$) go through this street.’
[Butt and King (2000) [their example (22)]]

[6] In (51) I have indicated identity between the two topics with a subscript, rather than with the arrow employed by Butt and King (2000).

(51) I-structure:

$$\left[\begin{array}{l}\left[\begin{array}{ll}\textsc{topic} & \{[\textsc{pred}\ \text{'I'}]_i\} \\ \textsc{focus} & \{[\textsc{pred}\ \text{'here'}]\} \\ \textsc{comp.inf} & \{[\textsc{pred}\ \text{'twenty-two years'}]\}\end{array}\right] \\ \left[\begin{array}{ll}\textsc{topic} & \{[\quad]_i\} \\ \textsc{focus} & \{[\textsc{pred}\ \text{'street'}]\} \\ \textsc{comp.inf} & \{[\textsc{pred}\ \text{'daily'}]\}\end{array}\right]\end{array}\right]$$

Notice that the values in i-structure are sets, allowing the discourse functions to have scope over material which does not form a constituent in f-structure or c-structure. Where discourse functions are associated with specific constituent structure positions, the c-structure node is annotated for that i-structure function: for example, in Hindi/Urdu, the constituent immediately to the left of the verb is in focus. For arguments which are null in c-structure, a-structure information is used to fill in a pronominal value; only (continuing) topics and background information are permitted to be null.

Choi (1997, 1999, 2001), on the other hand, has developed a different view of i-structure based on data from English, German, and Catalan. She uses the binary features [+/- New] and [+/- Prom], giving the four-way distinction in (52). She further assumes an OT implementation in which ranked constraints are sensitive to the i-structure features (as well as to grammatical functions), conspiring to produce optimal c-structures. In the simple example given in (53), the high ranking constraint PROM-L ensures that the [+Prom] constituent *the knife* appears at the left of the clause.

(52)	[+Prom, -New]	(shifted) topic, link	
	[-Prom, -New]	continuing topic, tail	
	[+Prom, +New]	contrastive/emphatic focus	
	[-Prom, +New]	completive/presentational focus	[Choi (2001:21)]

(53) Where did you put the knife? – The knife I put on the table.

[I]	[put]	[the knife]	[on the table]	
[-New]	[-New]	[-New]	[+New]	
[-Prom]	[-Prom]	[+Prom]	[-Prom]	[Choi (2001:47)]

With this brief overview of recent work on i-structure in mind, let us return to the problem of ensuring that both the verb and the subject in a sentence-focus construction are marked as focal. If we try annotating the c-structure nodes, as Butt and King (2000) do for other types of constructions in Hindi/Urdu, we run into the problem that neither the verb nor a postverbal subject is uniformly a focus position. This is in contrast to the topic position and the argument-focus position in Meskwaki, which can be seen as dedicated to specific functions.[7]

In Choi's framework, sentence-focus, or "all-focus", sentences are assigned the single feature [+New] to the whole sentence. None of the i-structure to c-structure mapping constraints apply; instead the word order pattern that emerges is assumed to be the canonical one (at least for Catalan). Choi's approach could be made to work for Meskwaki sentence-focus as well, if we assume that the order Verb Subject is the "canonical" order.

But there is more to information structure than simply getting the word order right. Recall the example of Chichewa Locative Inversion, which is licensed only in sentence-focus constructions. We cannot capture the conditions under which Locative Inversion applies merely by saying that the theme must be [+New]; rather, we need access to the whole construction that is being used. Here perhaps a propositional representation such as those given by Lambrecht (1994) in (7-9) may be of value in an i-structure representation: we could say that the sentence-focus construction is identified by having a null value for the presupposition, as in (9), repeated below, and where the focus is equal to the assertion.

(9) sentence-focus

Sentence:	*My* CAR *broke down.*
Presupposition:	---
Focus:	"speaker's car broke down"
Assertion:	"speaker's car broke down"

A constructional approach would avoid some of the problems that arise when trying to fit sentence-focus constructions into existing proposals for i-structure. For example, Butt and King's (2000) approach of annotating c-structure nodes for i-structure functions works well for overt topics, or for pre-verbal foci, since the scope of such functions is typically a single constituent, but is difficult to extend to the sentence-focus construction. Choi's solution, to treat such constructions as [+New] with no [+Prom] element, unfortunately confuses the discourse relation of focus with the separate issue of given vs. new information (see the discussion of example (3) above), and further entails that the word order pattern of sentence-focus constructions must be taken as the canonical word order of the language as a whole. While such a position may be justifiable for some languages, it seems hard to accept that conclusion for the spoken French example of sentence-focus in (6c) above.

In conclusion, I have surveyed a number of word order patterns in Meskwaki and found evidence supporting Lambrecht's typology of focus: distinct constructions for predicate-focus, argument-focus, and sentence-focus. The properties of the sentence-focus construction in particular pose challenges for existing theories of i-structure representation, suggesting that constructional information may be required in at least this projection of grammatical structure.

[7] King (1995) discusses similar issues in Russian, and it should be pointed out that Butt and King (2000) do not treat sentence-focus constructions. They also explicitly put aside the question of the verb's discourse function for later work.

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THE SYNTACTIC STRUCTURE OF TZ'UTUJIL MAYA

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0. Abstract

In this paper, I examine the ordering principles of the post verbal argument noun phrases (NPs) of the K'ichean language of Tz'utujil. I show that the ordering principles are primarily a function of the properties of the NPs with the definiteness property predominant. But other NP properties, such as animacy, clause weight, proper/common status, and pronominal use all contribute to NP ordering principles. I demonstrate that verb initial word order with NPs of equal definiteness (excluding the unmarked NP) is ambiguous but still grammatical. Yet syntax cannot be ignored in the ordering of post verbal NPs. I prove that VSO word order is grammatical, although VOS is clearly preferred.

I scrutinize Tz'utujil focus particles, re-evaluate past analyses about Tz'utujil's preverbal foci, and propose ordering principles for contrastive focus (ConFoc) and negative focus (NegFoc). I propose that the Tz'utujil topic phrase is in [Spec, CP], rather than [Spec, IP]. This result better accommodates adverb adjunction than does the currently proposed Kaqchikel model. In addition, I establish that the preverbal foci of ConFoc and NegFoc are in [Spec, IP], and are ordered such that ConFoc precedes NegFoc obligatorily. I demonstrate that X-bar theoretic functional projections, which until now have been considered to encode only discourse related material or pragmatics, can, in fact, encode grammatical relations as well. The Tz'utujil data is compared throughout to the K'ichean sister language of Kaqchikel for typological reasons. Ultimately a phrase structure for Tz'utujil Maya within the theoretical paradigm of Lexical-Functional Grammar but using a revised general schema is proposed.

1. Introduction[1]

In this paper, I shall examine the ordering principles of the post verbal argument noun phrases (NPs) of the K'ichean language of Tz'utujil. I shall look at the effect on ordering principles of the specific properties of NPs, in particular the property of definiteness. I shall also look at other NP properties, such as animacy, clause weight, and proper/common nominal status to see if they contribute to constituent ordering. I shall examine verb initial word order with NPs of equal definiteness, and I shall examine the

[1] Tz'utujil is a Mayan language spoken by about 100,000 people in Guatemala. This paper reports on the Tz'utujil dialect of San Pedro la Laguna, Lake Atitlán as spoken by Snr. Aku Kumatz. The paper uses the conventions of the national orthography, in which <x> = a voiceless alveopalatal sibilant (IPA [ʃ]), <tz> = a voiceless dental affricate (IPA [ts]), <ch> = a voiceless alveopalatal affricate (IPA [tʃ]), <q> is an uvular stop, and an apostrophe = glottal stop (following a vowel) or glottalization (following a consonant). The five lax vowels are short and the five tense vowels are long.

Glosses use the following abbreviations: A = absolutive agreement marker, AF = actor focus, com = completive aspect, E = ergative agreement marker, IF = instrument focus, inc = incompletive aspect, IV = (intransitive) phrase final marker, pl = plural, pass = passive, rel= relative pronoun, s = singular. Unless otherwise indicated, all data are taken from my fieldwork in San Pedro la Laguna.

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effect, if any, of syntax in the ordering of post verbal NPs. I shall also investigate VSO word order, which has always been considered ungrammatical in Tz'utujil.

I shall also scrutinize Tz'utujil focus particles, re-evaluate past analyses about Tz'utujil's preverbal foci, and suggest ordering principles for contrastive focus (ConFoc) and negative focus (NegFoc). The nature of the functional projections of X-bar theory will be reexamined in light of the absolute binary distinction between functional and lexical projections. The Tz'utujil data is also compared throughout to the K'ichean sister language of Kaqchikel for typological reasons. Ultimately a clause structure for Tz'utujil Maya within the theoretical paradigm of Lexical-Functional Grammar but using a revised general schema will be proposed.

2. The interaction of definiteness and word order

Tz'utujil is described as a predicate initial language with a 'basic' word order of VOS (Dayley 1985). Verb initial word order suggests we can find sentence final grammatical subjects and sentence medial grammatical objects in a simple matrix clause with two post verbal noun phrases (NPs):

(1) X-uu-tz'et jun miix ja tz'i'. VOS
com-3E-see det:one cat det:the dog
The dog saw a cat. (*A cat saw the dog.)

In terms of NP definiteness properties, the number of possible arrangements using VOS word order is surprisingly limited. I shall present all the post verbal NP options available to speakers.

Example (2) demonstrates that two post verbal argument NPs may both be unmarked for definiteness (cf. Dayley 1985:305 Ex.77a). Note that the subject in (2) can be determined through the lexical semantics of the verb and its NPs because the verb is not semantically reversible:

(2) a. N-uu-tij wej tz'i'. VOS
inc-3E-eat tortillas dog
The dog eats tortillas.

b. N-kee-tij wej tz'ii'. VOS
inc-3plE-eat tortillas dogs
Dogs eat tortillas.

Dayley (1985:304) notes that, along with an unmarked (for definiteness) subject, an unmarked (for definiteness) object NP may be interpreted as definite:

(3) X-kee-tij tzyaq ch'ooyaa'.
com-3plE-eat clothes rats
Rats ate (the) clothes. Dayley:305 Ex.77a

At this point, I do not see how Dayley's (1985:304) interpretation of the definite object NP *tzyaq* 'clothes' as being a generic can viably co-exist with a subject NP of less than or equal definiteness, for example the generic subject NP *ch'ooyaa'* 'rats.' Either way, if Dayley is correct, his sentence should be ambiguous but appears not to be.

The combination of an object NP unmarked for definiteness and a definite subject NP is also unambiguous and grammatical:

(4) a. N-uu-tij wej ja tz'i'. VOS
inc-3E-eat tortillas det dog
The dog eats tortillas.

b. N-kee-tij ixiim ja julee' tz'ii'. VOS
inc-3Epl-eat tortillas det some dog-pl
Some dogs eat corn.

But with an indefinite object and a subject unmarked for definiteness, the sentence is now ungrammatical:

(5) a. *N-uu-tij jun wej tz'i'. *VOS
inc-3E-eat det tortilla dog
(*The dog eats a tortilla.)

b. *X-uu-tz'et jun miix Ta Mari'y. *VOS
inc-3E-see det cat Miss Maria
(*Maria saw the cat.)

Yet (5b) becomes grammatical when the subject NP is marked as definite, as in (6):

(6) X-uu-tz'et jun miix ja Ta Mari'y. VOS
inc-3E-see det cat det Miss Maria
Maria saw a cat.

Example (7) shows an optimum distribution of NP definiteness in the predicate initial form: the object NP is indefinite and the subject NP is definite:

(7) X-uu-tz'et jun tz'i' jar Aa Xwaan. VOS
inc-3E-see det dog det Mr. Juan
(The) Juan saw a dog.

Another preference for post verbal NP word order in Tz'utujil is for animates to follow inanimates and for proper nouns to follow common nouns.

Example (8) illustrates, in a predicate initial clause, a common noun *jun miix* 'a cat' followed by a proper noun *Ta Mari'y*:

(8) X-uu-tz'et jun miix ja Ta Mari'y. VOS
com-3E-see det cat det Miss Maria
Maria saw a cat.

It is not ungrammatical to use VSO word order with a proper noun subject NP and a common noun object NP, as in (9) because of the overt difference in definiteness:

(9) X-uu-tz'et ja Ta Mari'y jun miix. VSO

com-3E-see det Miss Maria det cat
Maria saw a cat.

although VOS word order is preferred to VSO.

Dayley (1985:303-4) claims that a predicate initial clause with two post verbal third person NPs that have identical properties of definiteness is ungrammatical.

Example (10a) demonstrates this with definite determiners and (10b) with indefinite determiners:

(10) a. *X-uu-ch'ey jar ixok jar aachi. VOS
com-3E-hit det woman det man
(*The man hit the woman.) Dayley 305 (78b)

b. *X-uu-ch'ey jun ixok jun aachi. VOS
com-3E-hit det woman det man
(*A man hit a woman.) Dayley 305 (78c)

Yet in my research, I found that when two third person postverbal NPs are of equal definiteness, the result is ambiguity, not ungrammaticality as Dayley claims.

Example (11) demonstrates the ambiguity created with co-occurring definite and indefinite NPs: (11a) has two definite proper nouns while (11b) has two indefinite common nouns:

(11) a. X-uu-tz'et ja Ta Mari'y jar Aa Xwaan. V??
(Juan saw Maria./Maria saw Juan)

b. X-uu-tz'et jun tz'i' jun miix. V??
(A cat saw a dog./A dog saw a cat)

Both sentences in (11) are ambiguous because the listener cannot identify whom the acting subject or agent is. This is because the two post verbal NPs are similarly marked for definiteness.

Yet example (12), even though almost identical to (11a), is now totally unambiguous:

(12) X-uu-tz'et Ta Mari'y jar Aa Xwaan. VOS
com-3E-see Miss Maria det Mr. Juan
Juan saw Maria.

Example (12) is acceptable because the proper noun subject NP is definite and the proper noun object NP is unmarked for definiteness. Both postverbal argument NPs are easily identifiable in terms of grammatical relations because of their definiteness properties. That is, the NP *ta Mari'y*, unmarked for definiteness, is interpreted as the grammatical object. And the NP, *jar Aa Xwaan*, marked for definiteness with the determiner *ja(r)* 'the,' is easily interpreted as the grammatical subject.

It seems from these examples that it is not primarily syntax that determines the order of post verbal NPs but NP properties such as definiteness and proper/common status. It has been reported that the order of post verbal argument NPs in other Mayan languages is determined by the properties of the NPs (cf. Brody 1984, England 1991). Included amongst these NP properties are, for example, definiteness, clause weight or heaviness, animacy, and pronominality. The relevant NP property in the examples above is definiteness. Consequently in a simple matrix clause with two post verbal argument NPs, the NP property of definiteness operates in a hierarchically manner and is primarily responsible for determining the grammatical relations of the clause. However the role of syntax in determining NP ordering rules cannot be ruled out as we shall see.

3. Grammaticality of VSO word order in Tz'utujil Maya

In the following section, I shall prove that VSO is an acceptable word order in Tz'utujil. However it is not a preferred order and would be ranked lower than VOS in OT.

Dayley (1985:304) claims that the only ungrammatical word order in Tz'utujil is VSO. Dayley does not provide an example but the following should adequately illustrate his claim:

(13) *X-uu-ch'ey jar ixok jun aachi. *VSO
(*The woman hit a man.)

Yet I have found that VSO word order is acceptable to my consultants under certain circumstances, contra Dayley (1985). These primarily include sentences with post verbal argument NPs that exhibit a clear definiteness hierarchy as well as clauses with heavy objects.

Before addressing these issues, it is fairly straight foreword to prove that VSO is a grammatical word order in Tz'utujil. As we have already seen in example (11), the following example, although grammatical, is ambiguous because of two possible meanings that are both equally valid:

(14)	a.	X-uu-tz'et jun tz'i' jun miix. inc-3E-see det dog det cat	V??
	b.	A cat saw a dog.	VOS
	c.	A dog saw a cat.	VSO

If both of these two translations are grammatical, then in spite of their ambiguity, the second interpretation (14c) 'A cat saw a dog,' using VSO word order, is necessarily grammatical. This alone validates VSO word order as grammatical in Tz'utujil.

Continuing on then, heavy objects may be used in either VSO or VOS clauses. In (15), the heavy object is *ru-chi Ta Mari'y* '(the) cheek of Maria, a possessed noun phrase:

(15) a.	X-uu-tz'ub'-aj	ja	Aa Xwaan	ru-chi	Ta	Mari'y	VSO
	com-3E-kiss-der	det	Mr. Juan	3E-cheek	Miss	Maria	
	Juan kissed Maria on the cheek.						

b. X-uu-tz'ub'-aj ru-chi Ta Mari'y ja Aa Xwaan VOS
com-3E-kiss-der 3E-cheek Miss Maria det Mr. Juan
Juan kissed Maria on the cheek.

In example (16), the heavy object is an embedded (object) complement clause:

(16) X-uu-b'iij ja Ta Mari'y…
com-3E-say det Miss Maria

...chi Aa Xwaan x-uu-tz'et ruu-miix VSO
comp Mr. Juan com-3E-see 3E-cat
Maria said that Juan saw her cat.

Heavy subjects typically use SVO word order. In example (17), the object is *wey* 'tortillas' and the heavy subject is *Ja Ta Maria n-tior wi'* 'Miss Maria, who has a cold…':

(17) Ja Ta Maria n-tior wi' n-uu-tzak wey. SVO
det Miss Maria inc-drip head inc-3E-make tortillas
Maria, who has a cold, made tortillas.

Heavy subjects can also be used postverbally in a VOS sentence:

(18) N-uu-tzak wey ja Ta Maria n-tior wi'. VOS
inc-3E-make tortillas det Miss Maria inc-drip head
Maria, who has a cold, made tortillas.

Although heavy subjects can be used in both SVO and VOS sentences, heavy subjects using VSO word order are ungrammatical:

(19) *N-uu-tzak ja Ta Maria n-tior wi' wey. *VSO
inc-3E-make det Miss Maria inc-drip head tortillas
(*Maria, who has a cold, made tortillas.)

When the definiteness properties of the two post verbal NPs are clearly hierarchical, that is when there is an overt difference in NP definiteness, VSO word order is grammatical.

For example, when the subject NP is marked as definite and the object NP is marked as indefinite or is unmarked for definiteness, VSO is acceptable word order:

(20) a. X-uu-tz'et jar Aa Xwaan jun tz'i'. VSO
com-3E-see det Mr. Juan det dog
Juan saw a dog.

b. X-uu-tz'et ja tz'i' jun miix. VSO
com-3E-see det dog det cat
The dog saw a cat.

In example (20), grammatical interpretation of post verbal grammatical relations is a response to the inherent NP properties of definiteness. In fact, if the definiteness hierarchy and other properties of the NPs determine the grammatical relations of the clause, syntactically determined word order would now seem irrelevant. However this appears not to be entirely correct.

All things being equal, VOS word order is preferred to VSO word order. For example, when the object NP is either indefinite or unmarked for definiteness and the subject NP is definite, the preferred word order is predominantly VOS:

(21)	X-uu-tz'et	jun	miix	ja	tz'i'.	VOS
	com-3E-see	det	cat	det	dog	
	The dog saw a cat.					

Consequently their appears to be a syntactically determined VOS ordering constraint, totally independent from but dominated by the ordering principles of the competing internal properties of the post verbal argument NPs. As a result, the syntactic ordering constraint would be featured lower than the NP definiteness constraint in the OT tableau.

In Kaqchikel, it has been reported that VSO word order is also grammatical (Broadwell 2000). In example (22), the independent pronoun *rija'* 'him' is the object NP and a possessed noun phrase *ru-tz'i' ri ala'* 'the boy's dog' is the subject NP:

(22)	X-u-b'a	ru-tz'i'	ri	ala'	rija'.		VSO (Kaqchikel)
	com-3E-bite	3E-dog	det	boy	him		
	The boy$_i$'s dog bit him$_{*i/j}$.						Broadwell 2000

The grammaticality of VSO word order in Kaqchikel is completely in keeping with the Tz'utujil model. In fact, it is not uncommon for Mayan languages to allow all six word orders: for example, Yucatec (Durbin and Ojeda 1978), Tojolob'al (Brody 1982), K'iche' (Mondloch 1978), and other Maya languages permit all possible word order permutations.

4. Preverbal foci: contrastive focus (ConFoc) and negative focus (NegFoc).

I shall now examine the preverbal foci of contrastive focus (ConFoc) and negative focus (NegFoc) in Tz'utujil and compare them to their Kaqchikel equivalents. The results indicate that the two K'ichean daughter languages are remarkably similar structurally.

4.1 The Tz'utujil focus or clefting particle(s)

In Kaqchikel, the clefting particle (*ja*) is used when a subject is contrastively focussed. As a result, the verb obligatorily requires the actor focus voice.[2] In example (23), the subject NP is *ri a Juan* 'Juan' and the object is *wey* 'the tortilla':

(23)	Ja	ri	a	Juan	x-tij-o	wä'y.	SV$_{af}$O (Kaqchikel)
	foc	det	Mr.	Juan	com-eat-AF	tortilla	
	It was Juan who ate the tortilla.						Broadwell 2000

[2] Aissen (1999a) was the first to name this construction the actor focus.

But in Tz'utujil, the focus or clefting particle, *ja(a')* (Dayley 1985), is not always used with a contrastively focussed subject with obligatory actor focus:

(24) Jun aachi x-k'aaxaan-in ja masaat.
det man com-hear-AF det deer
a. A man heard the deer.
b. It was a man that heard the deer

However the focus particle *ja* in tandem with a contrastively focussed subject may also be used to emphasize focus semantics. In example (25), my consultant uses a local alternative *arjaa'* 's/he/it' in place of the standard focus article *ja(r)*:[3]

(25) a. Arjaa' Ta Mari'y ja x-oj-ow-i. $SV_{af}O$
foc Miss Maria rel com-dance-AF-IV
It was Maria that danced.

b. Arjaa' ja miix ja ma t-i-tij-ow-i …
foc det cat rel neg asp-ep-eat-AF-IV

... ja b'aaq r-xiin ak'. $SV_{af}O$
det bone 3E-RN:of chicken
It was the cat that did not eat the chicken bones.

In example (25), there is little probability that the morpheme *arjaa'* is acting as a sentence initial topic pronoun.

Let us examine more closely the Tz'utujil focus particle *ja*. Dayley (1985) claims that the various uses of the morpheme *ja(r)*, which include the definite article, the relative pronoun, and the clefting or focus particle, and combinations with other morphemes are ultimately derived from the third person independent pronoun, *jaa'*, such that *jaa'* > *ja(r)* (optionally).

But Dayley confusingly refers to the *ja(r)* particle, even in identical contexts, as both a cleft and as a third person independent pronoun (also Dayley 1985:389).

Compare example (26), where Dayley (1985:232 Ex.39) categorizes *Jar* as a clefting particle:

(26) Jar oojoj jar ooq k'o waawe' pa tinaamit
cleft 3Pro who 1plA be here prep:in town
It's us who are here in town Dayley:232 Ex.39

with example (27), where Dayley (1985:255 Ex.121) refers to *jar* as the definite determiner 'the':

(27) Jar oojoj ooq k'o waawe'
det 3Pro 1plA be here
We are here. Dayley:255 Ex.121

[3] Note in example (25b), the epenthetic *i*– between the potential aspect marker *t*– and the verb root –*tij* 'eat'

Note that the relative pronoun *ja(r)* 'who/what,' as in example (26), is used optionally in clefts.

Indeed Aissen (1992:75 Ex. 86) becomes entangled citing Dayley's data by claiming that *jaa'* 's/he/it' is acting as a sentence initial topic pronoun:

(28) Jaa' eskopéeta x-k'aq-b'eej ja chikop.
he shotgun com-shoot-IF det animal
It was a shotgun that he shot the animal with. Dayley:386

Although Aissen's core issue about continuing topics is correct, in my opinion the data, which she uses in example (28) to support it, is not.

Instead of using the standard Tz'utujil third person independent pronoun *jaa'* 's/he/it,' my consultant will occasionally employ (see example (25)) a local alternative *arjaa'* 's/he/it.' Possibly this is to more easily distinguish the homophonous standard focus particle *ja* from the definite article *ja*, which, when they co-occur, are immediately adjacent to each other.

Thus in a context of verbal actor focus morphology together with emphatic focus semantics—which are not necessarily related as we shall see—I propose the following generalization. The use of the preverbal third person independent pronoun *jaa'* and any of its morphological derivatives are best semantically interpreted as a focus particle albeit one with multiple forms.

4.2 Contrastive focus and negative focus: a commentary on Aissen (1992, 1999b)

I would like to review Aissen's (1992:46, 46 fig.3, 72; 1999b:172, 191 fn.7) proposal about negation in Tz'utujil. This is necessary because her model of preverbal foci differs somewhat from the one assumed in this paper and thus should be addressed.

Aissen (1992:72) suggests that the negative particle *ma* follows the topic. Also the negative particle '*ma* precedes the [contrastive] focus' (bracketed material not in original). Aissen (1992:46, 46 fig.3, 72; 1999b:172) also proposes that the Tz'utujil negative particle *ma* is left adjoined to IP.

In example (29), the focussed NP is the unmarked noun *ch'ooy*, 'rat':

(29) Ma ch'ooy ta x-tij-ow-i ja kéeso. $SV_{af}O$
neg rat irr com-eat-AF-IV det cheese
It wasn't a rat that ate the cheese. Dayley:322

In other words, Aissen (1992:72) interprets the *ma ch'ooy ta* 'not (a) rat' as a contrastively focussed NP that has been negated. The negative particle and the contrastively focussed NP are not in the same structural location in the constituent tree.

However Dayley (1985:322) claims that negated NPs themselves are best translated into English as cleft sentences, because that is how they are volunteered in

Spanish. So negated NPs translate best with focus semantics. But negated NPs are not situated in contrastive focus (ConFoc) according to Broadwell (2000) and others. Rather negated NPs are located in negative focus (NegFoc) and are necessarily preverbal. Aissen's model of preverbal focus, then, differs to some extent from the one assumed in this paper. Her theory of focus does not differentiate between contrastive focus and negative focus but rather melds them both into a single syntactic structural position. She does not seem to differentiate between them.

Consequently I propose that, in Tz'utujil Maya, there are two completely distinct preverbal foci of ConFoc and NegFoc. The negative particle *ma…(ta)* associates and combines with the negated NP, in example (29) the unmarked subject NP *ch'ooy* 'rat,' and are situated together in a single, preverbal structural position, which is NegFoc.

4.3 The actor focus voice

The actor focus voice has often been referred to as a detransitivizing construction (Aissen 1999a; Dayley 1985:347-358). However the verb may optionally retain both of its two direct arguments. Yet only one argument NP is actually cross-referenced on the verb and this is accomplished with the absolutive agreement marker. Which argument is actually referenced on the verb depends on the person hierarchy of the argument NPs.

An important feature of the actor focus voice is that the subject is obligatorily preverbal (Aissen 1992, 1999a; Dayley 1985):

(30)	Jun	tz'i'	x-kop-in-i	jar	Aa	Xwaan.	$SV_{af}O$
	det	dog	com-bite-AF-IV	det	Mr.	Juan	
	A dog bit Juan.						

Note that when in the actor focus voice, the subject, although obligatorily preverbal, may or may not be sentence initial.

The actor focussed subject NP may never follow the verb:

(31)	a.	*X-kop-in-i	jar	Aa	Xwaan	jun	tz'i'.	$V_{af}OS$
		com-bite-AF-IV	det	Mr.	Juan	det	dog	
		(*A dog bit Juan.)						
	b.	*Jar Aa Xwaan	x-kop-in-i			jun	tz'i'.	$OV_{af}S$
		det Mr. Juan	com-bite-AF-IV			det	dog	
		(*A dog bit Juan.)						

Dayley (1985:319 fn.8) claims that an indefinite, preverbal third person subject NP with an overt third person postverbal definite object NP obligatorily requires the use of either the actor focus voice or the passive.[4]

[4] Dayley (1985) himself refers to the actor focus voice as the '(agent) focus antipassive.' But Smith-Stark (1978) proves that this special type of voice cannot be an antipassive.

Leaving aside the passive, an indefinite preverbal subject NP requires the actor focus voice. The following configuration is ungrammatical because it does not use the actor focus voice:

(32) *Jun tz'i' x-uu-kopiij jar Aa Xwaan. *SVO
det dog com-3E-bite det Mr. Juan
(*A dog bit Juan.)

This is an important feature of the actor focus voice construction. The actor focus voice allows indefinite subject NPs to be base generated in a preverbal position.

Also unacceptable is a preverbal indefinite subject NP and a postverbal indefinite object NP. In fact, this type of clause is unacceptable for two separate reasons. First it violates Aissen's (1999b) definiteness effect, and is therefore ungrammatical. Secondly although not ungrammatical, it is ambiguous about which NP argument represents the transitive subject:

(33) *Jun tz'i' x-uu-tz'et jun miix. ?V?
det dog com-3E-see det cat
(*A dog saw a cat./*A cat saw a dog)

4.4 The ordering of preverbal foci: ConFoc and NegFoc in Tz'utujil

As we have seen, a sentence with an indefinite subject NP and a definite object NP obligatorily require the actor focus voice with the subject preverbal (Dayley 1985):

(34) Jun aachi x-k'aaxaan-in ja masaat. $SV_{af}O$
det man com-hear-AF det deer
A man heard the deer.

The object NP *ja masaat* 'the deer,' as used in example (35) in sentence initial position, functions as the topic NP (Aissen 1992, 1999b):

(35) Ja masaat jun aachi x-k'aaxaan-in. $OV_{af}S$
det deer det man com-hear-AF
The deer, a man heard./A man heard the deer.

As we have seen when a NP is negated, it is obligatorily preverbal and translates as if it were a cleft sentence (Dayley 1985:322). If the negated NP is a subject, then it requires the actor focus voice. But negated object NPs require no special voice or special verbal marking. As discussed above, I assume that all negated NPs, including subject and object NPs, reside in NegFoc.

Example (36) demonstrates the negation of the preverbal indefinite subject NP as well as showing the object NP as the sentence initial topic. Because the subject is negated the actor focus is required. Note also that the object NP '*Ja masaat*', as the sentence topic NP, is in the sentence-initial position:

(36) Ja masaat ma jun aachi ta x-k'aaxaan-in. OSV_{af}
det deer neg det man irr com-hear-AF
The deer, it was not a man that heard [it]./

It was not a man that heard the deer.

In example (37), the object NP *ja masaat* 'the deer' has been negated and is thus obligatorily preverbal. Using actor focus morphology in this example would be ungrammatical because it is the object NP, not the subject, that has been negated:

(37) Ma ja ta ja masaat x-uu-k'aaxaaj jun aachi. OVS
neg foc irr det deer com-3E-hear det man
It was not the deer that a man heard.

Note also that, in (37), the indefinite subject NP *jun aachi* 'a man' is post verbal. This is because an indefinite transitive NP cannot be in the sentence initial or preverbal topic position:

(38) *Jun aachi ma ja ta ja masaat x-k'aaxaaj. *OSV
det man neg foc irr det deer com-hear
(*It was not the deer that a man heard.)

One explanation of this restriction on the topic NP is what Aissen and others has called the 'definiteness effect.' As defined by Aissen (1999b:170-174), the definiteness effect claims that, for transitive predicates with two third person argument NPs, the pre-predicate (sentence initial or preverbal) topic NP must be definite, that is, identifiable. The definiteness effect is inviolable. It is theoretically formulated on Franz Brentano's (1924) concept of the categorical judgement: specifically a categorical versus a thetic assertion (cf. É Kiss 1995:7-14; 2002:14-20).

There is yet another reason for the indefinite subject NP being necessarily post-verbal in example (37). And this will introduce us to the evidence for the correct ordering of the preverbal foci of ConFoc and NegFoc in Tz'utujil.

Example (39), which is ungrammatical, contains a preverbal negated object NP and an indefinite preverbal subject NP with the accompanying obligatory actor focus construction. Note that the subject NP *jun aachi* intercedes between the negated object NP *ma ja ta ja masaat* and the actor focus morphologically-marked verb *k'aaxaan-in*:

(39) *Ma ja ta ja masaat jun aachi x-k'aaxaan-in. *OSV_{af}
neg foc irr det deer det man com-hear-AF
(*It was not the deer that a man heard.)

In ungrammatical example (39), the subject NP *jun aachi* is necessarily in ConFoc because it is both preverbal and has triggered actor focus voice morphology on the verb. Note that the negated, preverbal object NP in NegFoc does not require the actor focus voice. The only conclusion is that the subject NP in ConFoc may not follow the object NP in NegFoc. We can conclude then that, in Tz'utujil, ConFoc may not follow NegFoc but instead, ConFoc must precede NegFoc.

I do not at present have a Tz'utujil example of ConFoc preceding NegFoc, but one taken from Kaqchikel is supportive of my argument. I fully anticipate this ordering of foci to be the same in Tz'utujil.

In (40), *Ja ri a Ramón* is the preverbal subject NP in contrastive focus while *man jun wä'y* is the negated preverbal object NP. Keep in mind that the actor focus is not used because it is an object NP that is being negated, not a subject NP:

(40) Ja ri a Ramón man jun wä'y x-u-tij. SOV (Kaqchikel)
con the cl Ramon neg one tortilla com-3E-eat
It was Ramón who ate no tortillas. RKC: 1:82

The opposite order in Kaqchikel is ungrammatical:

(41) *Man jun wä'y ja ri a Ramon x-u-tij.
neg one tortilla con the cl Ramon com-3sErg-eat
*(It was Ramon who ate no tortillas.) Broadwell:17

In terms of ConFoc and NegFoc, the Kaqchikel model proposed by Broadwell (2000) in terms of OT constraints is that [–neg] precedes [+neg] and that they are both located in [Spec, IP]. For Tz'utujil, I propose a similar ordering model: that NegFoc and ConFoc are both located in [Spec, IP], and that ConFoc and NegFoc are ordered such that ConFoc precedes NegFoc, that is [–neg] precedes [+neg].

In Tz'utujil, when the sentence has a subject NP in the ConFoc position, which manditorily requires actor focus morphology, it is not possible to have a preceding object NP in an adjacent ConFoc position. In that situation, the object NP must be a topic. But Dayley (1985) claims that object NPs are completely excluded from being sentence topics. The inference is that there are two simultaneously occupied ConFoc positions. But Aissen (1992, 1999b) proves Dayley's claim incorrect by proving the first NP structural position is for topic, not focus.

Aissen (1992:74) places Tz'utujil sentential adverbs (temporal) after the topic position. Example (42) shows that the sentential adverb *ooxiij* 'in three days' follows the topic *Ja n-ata'* 'my father' and precedes the verb *n-b'e* 'goes':

(42) Ja n-ata' ooxiij n-b'e K'oqol Keej.
det 1E-father in:three:days inc-go Masatenango
In three days, my father is going to Masatenango. Dayley:275

But Aissen (1992:74) also claims that '…crucially, they [sentential adverbs] do not precede the topic.' This claim is at odds with my findings because sentential adverbs can, in fact, precede topic phrases, as shown in the following

In example (43), the topic phrase is *ja tz'i'* 'dog':

(43) *Iwiir* ja tz'i' x-uu-tz'et ja miix. AdvSVO
yesterday det dog com-3E-see det cat
Yesterday the dog saw the cat.

But although part of her argument of using adverb position is errant, Aissen's important, larger claim about the topic always preceding the focus is absolutely correct.

It is unclear to me how to implement an ordering of an adverb between topic and focus in the constituent tree that has been proposed for Kaqchikel by Broadwell (2000). If both the topic and the focus, appropriately ordered, are in [Spec, IP] as they are in the Kaqchikel model, it would be impossible to left adjoin an adverb to the IP that maintains the correct ordering of topic, adverb, and foci.

Accordingly I propose an amendment to Broadwell's Kaqchikel phrase structure model. The topic, instead of being positioned in [Spec, IP], would be in [Spec, CP]. This arrangement would accommodate adverb adjunction to IP. Additionally the topic would follow the complementizer (Comp) which would correctly predict their ordering of Comp preceding topic in both embedded and subordinate clauses.

5. Adverb placement and structural complexity

Following Broadwell (2000) and others, I argue that the predicate initial and argument initial word order manifest different syntactic structure. A principled way of capturing this difference is with markedness theory: it proposes a binary choice between either a higher or a lower level of complexity of structure. The syntactic structure with the least complexity is the unmarked structure. If a clause possesses more syntactic structure than the unmarked structure, it is considered marked. The violable constraint for building unnecessary structure in OT, here syntactic, is *STRUC.

It is possible to gain insight into the syntactic structure of the clause by analyzing adverb placement. Because adverbs are adjoined to maximal projections (Bresnan 2001), adverbs are somewhat constrained in their potential locations within the clause. We test first for predicate initial clauses then argument initial clauses, and a structural difference between the two clause types becomes quite evident.

With predicate initial clauses, such as VOS, adverb placement indicates that adverbs are found only at either the beginning (44a) or the end (44b) of the clause:

(44)	a.	Iwiir	x-uu-tz'et	jun	miix	ja	tz'i'.		AdvVOS
		yesterday	com-3E-see	det	cat	det	dog		
		Yesterday the dog saw the cat.							
	b.	X-uu-tz'et	jun	miix	ja	tz'i'	iwiir.		VOSAdv
		com-3E-see	det	cat	det	dog	yesterday		
		The dog saw the cat yesterday.							

Crucially adverbs are not able to be inserted between the verb and its object NP:

(45)	*X-uu-tz'et	iwiir	jun	miix	ja	tz'i'.	*VAdvOS
	com-3E-see	yesterday	det	cat	det	dog	
	(*The dog yesterday saw the cat.)						

or between the object NP and subject NP:

(46)	*X-uu-tz'et	jun	miix	iwiir	ja	tz'i'.	*VOAdvS
	com-3E-see	det	cat	yesterday	det	dog	
	(*The dog saw yesterday the cat.)						

But with argument initial order, adverbs are unrestricted in their placement between the major clausal constituents:

(47) a. Ja tz'i' iwiir x-uu-tz'et ja miix. SAdvVO
det dog yesterday com-3E-see det cat
The dog yesterday saw the cat.

b. Ja tz'i' x-uu-tz'et iwiir ja miix. SVAdvO
det dog com-3E-see yesterday det cat
The dog saw (yesterday) the cat.

c. Ja tz'i' x-uu-tz'et ja miix iwiir. SVOAdv
det dog com-3E-see det cat yesterday
The dog saw the cat yesterday.

In terms of structural complexity, the behaviour of preverbal and postverbal argument NPs seems identical to those in Kaqchikel (cf. Broadwell 2000). The predicate initial word order has its verb head and post verbal arguments as sisters under a non-endocentric, flat S(entence). But the preverbal argument generates a more hierarchical, endocentric structure under CP. It is therefore more marked due to the extra structure requirement of the CP functional projection.

6. Towards a phrase structure for Tz’utujil Maya

It is proposed by Aissen (1992; 1999b:169-72) that the syntactic structure of Tz’utujil includes a hierarchical verb phrase (VP). The grammatical subject NP is in [Spec,VP], the verb head and its complement the grammatical object NP are both daughters of V-bar, and the topic/logical subject is in [Spec, CP]. All projections are endocentric.

In contrast, Broadwell (2003:105) proposes a general flat schema for the phrase structure of Quiegolani Zapotec. The schema is shown in the following (Figure 1):

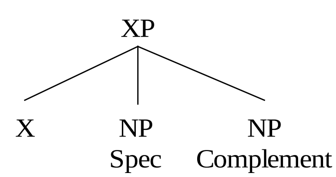

Figure 1. General schema for Quiegolani Zapotec (Broadwell 2003:105 fig.9)

where X = head, [Spec, XP] may contain interrogatives, possessives, and subjects, and [Comp, XP] is the complement to X, the head of the maximal projection XP. A critical structural difference from X-Bar theory is the total absence of the intermediate phrase, that is the X’ semi-projection. Except for S(entence), all heads are endocentric.

Consequently using the above general schema, I propose the following phrase structure for San Pedro la Laguna Tz’utujil (Figure 2):

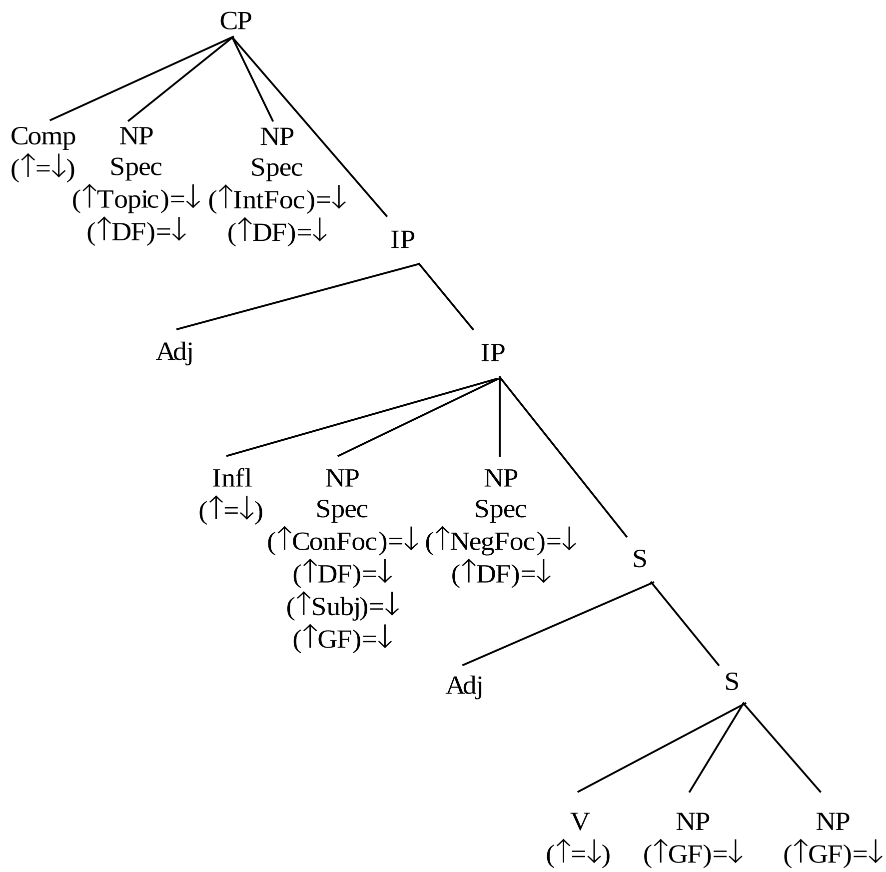

Figure 2. Phrase structure of San Pedro la Laguna Tz'utujil

7. Functional projection as grammatical relation

In predicate initial Maya languages, it has long been reported that two pre-predicate NP positions exist: the sentence initial topic position and the preverbal focus position (Norman 1977, Norman and Campbell 1978). Aissen (1992, 1999b) describes these pre-predicate NPs as occurring in the specifiers of the functional (maximal) projections of CP and IP, specifically in [Spec, CP] and [Spec, IP] respectively.

Irrespective of the validity of these specific claims, clearly one claim is that these X-bar theoretic functional projections represent syntactic loci for the singular use of pragmatics and the associated primitives of topic and focus. But in examining Tz'utujil data, I have found that these functional, preverbal NP positions may encode not just the expected information structure functions, but totally unrelated grammatical relation functions as well.[5]

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[5] Broadwell (2000) first noticed this phenomenon in Kaqchikel. With relevant preverbal NPs, Broadwell is reluctant to necessarily accord the status of sentence topic (as opposed to grammatical subject) to a non-focussed, preverbal position.

This phenomenon can be productively demonstrated with the actor focus voice. The actor focus voice, in addition to its usual task of enabling contrastive focus and associated focus semantics, appears capable of also resolving conflicting definiteness claims.

In SVO word order, I find that a preverbal indefinite subject NP with a postverbal unmarked object NP is ungrammatical. This is due to the definiteness effect:

(48) *Jun tz'i' x-uu-tz'et ta Mari'y. *SVO
(*A dog saw Maria./ Maria saw a dog.)

Also due to the definiteness effect is a preverbal indefinite subject NP with a postverbal indefinite object NP is ungrammatical:

(49) *Jun mix x-u-tz’et jun tz'i'. *SVO
(*A cat saw a dog.)

Consequently lower ranked indefinite subjects cannot be combined with higher ranked definite objects in the transitive. In order to use this hierarchical NP definiteness combination, the actor focus voice and the passive are the only choices (Dayley 1985:319 fn.8).

The actor focus voice suffixes morphemes *–o(w) ~ –u(w)* to the verb and inviolably requires its subject to be preverbal:

(50) Jun miix x-tz’et-ow-i ja tz'i'. $SV_{af}O$
det cat com-see-AF det dog
A cat saw the dog.

In example (51), the definite object NP *ja masaat* ‘the deer’ is in sentence initial topic position and the indefinite subject NP with actor focus verb morphology is preverbal:

(51) Ja masaat jun aachi x-k’axan-in. OSV_{af}
det deer det man com-hear-AF
The deer, a man heard./A man heard the deer.

As discussed above, when an indefinite subject co-occurs with a definite object, then either the actor focus construction or the passive must be used. And the actor focus voice has always been translated into English in the form of an ‘it-cleft’ construction.

But if we examine examples (50) and (51) closely, it is evident that the focus semantics of the it-cleft construction are totally absent. This raises the possibility that, in certain situations, the preverbal focus position has no discursive function and is probably better understood as having a grammatical function. The definiteness hierarchy of the relational NPs, which, in the above two examples, compels the use of the actor focus, is exclusively concerned with grammatical relations, not discourse functions.

We have been advised (cf. É. Kiss 1995; Aissen 1992:45-8, 1999b) that the preverbal and postverbal structural positions encode the discrete roles of the functional versus the lexical respectively. The distinction between the functional and the lexical or grammatical is critical in discourse configurational languages like Tz’utujil Maya. Yet we witness here the encroachment of the grammatical into the reportedly exclusive domain of the functional.

In summary, I propose that pre-predicate argument NP positions may be used not only for encoding discursive material but also for encoding grammatical relations. A productive way of demonstrating this is with the actor focus voice construction. The preverbal positions in the Maya languages have traditionally been understood as the sole domain of discourse or pragmatics. This proposal then adds a new grammatical function to preverbal functional positions.

8. Conclusion

In this paper, I have examined the ordering principles of the post verbal argument noun phrases (NPs) of the K’ichean language of Tz’utujil. I have shown that the ordering principles are primarily a function of the properties of the NPs with the definiteness property predominant. But other NP properties, such as animacy, clause weight, proper/common status, and pronominal use all contribute to NP ordering principles. These properties themselves can be ranked as a set of violable constraints in an OT framework. I have demonstrated that verb initial word order with NPs of equal definiteness (excluding the unmarked NP) is ambiguous but still grammatical. I have shown that syntax must also be factored in to the ordering of post verbal NPs. I have proved that VSO word order is a grammatical word order, although VOS is preferred.

I have scrutinized Tz'utujil focus particles, re-evaluated past analyses about Tz'utujil's preverbal foci, and proposed ordering principles for contrastive focus (ConFoc) and negative focus (NegFoc). I have proposed that the Tz'utujil topic phrase is in [Spec, CP], rather than [Spec, IP]. This result better accommodates adverb adjunction than does the currently proposed Kaqchikel model. In addition, I have established that the preverbal foci of ConFoc and NegFoc are in [Spec, IP], and are ordered such that ConFoc precedes NegFoc obligatorily. I have demonstrated that the functional projections of X-bar theory, which until now have been considered to encode only discourse related material or pragmatics, can, in fact, encode grammatical relations as well. The Tz’utujil data is also compared throughout to the K’ichean sister language of Kaqchikel for typological reasons. Ultimately a phrase structure for Tz'utujil Maya within the theoretical paradigm of Lexical-Functional Grammar but using a revised general schema has been proposed.

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The English Auxiliary System Revisited*

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Abstract

This paper examines the question of the functional status of auxiliaries in English. Two approaches are contrasted: one which treats auxiliaries as mere feature-carriers, and one which treats them as argument-taking predicates. It is argued that no analysis is correct for all auxiliaries: supportive *do*, perfective *be*, and the modals *will* (*shall*) and *would* are argued to be feature-carriers, while progressive *be* and the rest of the modals are argument-taking predicates. It is also argued that the selection of the past participle by perfective *have* is a case of c-structure selection, not f-structure selection or realizational morphology. An account is offered for the relative ordering of *have* and *be*.

1. The Problem

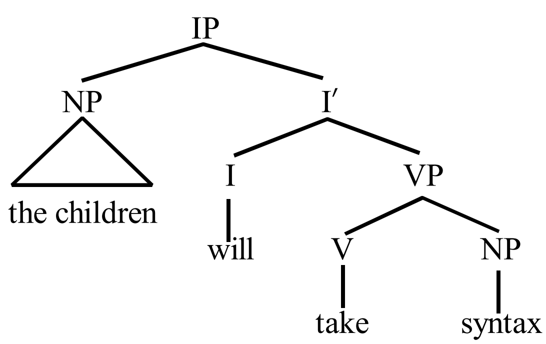
One of the most enduring issues in the analysis of English syntax is the nature of the auxiliary system. The issue that this paper will focus on is the question of the syntactic relations between the "verbal" elements of sentences with auxiliaries. If we consider a fairly simple sentence, such as (1a), are the relations as in (1b) or (1c)?

(1) a. The children will take syntax.
b. *will* is the head of the sentence, and *[take syntax]* is a complement of *will*
c. *take* is the head of the sentence, and *will* is a "modifier" or morphological marker expressing/realizing future tense

We will refer to these two analyses as the **aux-predicate** (1b) and **aux-feature** (1c) analyses. In early work in generative syntax, this question was related to the question of categorization: those who considered *will* to be a verb (such as Ross 1969 and Pullum and Wilson 1977) adopted the aux-predicate analysis, while those who considered it to belong to a distinct category (such as Chomsky 1965 or Jackendoff 1977) adopted the aux-feature analysis. However, more recent work has tended to dissociate these two issues.

In this study, we will assume that *will* belongs to the category Infl, which is the categorial head of the clause.[1]

(2)



However, such an analysis does not entail that *will* is functionally the head of the clause. This can be seen in extant non-LFG analyses; that is to say, analyses combining the IP approach to clauses with a version of the aux-feature approach, have also been proposed in other theoretical

[1] In the case of the aspectual auxiliaries *have* and *be*, we follow the standard "V-to-I" analysis, under which they are verbs when nonfinite and infls when finite. V-to-I is achieved by movement in derivational frameworks and by lexical specification in lexicalist frameworks.

frameworks. For example, Pollock (1989) argues in a GB analysis that auxiliaries do not assign θ roles, i.e. do not take arguments. Chomsky (1995: 198) takes the position that auxiliaries have no semantic features (such as predicate-argument structure). Radford (1997), a textbook on the Minimalist Program, states “Whereas a typical verb like *want* may take a range of different types of complement…, by contrast auxiliaries typically take a verb expression as their complement, and have the semantic function of marking grammatical properties associated with the relevant verb, such as *tense*, *aspect*, *voice*, *mood*, or *modality*.” These analyses in the transformational tradition thus take the position that *will* is the structural head of this sentence but *take* is the functional head: the equivalent of what we are calling the aux-feature analysis. LFG has the advantage of making more explicit than other frameworks do the dissociation between constituent and category information on the one hand and functional relations on the other.

The f-structure representations of the two analyses are as follows.

(3) a.

$$\left[\begin{array}{ll} \textsc{subj} & [\text{“the children”}] \\ \textsc{pred} & \text{‘will}\left\langle(\uparrow \textsc{xcomp})\right\rangle(\uparrow \textsc{subj})\text{’} \\ \textsc{xcomp} & \left[\begin{array}{ll} \textsc{subj} & \\ \textsc{pred} & \text{‘take}\left\langle(\uparrow \textsc{subj})(\uparrow \textsc{obj})\right\rangle\text{’} \\ \textsc{obj} & [\text{“syntax”}] \end{array}\right] \end{array}\right]$$

b.

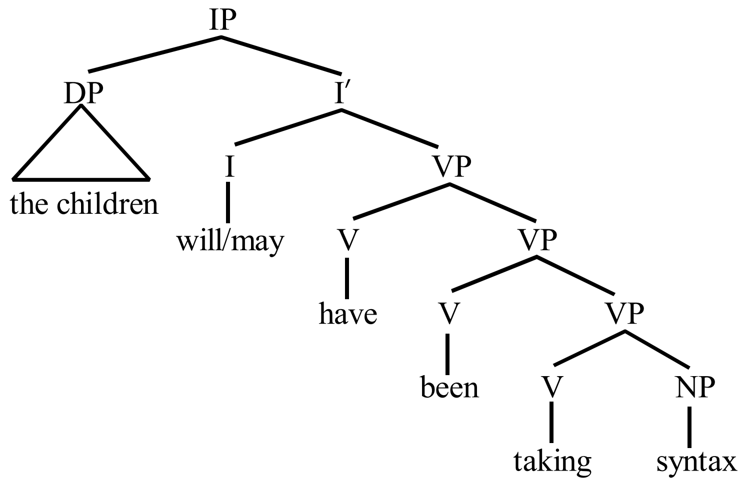
$$\left[\begin{array}{ll} \textsc{subj} & [\text{“the children”}] \\ \text{TENSE} & \text{FUT} \\ \textsc{pred} & \text{‘take}\left\langle(\uparrow \textsc{subj})(\uparrow \textsc{obj})\right\rangle\text{’} \\ \textsc{obj} & [\text{“syntax”}] \end{array}\right]$$

Under the aux-predicate analysis, *will* is a raising predicate, sharing its (nonthematic) subject with its complement. This is a functionally bi-clausal analysis. The aux-feature analysis is monoclausal; *take* is the only argument-taking predicate, and *will* provides the future tense feature.

It is not easy to distinguish these two analyses. Under the aux-predicate analysis, *will* takes a single thematic argument, the XCOMP. Since the SUBJ is not a thematic argument , *will* imposes no selectional restrictions. The internal structure of the XCOMP is almost indistinguishable from the sole functional level in the aux-feature analysis, the only difference being the lack of the future tense feature. There is thus not much on which to base an analysis. The present study takes as its starting point the analysis of Falk (1984), under which supportive *do* is given an aux-feature analysis while all other auxiliaries receive an aux-predicate analysis. More recent LFG analyses broaden the class of auxiliaries which receive an aux-feature analysis; we will conclude that in addition to supportive *do*, perfective *have* and the modals *will* (and *shall*) and *would* are simply carriers of features, while progressive *be* and the other modals are predicates defining their own clause nucleus. The various analyses are exemplified with the following sentence with a variety of auxiliaries.

(4) a. The children will/may have been taking syntax.

b. c-structure



c. f-structure under uniform aux-predicate analysis of all auxiliaries (e.g. Falk 1984)

$$\begin{bmatrix} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{PRES}\,? \\ \text{PRED} & \text{‘will/may}\left\langle(\uparrow \text{XCOMP})\right\rangle(\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \begin{bmatrix} \text{SUBJ} & \\ \text{PRED} & \text{‘perf}\left\langle(\uparrow \text{XCOMP})\right\rangle(\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \begin{bmatrix} \text{SUBJ} & \\ \text{PART} & \text{PERF} \\ \text{PRED} & \text{‘be}\left\langle(\uparrow \text{XCOMP})\right\rangle(\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \begin{bmatrix} \text{SUBJ} & \\ \text{PART} & \text{PRES} \\ \text{PRED} & \text{‘take}\left\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\right\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

d. f-structure under uniform aux-feature analysis of all auxiliaries (e.g. Bresnan 2001)

$$\begin{bmatrix} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{FUT/POSSIBILITY} \\ \text{PERF} & + \\ \text{PROG} & + \\ \text{PRED} & \text{‘take}\left\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\right\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{bmatrix}$$

e. f-structure of *will* sentence under analysis proposed here

$$\begin{bmatrix} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{FUT} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{‘be } \langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \begin{bmatrix} \text{SUBJ} & \\ \text{ASP} & \text{PROG} \\ \text{PRED} & \text{‘take } \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{bmatrix} \end{bmatrix}$$

f. f-structure of *may* sentence under analysis proposed here

$$\begin{bmatrix} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{‘may } \langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \begin{bmatrix} \text{SUBJ} & \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{‘be } \langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \begin{bmatrix} \text{SUBJ} & \\ \text{ASP} & \text{PROG} \\ \text{PRED} & \text{‘take } \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

We will begin by reviewing Falk's (1984) arguments for treating *do* as a mere feature carrier; we will then progress to perfective *have*, progressive *be*, then to *will* and *would*, and finally the other modals.

2. Supportive *Do*

We begin with supportive *do* (henceforth *do*). The idea that *do* is merely a carrier of the tense feature (or a spell-out of the tense feature in derivational frameworks) has a long tradition in generative syntax. Classical transformational grammar included a rule of *Do* Support which inserted *do* when the tense feature could not be attached to a verbal element. Translating such an analysis to LFG, (5a,b) would both have the f-structure (5c).

(5) a. The children took syntax.
b. The children did take syntax.
c.

$$\begin{bmatrix} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{‘take } \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{bmatrix}$$

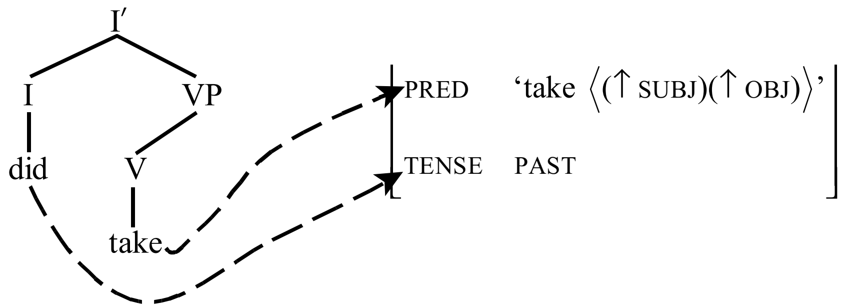
The lexical entries of the relevant verbal forms would be:

(6) a. *did*: $(\uparrow \text{TENSE}) = \text{PAST}$
b. *take*: $(\uparrow \text{PRED}) = \text{‘take } \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’}$

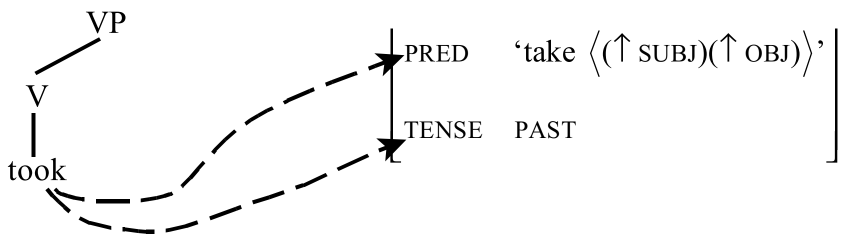
c. *took:* (↑ PRED) = ‘take ⟨(↑ SUBJ)(↑ OBJ)⟩’
(↑ TENSE) = PAST

The f-structure features of *did* and *take* unify to create the same f-structure fragment as the synthetic form *took*.

(7) a.



b.



The functional equivalence of the two sentences is thus accounted for.

It has occasionally been observed that these two sentences are not entirely equivalent. Sentence (5b) is ungrammatical if the auxiliary is unstressed, a deviance which disappears in inverted and polarized sentences. Sag (2000) refers to this as a “theoretically central issue” which constraint-based accounts have failed to explain. However, as assumed by Falk (1984), this can be explained on the grounds of what would be referred to in contemporary LFG as the Economy of Expression principle, which, inter alia, prefers morphological expression to syntactic expression.

Falk (1984) argues for the aux-feature analysis of *do* on the basis of co-occurrence restrictions. The habitual expression *used to* is restricted to appear in past tense clauses. This can be expressed by associating *used to* with the following lexical constraint:

(8) (↑ TENSE) $=_c$ PAST

There are two ways in which this requirement can be met: the verb *use* can be affixed with the past tense suffix (9a), or it can cooccur with supportive *did* (9b).

(9) a. The children used to take syntax.
b. The children did not/so use to take syntax.
c. Did the children use to take syntax?

An analysis of *do* under which it is an argument-taking predicate (as in the analysis of Sag 2000, shown in (10)) is unable to maintain a uniform analysis of the restriction on *used to*.

(10)
$$\begin{bmatrix} \text{HEAD} & \begin{bmatrix} v & \\ \text{VFORM} & \textit{fin} \\ \text{AUX} & + \end{bmatrix} \\ \text{COMPS} & \left\langle \overset{\text{VP}}{\begin{bmatrix} \text{VFORM} & \textit{base} \\ \text{SUBJ} & \boxed{1} \end{bmatrix}} \right\rangle \\ \text{SUBJ} & \boxed{1} \end{bmatrix}$$

As in 1984, we maintain that this is a strong argument for the aux-feature analysis of *do*.

An alternative implementation of this analysis has been suggested in the context of recent work on realizational morphology (e.g., by Ackerman and Stump 2003). From the perspective of the argument being made here, the choice between implementing the aux-feature analysis of supportive *do* as unification or as periphrastic morphological realization makes little difference. What is important is the adoption of the aux-feature analysis, however it will be implemented. However, it is unclear that the *do* supported forms could be profitably analyzed as members of paradigms when the verbs also have synthetic present and past tense forms. The competition between, e.g., *took* and *did take* is not at the level of morphology but rather syntax; if it were morphology then only one would exist. As it is, both exist but are used in different syntactic constructions.

3. Perfective *Have*

3.1.The Analysis

The next auxiliary we discuss is perfective *have* (henceforth *have*). *Have* has certain properties that make it a good candidate for an aux-feature analysis. The perfective verb forms in English and morphologically similar languages consist of two parts: the auxiliary *have* (or 'have' and 'be' in some languages) and a participial form. In some languages (such as French), when the auxiliary is in the present tense the perfect form is used for simple reference to past time, making an aux-predicate analysis for such languages implausible. As observed by Frank and Zaenen (2002), the following French sentences are functionally identical.

(11) a. Il parla.
he speak.PST
b. Il a parlé.
he has spoken
'He spoke.'

This is similar to the English situation, where *He spoke* and *He did speak* are alternate versions of the past tense, as discussed in the previous section. The use of these two forms in French differs from that in English; in French these forms are distinguished stylistically, with the analytic form being the one used in ordinary conversation. However, the logic of providing the same f-structure for *he spoke* and *he did speak* applies here as well. An analysis parallel to the English case thus appears to be called for.

(12) a. *a*: (↑ TENSE) = PAST
b. *parlé*: (↑ PRED) = 'speak ⟨(↑ SUBJ)⟩'
c. *parla*: (↑ PRED) = 'speak ⟨(↑ SUBJ)⟩'
(↑ TENSE) = PAST

d.

$$\begin{bmatrix} \text{SUBJ} & [\text{“he”}] \\ \text{TENSE} & \text{PAST} \\ \text{PRED} & \text{‘speak } \langle(\uparrow \text{SUBJ})\rangle\text{’} \end{bmatrix}$$

It has been argued on other grounds in LFG that perfective constructions in the Romance languages are monoclausal (Schwarze 1996; for similar arguments from an HPSG perspective Abeillé and Godard 1995). For example, while XCOMPs can be pronominalized, the VP following the perfect auxiliary cannot, as in the following Spanish examples.

(13) a. Ver el castillo, lo quiere.
to.see the castle it.ACC he.wants
‘To see the castle, he wants (it).’
b. *Visto el castillo, lo ha.
seen the castle it.ACC he.has
‘Seen the castle, he has`(it).’

Other arguments that have been proposed are less convincing. For example, Butt, King, Niño, and Segond (1999: 61) point out that what is done with an auxiliary construction in one language is done with inflectional morphology in another. They argue that treating auxiliaries as not being argument-taking predicates “allows for the invariant contribution of auxiliaries to (complex) tenses to be modelled crosslinguistically in the f-structure, while language particular idiosyncratic syntactic properties … are handled in the c-structure.” In a related vein, Frank and Zaenen (2002) observe that auxiliaries proved temporal and aspectual information, unlike verbal predicates. Arguments of this type are based on a concept that f-structure ought to be relatively transparent semantically, and therefore synonymous sentences in different languages should have essentially identical f-structures. However, as Dyvik (1999) points out, this represents an a priori view which is fundamentally in conflict with the role of f-structure in LFG as a level of **syntactic** representation.

The aux-feature analysis of perfective auxiliaries in Romance languages seems reasonable to us. This, of course, does not necessarily mean that the analysis is correct for English.[2] However, the properties of the English perfective construction do suggest that an aux-feature analysis is desirable.[3] Specifically, we propose that forms of *have* have lexical entries such as the following:

(14) *have* $(\uparrow \text{TENSE}) = \text{PRES}$
$(\uparrow \text{ASP}) = \text{PERF}$

and that a typical f-structure is the following:

(15) a. The children have taken syntax.

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[2]Dyvik (1999) provides an aux-predicate analysis for the perfect auxiliary in Norwegian, but, unlike his analysis of modals, to which we will return later, he does not provide any arguments for this analysis.

[3]Falk (1984) considers and rejects an aux-feature analysis for reasons that I now consider flawed. It is noted there in a rather cryptically worded footnote (fn 18) that *had used to* is ungrammatical. The argument is that this ought to be grammatical under an aux-feature analysis because the past tense feature of *had* is in the same f-structure as *used to*, so the past tense constraint is met. Therefore, so the argument goes, *had* and *used to* must define separate local f-structures. However, it is plausible that *had used to* is ungrammatical for aspectual reasons: the perfective aspect of *had* and the habitual aspect of *used to* clash.

b.
$$\left[\begin{array}{ll} \text{SUBJ} & \left[\text{“the children”}\right] \\ \text{TENSE} & \text{PRES} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{‘take}\left\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\right\rangle\text{’} \\ \text{OBJ} & \left[\text{“syntax”}\right] \end{array}\right]$$

That is to say, we propose that *have* provides two features: a tense feature and an aspectual feature. The past participle form, on the other hand, provides the verb's predicate, but no tense or aspectual information. There are facts which suggest that the aspectual information is provided by *have* rather than the participle. In the first place, as noted by Bresnan (1982), the participle is not sufficient for the perfective aspect.

(16) a. Anyone taking syntax [=anyone who is taking syntax] should have his head examined. **[present participle]**
b. Any subject taken by the children [=any subject which is taken by the children] is boring. **[passive participle]**
c. *Anyone taken syntax [=anyone who has taken syntax] should have his head examined. **[past participle]**

Moreover, past participles are not even necessary for perfective aspect. As noted by Andrews (1994) and Bresnan (2001), a fronted VP in a perfective sentence in English need not be a past participle.[4]

(17) a. Take linguistics they have!
b. ?*Taken linguistics they have!

We will return to the analysis of this pattern in the next section. But the point here is that the past participle is not necessary for a perfect construction. Another indication of this is the following dialog; note that in B's answer there is no need for a past participle for the perfect interpretation:

(18) A: (Taking orders for lunch.) Who eats falafel?
B: Well, I have in the past, but I really don't want any now.

As in the case of *do*, there appear to be co-occurrence restrictions that can only be accounted for under the aux-feature analysis of *have*. One of these concerns *have got*. As discussed by Fodor and Smith (1978), *got*, at least in American English, must be analyzed as a distinct verb, which is irregular in that it is supported by *have* rather than by *do*. Part of their evidence is a drift in progress from *have got* to *do got*, which they analyze as a regularization of the verb.[5] The lexical entry of *got* in the *have got* dialect is:[6]

---

[4]There appears to be some variation between speakers over whether the participle is even possible in fronted position. What is critical here is the grammaticality of the version with the bare verb.

[5]My analysis of *have got* differs somewhat from that of Fodor and Smith, in that they argue that the *have* in *have got* is not the perfective *have*, as it does not have perfective meaning. I assume that since *have got* is idiom-like (a point on which Fodor and Smith concur), the [ASP PERF] feature does not receive the usual semantic interpretation.

[6]In all dialects with which I am familiar, *have got* is limited to present tense, and I have included that constraint in the lexical entry. Those for which such a constraint does not exist would not have the constraint equation for TENSE.

(19) *got*: $(\uparrow \text{PRED}) = \text{‘got}\ \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’}$
$(\uparrow \text{ASP}) =_c \text{PERF}$
$(\uparrow \text{TENSE}) =_c \text{PRES}$

In the *do got* dialect, the idiosyncratic aspectual constraint has been lost. Another case of a co-occurrence restriction of this kind is *had better*.

(20) a. *better* $(\uparrow \text{PRED}) = \text{‘better}\ \langle(\uparrow \text{SUBJ})(\uparrow \text{XCOMP})\rangle\text{’}$
$(\uparrow \text{TENSE}) =_c \text{PAST}$
$(\uparrow \text{ASP}) =_c \text{PERF}$

b. The children had better take syntax.

$$\left[\begin{array}{ll} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{PAST} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{‘better}\ \langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \left[\begin{array}{ll} \text{SUBJ} & \\ \text{PRED} & \text{‘take}\ \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{array}\right] \end{array}\right]$$

3.2. Selection of the Past Participle

The behavior of the past participle heading the VP complement to *have* raises interesting issues concerning the selection of inflectional features.

In Falk (1984), where an aux-predicate analysis was adopted for *have*, the selection was part of complement selection; in addition to selecting an XCOMP, *have* was analyzed as specifying that the XCOMP must include the inflectional feature [PART PAST].

(21) $(\uparrow \text{XCOMP PART}) =_c \text{PAST}$

This is, of course, inconsistent with the aux-feature analysis. Furthermore, it is based on the assumption that the selection of the past participle by *have* is an f-structure property. In fact, as shown by (17) above, it is a c-structure property: the VP takes on the past participle form only when it is in c-structure complement position. An f-structure complement-selection approach is therefore inappropriate.

Realizational morphology provides another possible approach. Under realizational morphology, *have* does not select the past participle. Instead, *have* and the past participial morphology jointly constitute the realization of the paradigmatic positions associated with the perfect forms. Spencer (2001) states the rule informally as follows:

(22) Realize the feature ASPECT PERFECT on a verb V by means of the construction:
have + V[Vform:-*en*]

In Spencer (2003) he states rhetorically: “If we are to treat this as a piece of compositional syntax then we will have to decide which formative it is that bears the feature ASPECT PERFECT, the auxiliary or the past participle suffix. It’s not clear how such a question could be answered.” As an implementation of the aux-feature analysis, the realizational morphology approach does not suffer from reliance on f-structure. However, it implies that *have* and the past participle are equally necessary to create a perfect form. As we have seen, we reject the implication in Spencer's comment that there is no way to decide which element is bears the aspectual feature: the two are not equally necessary for the construction. In other languages, it may well be the case that a realizational approach is superior, but it is not for English.

The correct generalization appears to be the following:

(23) The "main verb" in the perfective must be a past participle if the VP it heads is in a complement position in *have*'s extended projection. (The VP need not be a sister of *have*; in subject-auxiliary inversion, where *have* is in C position, the VP is still a past participle.)

When fronted to a non-complement position, it no longer needs to be a past participle, and (for many speakers, at least) takes on the default infinitive form.

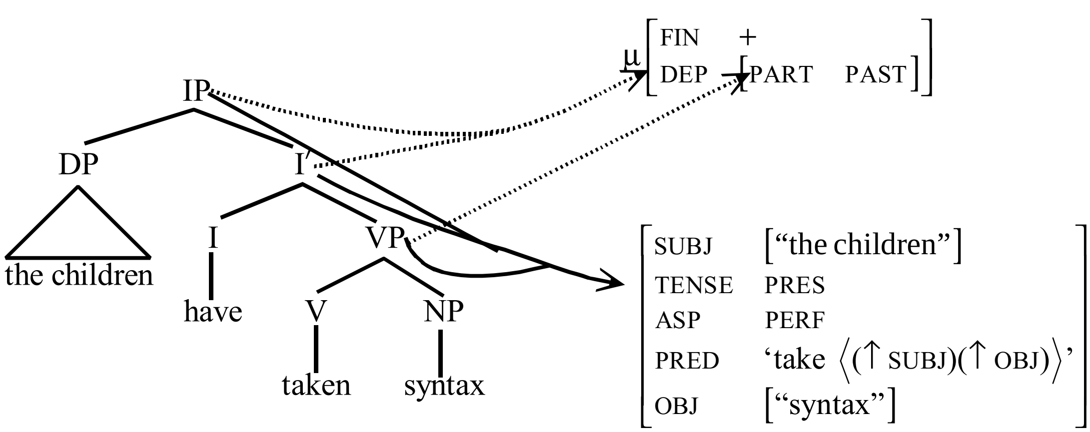
An approach which has been used frequently in the recent LFG literature is to hypothesize an additional level of representation, m(orphosyntactic)-structure, as a projection of c-structure (Butt, King, Niño, and Segond 1999). Under this proposal, m-structure reflects the embedding of c-structure independently of f-structure, and the relevant morphological selection can be expressed in those terms. Using μ to represent the c-structure–m-structure mapping, this involves the following phrase structure rule, lexical specification for *have*, and structures.

(24) a.

$$\mathrm{I}' \rightarrow \begin{array}{cc} \mathrm{I} & \mathrm{VP} \\ \uparrow=\downarrow & \uparrow=\downarrow \\ \hat{*}_\mu = *_\mu & (\hat{*}_\mu\ \mathrm{DEP}) = *_\mu \end{array}$$

b. *have*: $(\uparrow \mathrm{TENSE}) = \mathrm{PRES}$
$(\uparrow \mathrm{ASP}) = \mathrm{PERF}$
$(\hat{*}_\mu\ \mathrm{DEP\ PART}) =_c \mathrm{PAST}$

c.



Since m-structure is a projection from c-structure, an m-structure–based analysis reflects the c-structural nature of the selection. However, the m-structure-based analysis suffers from several formal and conceptual problems. The formal problems are discussed by Frank and Zaenen (2002), and involve the relationship between m-structure and f-structure. The conceptual problem is that it is not clear why morphosyntactic structure should be a distinct level. Many inflectional properties are clearly related to f-structure properties, and it is only an a priori concept of the universality/semantic relevance of f-structure, correctly disputed by Dyvik (1999), that would lead one to not include such features in f-structure. Those properties which are c-structural (such as, apparently, the past participle feature in English) should be represented directly at c-structure. Recent work on morphology in LFG further undermines the idea of a morpho*syntactic* structure of the kind that m-structure is supposed to be.

We propose analyzing the selection of the past participle explicitly as c-structure selection. We follow the suggestion by Frank and Zaenen (2002) that c-structure contain categories that are more fine-grained than is traditional, what they refer to as complex categories. These complex categories include inflectional features. Past participles belong to the complex category V[part], and the verb *have* selects a c-structure complement that belongs to this category. Complex categories of this kind are used in HPSG, and often implicitly in other frameworks. While Frank and Zaenen discuss this within the context of a theoretical architecture that includes a level of m-structure, they note that

> one might wonder whether the formal device of complex c-structure categories…could be extended to an approach where all morphological constraints are encoded in terms of complex c-structure categories. A separate level of representation for morphological constraints [m-structure] would then be unnecessary. At first glance it seems, though, that not all morphological distinctions can be naturally encoded in terms of c-structure categories. In the case of the French auxiliary system, for example, one has to express certain restrictions on tense formation which preclude ungrammatical constructions like **est eu travaillé* [‘is had worked’] as opposed to the well-formed *a eu travaillé* [‘has had worked’], and similarly for **est été arrivé* [‘is been arrived’] as opposed to *a été arrivé* [‘has been arrived’]. To capture these restrictions, an analysis that relies on purely c-structure categorial distinctions will have to encode the lexical form of the auxiliary, *être* vs. *avoir*, as a c-structure parameter of auxiliary categories. Here we would have to decide whether this kind of lexicalization is still within the range of a natural complex c-structure category.

For present purposes, we will assume that those morphological constraints which are not best expressed at f-structure or in terms of realizational morphology will be expressible in terms of complex c-structure categories, without m-structure. Using the informal “compl” to refer to an element in c-structure complement position, and λ for the category label function, we can express the requirement of *have* semiformally as:

(25) $(\hat{*}\ \text{compl}) \Rightarrow \lambda\,(\hat{*}\ \text{compl}) =_c \text{VP[part]}$

4. Progressive *Be*

The progressive auxiliary *be* is often grouped together with *have*, the two of them forming the class of aspectual auxiliaries. However, there is reason to believe that the analysis of progressive *be* differs from that of *have*; in particular, that it is best treated under the aux-predicate analysis. In this, we are following in essentials an analysis suggested by Jackendoff (1977), where progressive *be* is treated as a “main verb”.

In the first place, progressive *be* appears to be predicative. As noted by Jackendoff (1976), progressive *be* is in paradigmatic contrast with other verbs that take progressive complements.

(26) a. The children were taking syntax.
b. The children started taking syntax.
c. The children kept taking syntax.
d. The children stopped taking syntax.

These sentences can be paraphrased as follows:

(27) a. The children were in the state of taking syntax.
b. The children entered the state of taking syntax.
c. The children continued in the state of taking syntax.
d. The children left the state of taking syntax.

It is the participial complement which is progressive in these examples, the governing verbs specify the relationship between the subject and the state. In a similar vein, Jackendoff (1977) notes that some of these verbs take PP predicative complements (XCOMPs) as an alternative to the participle (28a,b); although he doesn't mention it explicitly, this is even true of progressive *be* (28c).

(28) a. John kept Bill $\left\{\begin{matrix}\text{running}\\ \text{at a run}\end{matrix}\right\}$.

b. Moe went on $\left\{\begin{matrix}\text{working}\\ \text{with his work}\end{matrix}\right\}$.

c. Rodgers is $\left\{\begin{matrix}\text{working}\\ \text{at work}\end{matrix}\right\}$ on a new play.

There is no reason to analyze progressive *be* differently at the functional level than any of these other verbs.[7]

(29) a.

$$\left[\begin{array}{ll}
\text{SUBJ} & [\text{“the children”}] \\
\text{TENSE} & \text{PAST} \\
\text{PRED} & \text{‘be}\ \langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{’} \\
\text{XCOMP} & \left[\begin{array}{ll}
\text{SUBJ} & \\
\text{ASP} & \text{PROG} \\
\text{PRED} & \text{‘take}\ \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\
\text{OBJ} & [\text{“syntax”}]
\end{array}\right]
\end{array}\right]$$

b.

$$\left[\begin{array}{ll}
\text{SUBJ} & [\text{“the children”}] \\
\text{TENSE} & \text{PAST} \\
\text{PRED} & \text{‘start}\ \langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{’} \\
\text{XCOMP} & \left[\begin{array}{ll}
\text{SUBJ} & \\
\text{ASP} & \text{PROG} \\
\text{PRED} & \text{‘take}\ \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\
\text{OBJ} & [\text{“syntax”}]
\end{array}\right]
\end{array}\right]$$

Progressive *be* is no different from main verb *be*, which also expresses the existence of a state. Like progressive *be*, main verb *be* also undergoes V-to-I, so there is no c-structure difference between them either. Progressive participle phrase can even be coordinated with other

[7]Andy Spencer has suggested to me that the present participle form, which is morphologically identical to the nominal gerund form, may have some residual nominality itself. He notes the following:

(i) a. Horse-riding is fun.
b. The children are horse-riding.
c. *The children have horse-ridden.
d. *The children horse-rode.

XCOMP arguments of *be*. We propose that the lexical entry for *be* includes the following:

(30) $(\uparrow \text{PRED}) = \text{'be} \langle(\uparrow \text{XCOMP})\rangle (\uparrow \text{SUBJ})\text{'}$
$\text{VP} \in \text{CAT}\ (\uparrow \text{XCOMP}) \Rightarrow (\uparrow \text{XCOMP ASP}) =_c \text{PROG}$

The present participle form will include the aspectual feature.

(31) $(\uparrow \text{ASP}) = \text{PROG}$

We leave as an open question the analysis of passive *be*.

One interesting consequence of the aux-predicate analysis of *be* is that, as a biclausal structure, a sentence with progressive *be* should be able to have distinct modifiers for *be* and its complement. It is difficult to set up a convincing test case, but it is possible, and the resulting sentence is grammatical.

(32) Today, the repairman is coming tomorrow (but tomorrow that may change).

This sentence means that today the repairman is in the state of coming tomorrow. Such a sentence works when combined with appropriate real-world knowledge, such as the unreliability of repairmen. But syntactically, it requires the *is* (modified by *today*) and the *coming* (modified by *tomorrow*) to be in distinct functional clauses.

Finally, we note that our analysis of progressive *be* accounts for one of the most recalcitrant facts about the English auxiliary: the relative ordering of *have* and *be*.

(33) a. The children have been taking syntax.
b. *The children are having taken syntax.

Under our analysis, the f-structure of (33a) is the unremarkable (34).

(34)
$$\left[\begin{array}{ll}
\text{SUBJ} & [\text{“the children”}] \\
\text{TENSE} & \text{PRES} \\
\text{ASP} & \text{PERF} \\
\text{PRED} & \text{'be} \left\langle(\uparrow \text{XCOMP})\right\rangle(\uparrow \text{SUBJ})\text{'} \\
\text{XCOMP} & \left[\begin{array}{ll}
\text{SUBJ} & \\
\text{ASP} & \text{PROG} \\
\text{PRED} & \text{'take} \left\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\right\rangle\text{'} \\
\text{OBJ} & [\text{“syntax”}]
\end{array}\right]
\end{array}\right]$$

On the other hand, there is no well-formed f-structure for the ungrammatical (33b). The putative present participle *having* would specify two conflicting values for the feature ASP: PERF by virtue of being a form of *have* and PROG because of the present participle form:

(35) $(\uparrow \text{ASP}) = \text{PERF}$
$(\uparrow \text{ASP}) = \text{PROG}$

The f-structure of any sentence with *having* would therefore be inconsistent, and therefore ill-formed.

(36)

$$\left[\begin{array}{ll} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{‘be}\ \langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \left[\begin{array}{ll} \text{SUBJ} & \\ \text{ASP} & \text{PROG} \\ \text{ASP} & \text{PERF} \\ \text{PRED} & \text{‘take}\ \langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{array}\right] \end{array}\right]$$

An analysis in which both *have* and progressive *be* receive the aux-feature treatment would be unable to express this contrast without additional stipulations.[8]

5. Modals

5.1. Overview

We turn now to the modals: *will(/shall)*[9], *would*, *can*, *could*, *may*, *might*, *should*, *must*, *ought*, modal *dare*, and modal *need*. These differ from *have* and *be*, and even *do*, in having no verb-like properties. They are thus generally analyzed as lexical items that belong to the category I, rather than verbs which undergo V-to-I. We accept this categorial analysis here without argument.

As infls, modals belong unambiguously to what is generally referred to as a functional category, rather than a lexical category. The nature of functional categories is that they are generally taken to not be predicative categories, but rather feature carriers. This is the meaning of the name “functional category”, which has its origins in transformationalist studies of $\bar{X}$ theory. In recent work in LFG, it has been hypothesized that, among the universal constraints on c-structure–f-structure mapping is the following principle (Bresnan 2001):

(37) C-structure complements to functional categories are f-structure coheads.

Bresnan (2001: 105f) states that this

> captures the intuition that the relation of the functional F^0 categories to their complements is not that of predicator to argument; either the F^0 element is a function word lacking descriptive content altogether, or it is an inflectionally defined lexical element such as a finite verb which is related to arguments within its phrasal cohead at the level of f-structure.

However, it is telling that the only f-structures Bresnan presents for sentences with infls have the auxiliaries *do* and *will*: we have already provided an aux-feature analysis for *do*, and of the modals *will* is the most plausible case for an aux-feature analysis. It is therefore unclear whether Bresnan would extend such an analysis to a modal like *can*. More interesting is a comment by Dalrymple (2001: 178), who accepts (37). Her examples of sentences with auxiliaries involve the non-modals *have* and *be*, of which we have accepted the aux-feature analysis for the former but not the latter. She states that

---

[8] One of the difficulties here is that the suffix *-ing* has other uses. The form *having* is possible with any use of *-ing* which is not progressive, because then there is no inconsistency in the feature ASP. It is grammatical, for example, in the following:

(i) Having taken linguistics, David knew he would never be sane again.

[9] In the variety of English covered here, *shall* exists only as a stylistically marked variant of *will*. We will not have anything to say about *shall* in what follows.

although a multiclausal structure may be appropriate for English modals, there is no compelling evidence in English for a multiclausal structure for non-modal auxiliaries, and indeed it has often been argued that auxiliary verbs and their complements in other languages correspond to a single f-structure…

By acknowledging the possibility of an aux-predicate analysis for the modals, elements which are purely infls (not inflected forms of verbs), Dalrymple undermines (37) as an inviolable principle.

Our approach will be to propose an aux-feature analysis for *will* and *would*, and an aux-predicate analysis for the other modals. This appears to be the analysis most consistent with the behavior of these elements. It is also consistent with the implicit analysis in Butt, King, Niño, and Segond (1999), where it is explicitly stated that modals are predicative, but an f-structure is provided for a sentence with *will* in which it is simply a carrier of the future tense feature.

5.2. *Will* and *Would*

The modals *will* and *would* are the most tense-like of the modals. In fact, it is tempting to see the following as a pattern of syntactic expression of tense.[10]

(38) a. The children did take syntax. (past tense)
b. The children do take syntax. (present tense)
c. The children will take syntax. (future tense)
d. The children would take syntax. (conditional tense)

Under such a view, which we accept, the only difference between the past and present on the one hand and the future and conditional on the other is that for the former English also has competing synthetic forms which, because morphological means are generally preferred over syntactic means, are usually used instead.

The use of an analytic form for future tense is not uncommon, at least among the Indo-European languages. An interesting case, discussed by King (1995), is Russian. In Russian, the imperfective future is analytic, while all other tense/aspect combinations are synthetic.

(39) a. Ja budu čitat' knigu.
I will read.IMPF book
'I will be reading a book.'
b. Ja pročitaju knigu.
I PRF.read.FUT book
'I will read the book.'
c. Ja čitala knigu.
I read.PST.IMPF book
'I was reading the book.'
d. Ja pročitala knigu.
I PRF.read.PST book
'I read the book.'

Since the only difference between (39a) and (39b) is aspect, and the only difference between (39a) and (39c) is tense, King argues, the best analysis would not make (39a) biclausal at

[10]Of course, the semantics of *will* and *would* are more complicated than "future" and "conditional", but there do not appear to be any syntactic differences between, for example, the strictly future use of *will* and the probability use as in *That will be Joan*. It is also possible to hypothesize that this is a different *will*, but I know of no syntactic evidence for this.

f-structure.

On the other hand, Dyvik (1999) argues that the construction cognate to the English future is biclausal in Norwegian. That is to say, he proposes an aux-predicate analysis for Norwegian *ville*. However, there is a crucial difference between the English and Norwegian cases: in Norwegian, *ville* also has the clearly predicative meaning of 'want', a meaning which is lacking in present-day English *will*.

(40) a. Han vil dreie håndtaket.
he will turn the.lever
'He will [i.e. future] turn the lever.'/'He wants to turn the lever.'

b. He will turn the lever. (≠ He wants to turn the lever.)

Norwegian *ville* thus exhibits both root and epistemic uses, behavior which is typical of some other modals in English but crucially not *will*. Thus, while the aux-predicate analysis of Norwegian *ville* appears correct, present-day English *will* is better assigned an aux-feature analysis.

In the case of *would*, there is also the evidence of co-occurrence restrictions, as there was with *do* and *have*. The predicate *rather* requires the auxiliary *would* to appear in its clause.

(41) a. The children would rather take syntax.

b. *rather* $(\uparrow \text{PRED}) = \text{`rather} \langle(\uparrow\text{SUBJ})(\uparrow\text{XCOMP})\rangle\text{'}$
$(\uparrow \text{TENSE}) =_c \text{CONDIT}$

This provides further support for an aux-feature analysis of *would*.

5.3. Other Modals

For modals other than *will* and *would*, the aux-feature analysis seems significantly less attractive. At the center of the argument in favor of the aux-predicate analysis is what is often referred to as the distinction between root and epistemic uses of modals.

(42) The children may take syntax.
a. ≈It is possible that the children will take syntax. (epistemic)
b. ≈The children are permitted to take syntax. (root)

In both uses, the modal appears to be predicative; at the very least, it can be paraphrased with predicates like *possible* and *permitted*. That is to say, under both uses the aux-predicate analysis is plausible. However, the argument is stronger under the root use, because the modal imposes selectional restrictions on the subject, which is a thematic argument of the modal. Thus, the following sentence, with a pleonastic subject, is unambiguously the epistemic use.

(43) There may be children taking syntax. (≈It is possible that there are children taking syntax.)

This is even clearer with a modal that has only a root use, such as modal *dare*. In such a case, a sentence with a pleonastic subject is ungrammatical.

(44) a. The children dare not take syntax.
b. *There dare not be any children taking syntax.

Ross (1969) was the first to suggest analyzing root modals as equi (control) predicates and epistemic modals as raising predicates. This analysis is adopted in the LFG analysis of Falk (1984) for all modals. While we have now rejected such an analysis for *will* and *would*, it appears to be correct for the other modals. The f-structures for the two readings of (42) are:

(45) a.

$$\left[\begin{array}{ll} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{‘may}_{\text{epist}} \left\langle (\uparrow \text{XCOMP}) \right\rangle (\uparrow \text{SUBJ})\text{’} \\ \text{XCOMP} & \left[\begin{array}{ll} \text{SUBJ} & \\ \text{PRED} & \text{‘take} \left\langle (\uparrow \text{SUBJ})(\uparrow \text{OBJ}) \right\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{array}\right] \end{array}\right]$$

b.

$$\left[\begin{array}{ll} \text{SUBJ} & [\text{“the children”}] \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{‘may}_{\text{root}} \left\langle (\uparrow \text{SUBJ})(\uparrow \text{XCOMP}) \right\rangle\text{’} \\ \text{XCOMP} & \left[\begin{array}{ll} \text{SUBJ} & \\ \text{PRED} & \text{‘take} \left\langle (\uparrow \text{SUBJ})(\uparrow \text{OBJ}) \right\rangle\text{’} \\ \text{OBJ} & [\text{“syntax”}] \end{array}\right] \end{array}\right]$$

For the epistemic modals, the argument for an aux-predicate analysis is weaker, since there is no relation of selection between the modal and the subject. Dyvik (1999) argues for such an analysis for Norwegian modals, but their properties differ in certain respects from those of English modals. Specifically, Norwegian modals can take nominal objects, and even epistemic modals can have pronominalized complements.

(46) a. Jeg vil/kan/må/skal dette.
I will/can/may/shall this
‘I want/am able to do/am obliged to do/have a duty to do this’
b. (Vil det regne?) Det vil det.
(will it rain?) it will that
‘(Will it rain?) It will (that).’

In English, nominal or pronominal complements of modals are ungrammatical, presumably because modals are infls and not verbs in English. For some, separate modification of the two clauses appears to be possible, although it is less clearly well-formed than in the case of progressive *be*.

(47) ??Today, the repairman may come tomorrow (but tomorrow that may change).

In a similar vein, it is sometimes possible to distinguish between a single adverbial modifying the modal and one modifying the verb, either because one is ungrammatical or because they have different meanings.

(48) a. *Tabs never may be kept on syntax students.
b. Tabs may never be kept on syntax students.

(49) a. Tabs never should be kept on syntax students. (≈ There is never an obligation.)
b. Tabs should never be kept on syntax students. (≈ There is an obligation to never keep tabs on them.)

This suggests that the aux-predicate analysis is correct even for epistemic modals. We are aware of no specific evidence in favor of the alternative aux-feature analysis for epistemic modals, such as co-occurrence restrictions.

It is important to reiterate that the aux-predicate analysis is the only possible analysis of root modals. There is no other way to express the fact that the subject is thematically selected by the modal. Thus, even if this analysis were to be rejected for the epistemic modals, it would still not be possible to maintain that infls can never be argument-taking predicates.

6. Where does this leave us?

Although our specific analyses differ somewhat from those of Falk (1984), the essential conclusion is the same. There is no single analysis that covers all auxiliaries. Each one needs to be examined on its own terms. This differs from what is assumed, sometimes explicitly and sometimes implicitly, in most other analyses, regardless of theoretical framework. There is no escape from the conclusion that some auxiliaries require the aux-feature analysis, and others the aux-predicate analysis.

Furthermore, as argued by Falk (1984), the LFG framework is particularly well suited to account for facts of this kind. The parallel architecture, in which constituent structure and functional relations are dissociated, allows us to express naturally the fact that the constituency of auxiliaries is fairly uniform, while functionally there is greater diversity.

Appendix: Lexical Entries

tensed forms are given in the past tense so as not to create confusion with the bare infinitive

did category: I
(↑ TENSE) = PAST

had category: I
(↑ TENSE) = PAST
(↑ ASP) = PERF
($\hat{*}$ compl) ⇒ λ ($\hat{*}$ compl) $=_c$ VP[part]

was category: I
(↑ PRED) = 'be ⟨(↑ XCOMP) (↑ SUBJ)⟩'
(↑ TENSE) = PAST
VP ∈ CAT (↑ XCOMP) ⇒
(↑ XCOMP ASP) $=_c$ PROG

will category: I
(↑ TENSE) = FUT

may category: I
(↑ TENSE) = PRES
(↑ PRED) = 'may$_{\text{epist}}$ ⟨(↑ XCOMP)⟩ (↑SUBJ)'

may category: I
(↑ TENSE) = PRES
(↑ PRED) = 'may$_{\text{root}}$ ⟨(↑SUBJ)(↑ XCOMP)⟩'

would category: I
(↑ TENSE) = CONDIT

take category: V[base]
(↑ PRED) = 'take ⟨(↑ SUBJ)(↑ OBJ)⟩'

took category: V[fin]
(↑ PRED) = 'take ⟨(↑ SUBJ)(↑ OBJ)⟩'
(↑ TENSE) = PAST

taken category: V[part]
(↑ PRED) = 'take ⟨(↑ SUBJ)(↑ OBJ)⟩'

taking category: V[prog]
(↑ PRED) = 'take ⟨(↑ SUBJ)(↑ OBJ)⟩'
(↑ ASP) = PROG

used (to) category: V[fin]
(↑ PRED) = used-to ⟨(↑ XCOMP)⟩ (↑ SUBJ)'
(↑ TENSE) $=_c$ PAST
(↑ ASP) = HABITUAL
(↑ TENSE) = PAST

use (to) category: V[base]
(↑ PRED) = used-to ⟨(↑ XCOMP)⟩ (↑ SUBJ)'
(↑ TENSE) $=_c$ PAST
(↑ ASP) = HABITUAL

got category: V[part]
(↑ PRED) = 'got ⟨(↑ SUBJ)(↑ OBJ)⟩'
(↑ ASP) $=_c$ PERF

better category: V[part]?
(↑ PRED) = 'got ⟨(↑ SUBJ)(↑ OBJ)⟩'
(↑ TENSE) $=_c$ PAST
(↑ ASP) $=_c$ PERF

rather category: V[base]?
(↑ PRED) = 'rather ⟨(↑SUBJ)(↑XCOMP)⟩'
(↑ TENSE) $=_c$ CONDIT

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Treebank Conversion

Creating a German f-structure bank from the TIGER Corpus

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Abstract

This paper reports on the conversion of the TIGER treebank, a syntactically interpreted corpus of German newspaper texts, into a testsuite for a broad-coverage Lexical-Functional Grammar (LFG) for German. It presents the two major steps of the conversion, which consists of an XSLT transformation of the TIGER XML representation into a relational Prolog-like representation and the subsequent application of term-rewriting rules as they are used in certain MT transfer components to that representation. Then some problems due to considerable differences in analysis or to information not encoded in the TIGER representation are discussed. The output consists of (partly ambiguous) f-structure charts, which can then be mapped against the grammar's output for evaluation purposes.

1 Introduction

In grammar development, the lack of large annotated testsuites is a serious obstacle to the further extension and adaptation of the grammars concerned, because it makes it extremely costly to evaluate grammars systematically and to keep track of the consequences of grammar modifications on coverage, efficiency and accuracy. At present, without large testsuites for German, a linguist involved in the development of a broad-coverage grammar such as the German ParGram LFG can of course run the grammar on large corpora and state afterwards how many sentences in a given corpus were parsed, what percentage timed out or failed because of storage overflow, and how many did not get any analysis. It is virtually impossible, however, to determine the accuracy of the analyses obtained, which relativizes the informational value of the given figures considerably.

Moreover, large f-structure banks lend themselves to the (supervised) training of probabilistic disambiguation modules, which select the most probable parse out of the sometimes extremely numerous analyses proposed by the symbolic grammar. (See Riezler et al. (2002) for the development of such a module for the English ParGram LFG.) It is thus evident that the creation of such f-structure banks would be a considerable advance in LFG grammar engineering.

Since the manual annotation of such testsuites would be extremely time-consuming, it seems reasonable to use an existing treebank, the TIGER corpus in our case, and to convert it to the format we need, which is the one of LFG f-structures.

Similar efforts of f-structure annotation of treebanks have been reported on in Van Genabith et al. (1999), Sadler et al. (2000), Frank (2000), Frank et al. (2001), Van Genabith et al. (2001), and Cahill et al. (2002). Since in all that work the source format (AP corpus, Susanne corpus, Penn treebank) differs considerably from the TIGER format in that it encodes mainly phrase-structural information, our approach is quite different, however, from the ones mentioned. Dependency information being expressed explicitly in the edge labels, we do not need to f-annotate the treebank (or a context-free grammar extracted from it), but we can directly convert the hybrid TIGER representation into f-structures.

Another related work is Frank (2001), which consists of the extraction of an LTAG from the NEGRA corpus. Here, the source format is comparable to ours, the TIGER format being an extension of the NEGRA format, and the main differences with respect to our work are due to the different target format. For the conversion of the corpus to a collection of f-structures, constituency information is almost irrelevant, whereas it is crucial for the extraction of an LTAG.

Finally, our conversion is, of course, in many ways similar to the inverse conversion from LFG analyses to TIGER trees Zinsmeister et al. (2002). E.g. we use the same term-rewriting system. However, since the relation between TIGER trees and f-structures is far from being a one-to-one mapping, it raises new questions. Moreover, we aim at converting the entire TIGER treebank into an 'f-structure bank' with hardly any human intervention, an objective that is quite different from grammar-based treebank annotation.

Our presentation of the conversion process is organized as follows. Section 2 describes the first step in the process, which is the transformation of TIGER trees into feature structures. In section 3 we present the transfer system we use for the transformation of TIGER-like feature structures into f-structures, as well as a number of transfer phenoma and their treatment in that formalism. Section 4 presents some results. Finally, section 5 gives an outlook on the possibilities for future work offered by the resulting f-structure bank.

2 The TIGER treebank and the relational TIGER representation

The TIGER Corpus comprises currently 40,000 syntactically annotated German newspaper sentences. The annotation consists of generalized graphs, i.e. trees which may contain crossing and secondary edges. Edges are labeled, so that a TIGER tree encodes both phrase-structural information and information on dependency relations.[1]

The TIGER trees are represented in a specific XML format, the so-called TIGER XML.[2] Figure 2 illustrates what the TIGER XML representation of an annotated sentence like the one in figure 1 looks like.

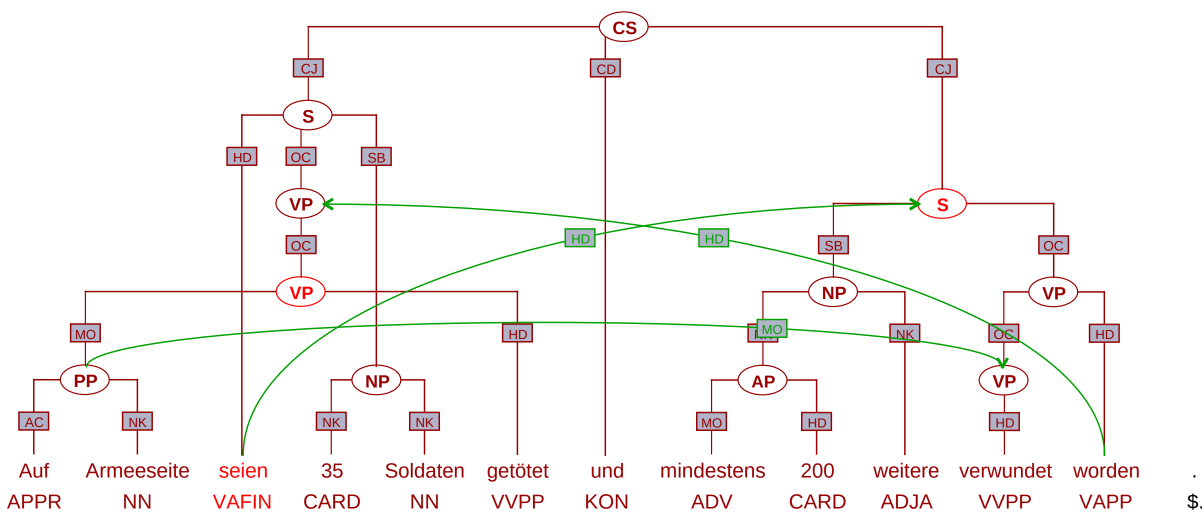

Figure 1: TIGER tree representation of corpus sentence no. 1376

In order to be able to use the XTE term-rewriting system for the conversion of the TIGER trees into f-structures, we first need to have the TIGER corpus available in a relational Prolog-like representation. Instead of being a generalized graph, a TIGER tree then has to take the form of a feature structure.

This conversion raises a first problem: In a TIGER tree, there can be several identically labelled edges that go from one single node to various of its daughter nodes. In feature structures, on the contrary, a given attribute can only have one unique value. It is thus not possible to convert a TIGER tree into a feature structure by a one-to-one mapping. Fortunately, there is quite a straightforward solution to this problem: As attributes in a feature structure can be set-valued, all identically labeled daughter nodes of a given node can be put into a set. The resulting representation differs somewhat from the initial tree, but it contains basically the same information.

[1] For more details on the annotation scheme see Skut et al. (1997), Brants & Hansen (2002), and Brants et al. (2002).

[2] See Mengel & Lezius (2000).

```
...
 <t id="s1376_7" word="und" pos="KON" morph="--"/t>
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 <t id="s1376_12" word="worden" pos="VAPP" morph="--">
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 </t>
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</terminals>
<nonterminals>
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  <edge label="NK" idref="s1376_2" />
  <secedge label="MO" idref="s1376_503" />
 </nt>
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  <edge label="NK" idref="s1376_4" />
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 </nt>
 <nt id="s1376_502" cat="AP">
  <edge label="MO" idref="s1376_8" />
  <edge label="HD" idref="s1376_9" />
 </nt>
...
```

Figure 2: excerpt of the TIGER XML representation of corpus sentence no. 1376

Another problem that we need to deal with when converting TIGER trees into feature structures is the fact that, generally, the latter do not encode any information about precedence relations. This kind of information can be crucial, however, for subsequent steps in the conversion from one format to the other. Genitive attributes, for example, are labeled AG in the TIGER treebank, whether they are on the left or on the right of their head noun. The broad-coverage LFG for German, on the contrary, analyzes them in two different ways, either as a SPEC POSS, when they are in prenominal position, or as a member of the set-valued feature ADJUNCT, when they appear postnominally. This means that a minimum of information about precedence needs to be encoded in the relational TIGER representation.

This can be done with the help of a the special XLE predicate 'scopes' that allows us to state that a certain node A precedes another node B. By means of 'scopes', we express precedence relations between daughters of the same mother node. This kind of information is sufficient to disambiguate all TIGER-LFG mismatches which can be disambiguated on the basis of precedence information.

The first step of the conversion of TIGER trees into f-structures thus consists of transforming the trees into feature structures. As this task does not require any major structural changes, it can be carried out quite comfortably by means of an XSL style sheet[3]. Figure 3 shows an excerpt of the relational Prolog-like representation of the corpus sentence displayed in figure 1 that results from the XSL conversion of the TIGER XML representation illustrated in figure 2. Figure 4 displays the corresponding feature structure.

3 Treebank conversion by (MT) transfer rules

Although the f-structures we obtain from our broad-coverage LFG and the TIGER treebank representations coincide in core aspects, e.g. the encoding of grammatical functions, there are mismatches in

[3]Thanks to Hannes Biesinger for a first version of the XSL style sheet and to Stefanie Dipper for her contribution to its final adaption.

```
...
, cf(1, eq(attr(var(6), 'TI-FORM' ), 'getötet'))
, cf(1, eq(attr(var(6), 'TI-ID' ), 6))
, cf(1, eq(attr(var(6), 'TI-POS' ), 'VVPP'))
, cf(1, eq(attr(var(504), 'MO' ), var(1011504)))
, cf(1, in_set(var(500), var(1011504)))
, cf(1, eq(attr(var(500), 'TI-CAT' ), 'PP'))
, cf(1, eq(attr(var(500), 'TI-ID' ), 500))
, cf(1, scopes(var(1), var(2)))
, cf(1, eq(attr(var(500), 'AC' ), var(1001500)))
, cf(1, in_set(var(1), var(1001500)))
, cf(1, eq(attr(var(1), 'TI-FORM' ), 'Auf'))
, cf(1, eq(attr(var(1), 'TI-ID' ), 1))
, cf(1, eq(attr(var(1), 'TI-POS' ), 'APPR'))
, cf(1, eq(attr(var(500), 'NK' ), var(1012500)))
, cf(1, in_set(var(2), var(1012500)))
, cf(1, eq(attr(var(2), 'TI-FORM' ), 'Armeeseite'))
...
```

Figure 3: excerpt of the relational Prolog-like representation of corpus sentence no. 23474

analysis details that are comparable to translation mismatches in natural language translation. One such phenomenon is the flat analysis of auxiliary constructions generally adopted in LFG versus the intricate analysis that has been chosen for the TIGER treebank. This kind of mismatches motivates the use of transfer technology originally developed for machine translation.

3.1 The transfer system

The transfer system we use is a term rewriting system based on Prolog. It has originally been developed by Martin Kay and is now part of the XLE grammar development platform. [4] The rules it processes are ordered, which means that the output of a given rule r_i is input to rule r_{i+1}. Each rule replaces a certain set of predicates (those on the left-hand side of the rule) by another set of predicates (those on its right-hand side). Input and output predicates are separated by a rewriting symbol, the operator '==>'. The most basic rules simply rewrite the name of the predicate and pass on the values of the arguments unchanged. For example, the rule given in (1) maps the TIGER edge label OA (accusative object) to the LFG function OBJ.

(1) `oa(X,Y) ==> obj(X,Y).`

In addition, it is possible to specify predicates on the left-hand side that have to be matched, but are not replaced (marked with a '+'), as well as predicates that must not be matched for the rule to be applied (marked with a '-'). These mechanisms are used in the following rule, which takes a partial feature structure whose attribute TI-POS has the value PIAT (for 'attributive indefinite pronoun') out of the set that is the value of the feature NK (for 'noun kernel') and attributes it to a new feature SPEC QUANT, if that feature does not yet exist.

(2)
```
+nk(A,SET), in_set(B,SET), +ti_pos(B,'PIAT'), -spec(A,_) ==>
spec(A,SPEC), quant(SPEC,B).
```

It is also possible to delete features by writing a zero on the right-hand side of a rule, which stands for the empty set. In this case, all predicates on the left-hand side of the rule are deleted from the set of terms without replacement.

[4] I would like to thank Anette Frank (DFKI Saarbrücken) for her input and great help with the transfer component.

```
"Auf Armeeseite seien 35 Soldaten getötet und mindestens 200 weitere verwundet worden . "

CD {-11[TI-FORM und, TI-ID 7, TI-LEMMA und, TI-POS KON]}
       HD [TI-FORM seien, TI-ID 3, TI-LEMMA sein, TI-POS VAFIN]
          HD [TI-FORM worden, TI-ID 12, TI-LEMMA werden, TI-POS VAPP]
             HD [TI-FORM verwundet, TI-ID 11, TI-LEMMA verwunden, TI-POS VVPP]
                AC {-3[TI-FORM Auf, TI-ID 1, TI-LEMMA auf, TI-POS APPR]}
       OC OC MO     MOD {-1[TI-LEMMA Armee]}
                NK {-2[TI-FORM Armeeseite, TI-ID 2, TI-LEMMA Seite, TI-POS NN]}
                TI-CAT PP, TI-ID 500
             TI-CAT VP, TI-ID 503
          TI-CAT VP, TI-ID 506
             -8[DEGREE comparative_, TI-FORM weitere, TI-ID 10, TI-LEMMA weit, TI-POS ADJA]
                HD [TI-FORM 200, TI-ID 9, TI-LEMMA 200, TI-POS CARD]
CJ {   SB NK {  MO {-6[TI-FORM mindestens, TI-ID 8, TI-LEMMA mindestens, TI-POS ADV]}
             -7 TI-CAT AP, TI-ID 502
          TI-CAT NP, TI-ID 505
   -10[TI-CAT S, TI-ID 508
       HD [-10-HD]
          HD [-10-OC-HD]
       OC OC HD [TI-FORM getötet, TI-ID 6, TI-LEMMA töten, TI-POS VVPP]
             MO <[-10-OC-OC-MO]>
             TI-CAT VP, TI-ID 504
          TI-CAT VP, TI-ID 507
          NK {-5[TI-FORM 35, TI-ID 4, TI-LEMMA 35, TI-POS CARD]
       SB     -4[TI-FORM Soldaten, TI-ID 5, TI-LEMMA Soldat, TI-POS NN]}
          TI-CAT NP, TI-ID 501
    -9[TI-CAT S, TI-ID 509
-12[TI-CAT CS, TI-ID 0
```

Figure 4: representation of corpus sentence no. 1376 as a TIGER-annotated feature structure

(3) `ti_form(_,_) ==> 0.`

Finally, the possibility of defining rules as optional needs to be mentioned as well. Optional rules are characterized by the use of the operator '?=>' instead of '==>'. They allow us to transfer a given input feature structure to two alternative output structures - or more, if several optional rules are applied. We can thus handle cases where we cannot clearly decide on the sole basis of the input what the output must look like. The TIGER label MO (for 'modifier'), for example, is such a phenomenon, because the context is not always sufficient to determine whether it is to be transferred to an element of the set-valued feature ADJUNCT, to an OBL-DIR (directional oblique), an OBL-LOC (locative oblique) or still another grammatical function. The following rule optionnally transfers a MO-PP with an AC (the edge label used for pre- and postpositions in TIGER) that has the form 'nach' into an OBL-DIR.

(4)
```
+ti_cat(S,'S'), +mo(S,MO), in_set(PP,MO), +ti_cat(PP,'PP'),
+ac(PP,APPR), +ti_form(APPR,'nach') ?=>
obl_dir(S,PP).
```

For reasons of userfriendliness and maintainability, the XLE transfer system also allows the use of templates and macros. They are short-hand notations for sets of rules and predicates respectively. As they are not directly relevant for our presentation, however, we do not present them here in more detail.

3.2 Transfer phenomena

Unlike transfer in machine translation, the transfer from TIGER trees to LFG f-structures does not aim at changing the surface string. The task is rather to map a limited set of grammatical features into another limited set of grammatical features. Nevertheless, the format conversion is far more complex than a simple mapping from one feature set to another, because (i) there is no one-to-one correspondence between features, (ii) the different analyses chosen for certain grammatical phenomena can have relatively heavy repercussions on the structure of the representations involved, and (iii) the TIGER Corpus graphs contain most, but not all information needed for the conversion to f-structures.

3.2.1 Ambiguous edge labels

In section 2, we mentioned the case of the TIGER edge label AG, which depending on the position of the AG constituent with respect to its head noun corresponds to either a SPEC POSS feature or an ADJUNCT feature in a German LFG analysis. Still, this kind of ambiguity can easily be resolved on the basis of precedence information, so that we simply need two obligatory rules for the transfer of AGs, one for prenominal ones and a ’default rule’ for postnominal ones. As rules are ordered, the ’default rule’ is only applied, if the more specific rule was not.

(5) a.
```
+ti_cat(NP,'NP'), +nk(NP,NKSET), +in_set(HEAD,NKSET),
+ti_pos(HEAD,'NN'), +scopes(AG,HEAD), ag(NP,AG) ==>
spec(NP,SPEC), poss(SPEC,AG).
```
b.
```
ag(NP,AG) ==>
adjunct(NP,ADJUNCT), in_set(AG,ADJUNCT).
```

A somewhat more complex case is the transfer of the predicate MO. It can correspond to the predicates ADJUNCT, OBL-DIR and OBL-LOC. This is due to the fact that PPs such as *auf Armeeseite* in corpus sentence no. 1376 are always annotated as MOs in the TIGER Corpus, whereas the German LFG analyses them as subcategorized arguments in some contexts.

We deal with this case by first using the optional rule in (6a), which similarly to the one in (4) converts a MO into an OBL-LOC, and then applying the default rule given in (6b), which transfers all MOs to ADJUNCTs. In order not to obtain too many output f-structures, we try to limit the application of the optional rules to as few contexts as is reasonably possible, while keeping them general enough to cover all cases that we need for a justifiable comparison of the output of the German LFG and the TIGER annotation. Nevertheless, the optional rules we use give rise to a considerable amount of ambiguity, which can easily been seen in figure 5.

(6) a.
```
+ti_cat(S,'S'), +mo(S,MO), in_set(PP,MO), +ti_cat(PP,'PP'),
+ac(PP,APPR), +ti_form(APPR,'auf') ?=>
obl_loc(S,PP).
```
b.
```
mo(S,MO) ==> adjunct(S,MO).
```

```
"Translation of: Auf Armeeseite seien 35 Soldaten getÃ¶tet und mindestens 200 weitere verwundet worden

     PRED      'verwunden'
               PRED     'pro'
                              PRED    'weit'
               ADJUNCT        SUBJ    PRED       'pro'
     SUBJ                             PRON-TYPE null
                            -3 DEGREE comparative
               SPEC     NUMBER   PRED     '200'
                                 ADJUNCT  -2 PRED 'mindestens'
                  PRED 'auf'
     ADJUNCT      OBJ   PRED 'Seite'
                  -4    MOD  -1 PRED 'Armee'
     TNS-ASP   ASPECT    PERF +
  -6           PASS-SEM  dynamic
     PRED      'tÃ¶ten'
     SUBJ      PRED 'Soldat'
               SPEC NUMBER PRED '35'
     OBL-DIR   =(<b:1 [-4:auf]>)
     OBL-LOC   =(<c:1 [-4:auf]>)
     ADJUNCT   c:2  [-4:auf]
     OBL       =(<a:1 [-4:auf]>)
     TNS-ASP   ASPECT    PERF +
  -5           PASS-SEM  dynamic
-7 COORD-FORM und
```

Figure 5: F-structure derived from the TIGER tree associated to corpus sentence no. 1376

3.2.2 Structural changes

Given that TIGER trees on the one hand encode information about both phrase structure and dependency relations and that f-structures on the other hand only represent the latter type of information, it is not surprising that the analysis of a few grammatical phenomena differs considerably between the TIGER corpus and the German LFG analyses. This is the case of analytic tenses, for example, which generally get a flat analysis in LFG, the auxiliary and the main verb being treated as f-structure co-heads, whereas in TIGER the VP containing the non-finite main verb form is analysed as a clausal object (OC) of the auxiliary. By comparing figure 5, which shows the f-structure derived from the TIGER tree in figure 1, and that same figure you can state that the resulting structure is less intricate.

This kind of structural change is known as head-switching in the field of machine translation. As studies about the treatment of head-switching phenomena have shown, they can be dealt with without major difficulty by a term-rewriting system.

3.3 Information not present in the TIGER Corpus

A more problematic aspect of the conversion of TIGER graphs to LFG f-structures is the fact that there is no information whatsoever in the annotation about the subjects of infinitives. For f-structures that respect completeness and coherence, this information is needed, however.

Our approach to solve this problem is to use the control information contained in the lexicon of our grammar. The drawback of this method is that erroneous or missing information in the lexicon will be reflected in the transfer output, but we judged it the most adequate way to assign subjects to infinitives without human intervention.

4 Results

An evaluation of our treebank conversion has been carried out on the basis of sentences 8001 to 8200 of the TIGER Corpus. [5] For this purpose, we established a gold standard for those sentences using roughly the same methodology and format as King et al. (2003) did for the PARC 700 Dependency Bank. Then the result of our treebank conversion was matched against this gold standard, taking into account predicate-argument relations only. (The current TIGER release is not yet annotated morphologically.) The matching was done in such a way that an f-structure chart counted as a complete match, if the correct analysis was among the readings contained in it.

Of the 200 sentences, 6 consisted of one single word, which makes it impossible to match predicate-argument relations, and 10 could not be converted to feature structures, because they were sequences of syntactic phrases rather than sentences (example: *dah FRANKFURT A. M. , 6. November* .). This left us with 184 sentences for evaluation, of which 9 didn't entirely match due to errors in the original TIGER annotation. Out of the 175 correctly annotated sentences, 1 failed to match due to an erroneous lemmatization and 13 had not been transferred correctly. 161 out of the 175 sentences were converted correctly, which corresponds to 92

5 Outlook to the use of the resulting 'f-structure bank' in grammar development

Having this large German f-structure bank available will make it possible to evaluate the German ParGram LFG in a much more informative way than this can be done at the moment. No longer will we be restricted to observing what percentage of a given corpus can be parsed by the grammar, what proportion fails due to timeout or storage overflow and what percentage is rejected, but we will have the means to determine whether the desired analysis is among the analyses proposed by the grammar and whether it is among the preferred solutions.[6]

In a preliminary experiment we evaluated the analyses proposed by the German ParGram LFG against the gold standard established for sentences 8001 through 8200, in order to get an idea of the quality of our analyses. Out of the 200 sentences, 151 received at least one parse. (For the moment, we do not use partial parsing techniques, although this is planned for the near future.) 4 of them could not be used for the matching of predicate-argument relations, since they consist of one single word. The evaluation of the remaining 147 sentences yielded a precision of 0.814, a recall of 0.809 and thus an f-score of 0.812 (upper-bound). By mapping against an f-structure bank derived from the whole TIGER Corpus, we will have an even more complete and detailed picture of how good (or bad) the analyses are which the German ParGram LFG proposes, and it will no longer be a problem to control the repercussions of grammar modifications intended to increase coverage or efficiency on parse quality.

Last but not least, the resulting f-structure bank will be indispensable for the supervised training of the disambiguation modules we plan to use along with the German ParGram LFG. These will be, on the

[5] Aoife Cahill (Dublin City University) and myself decided once that sentences 8001 through 10000 would serve as unseen test section for work done on the basis of the TIGER corpus. This corpus section was selected aleatorily.

[6] XLE provides a non-statistical OT-inspired disambiguation method, which prefers or disprefers certain solutions with respect to other ones. See Frank et al. (1998).

one hand, the optimality-theoretically inspired disambiguation module already implemented in XLE, for which we plan to learn the OT ranking in a stochastic OT fashion, and on the other hand discriminative estimation techniques as used by Riezler et al. (2002). It is important to consider the two techniques, because the OT-inspired module allows to cut down the number of preferred analyses in a very efficient way, whereas the log-linear models allow more fine-grained disambiguation.

In conclusion, treebanking along with treebank conversion opens up a whole series of new possibilities for the development of fine-grained syntactic analyzers. Most importantly, it will permit the use of probabilistic disambiguation based on supervised training and facilitate detailed grammar evaluation. And since it is relatively straight-forward to convert f-structures into more theory-neutral dependency triples like the ones of the PARC 700 Dependency Bank, it might even open the way for the comparison of different parsers for German.

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Projecting LFG F-Structures from Chunks

– or (Non-)Configurationality from a Different View-Point –

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Abstract

In this paper we pursue two related goals: First, we establish a conceptual link between chunk-based syntactic structures as typically assumed in shallow parsing approaches, as opposed to principle-based syntactic structures as assumed in theoretical linguistics research. This conceptual link emerges from the study of configurational vs. non-configurational languages, their analysis within the LFG framework, and the observation of diverse strategies for ambiguity resolution across this spectrum of (non-)configurational language types. Second, we show how shallow analyses as usually employed in practical NLP applications can be refined to deliver full-fledged syntactic representations, by designing an architecture for LFG f-structure projection from chunk-based syntactic analyses.

In line with our two-fold goal we will demonstrate that principles for f-structure projection from chunks are similar – modulo specific attachment constraints – to the LFG analysis of non-configurational languages. In essence, then, besides the design of a new style of robust LFG processing from chunk-based analyses, our investigation offers theoretical insight into the kind of abstraction (i.e. underspecification) employed in shallow analysis, and how it can be formalised within the LFG framework. In particular, we will show how to adapt the LFG analysis of non-configurational case-stacking languages in terms of inside-out functionality to the projection of full-fledged f-structures from chunk-based analyses of configurational languages.

1 Introduction

LFG theory has reached a high degree of sophistication and coverage, both at the level of theoretical linguistic research into diverse languages and language types, and in the area of computational processing, by providing efficient algorithms and system implementations, as well as wide-coverage computational LFG grammars (cf. [Bresnan, 2001, Dalrymple, 2001, Butt et al., 2002, Riezler et al., 2002, Cahill et al., 2003]). Still, none of the computationally tractable grammatical frameworks – be it LFG, HPSG, TAGs, or CG – is usually employed in practical NLP applications. The main reason being that despite tremendous achievements, we haven't, as of today, reached full coverage of natural language, as found in actual usage. Likewise, while computational processing has made enormous progress in speed, robustness, and analysis selection, efficiency and robustness are often (feared to be) not sufficient to lend themselves to practical NLP applications.

Starting with [Abney, 1996], we observe the emergence of a paradigm of shallow syntactic processing that restricts itself to the detection of base constituents (NP, PP, etc.), so-called 'chunks'. This type of shallow syntactic processing achieves robustness and speed by abstraction from fine-grained and ambiguity-prone syntactic distinctions, such as the specification of local attachment relations between chunks, or long-distance relationships. We are thus confronted with a tension between linguistically motivated 'deep' syntactic analysis on the one hand, and 'shallow' syntactic analysis, which is developing largely independently from theoretical linguistic research.

In this paper we pursue two related goals: First, we establish a conceptual link between chunk-based structures as assumed in shallow parsing, as opposed to the principle-based syntactic structures assumed in theoretical linguistic research. This link emerges from the study of configurational vs. non-configurational languages, the analysis of these languages in the LFG framework, and the observation of diverse strategies for ambiguity resolution within this spectrum of (non-)configurational language types. Second, we show how shallow analysis as usually employed in practical NLP applications can be refined to deliver full-fledged syntactic representations, by designing an architecture for LFG f-structure projection from chunk-based analyses.

In line with our two-fold goal, we will demonstrate that principles for f-structure projection from chunks are similar – modulo specific attachment constraints – to the LFG analysis of non-configurational languages. In essence, then, besides the design of a new style of robust LFG processing from shallow analyses, our investigation offers theoretical insight into the kind of abstraction (i.e. underspecification) employed in shallow analysis, and how it can be formalised within the LFG framework.

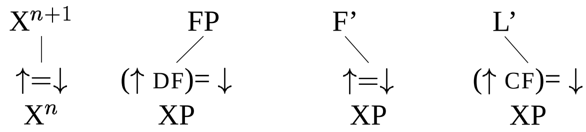
The remainder of this paper is structured as follows. In Section 2 we review the analysis of configurational and non-configurational languages in the LFG framework, considering in particular the interactions of (non-)configurationality, morphological marking and ambiguity resolution. In Section 3 we briefly characterise the complementary natures of shallow vs. 'deep' syntactic analysis in computational linguistics. Building on an existing cascaded shallow parsing architecture that combines a stochastic topological parser for German with chunk parsing, we develop a novel account to combine the complementary shallow and deep paradigms, by designing an architecture to project full-fledged LFG f-structures from chunk-based shallow analyses. In Section 4 we show how to resolve the underspecified attachment of chunks in a fully specified (disjunctive) f-structure, by use of inside-out functional uncertainty equations. In contrast to typical non-configurational languages, though, these are subject to specific adjacency constraints. Section 5 presents some conclusions.

2 (Non-)Configurationality and Ambiguity

Lexical-Functional Grammar accounts for the analysis of a wide spectrum of language types, ranging from configurational to non-configurational languages. Within its multi-level projection architecture, the c-structure allows for the flexible encoding of a wide variety of surface syntactic properties across languages, while the f-structure representation encodes functional syntactic properties that are largely shared across typologically distinct languages. General principles of c-structure encoding (X-bar theory) and principles of structure-function mappings (cf. Fig. 1) encode a principle-based mapping between c-structure and f-structure representations.

2.1 Morphology competes with Syntax

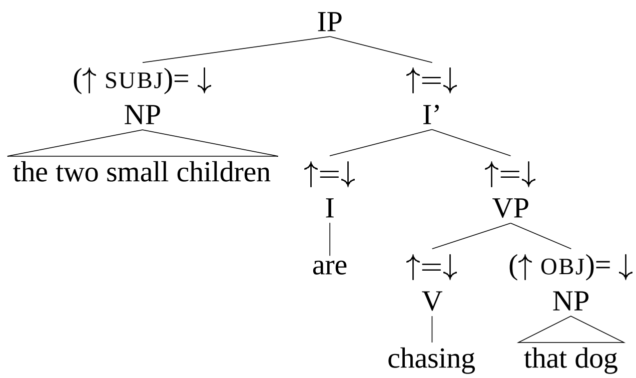
Configurational languages typically exhibit rather rigid word order constraints, and do in general not permit discontinuous realisation of constituents. Moreover, configurational languages usually don't possess overly rich systems of morphological marking. Endocentric c-structure and structure-function mapping principles jointly account for these characteristic properties of configurational languages, through a predominantly structural encoding of grammatical functions via language



$$\text{DF} = (\ \text{TOP} \mid \text{FOC} \mid \text{SUBJ}\ )$$
$$\text{CF} = (\ \text{SUBJ} \mid \text{OBJ} \mid \text{OBJ}_\Theta \mid \text{OBL}_\Theta \mid \text{COMP}\ )$$

Figure 1: Structure-function-mappings [Bresnan, 2001]

specific structure-function associations and ordering principles. Thus, in these languages the c-structure–f-structure mapping is largely determined by positional criteria, such as the association of the SUBJ function with the specifier position of IP in languages like English (cf. Fig. 2).



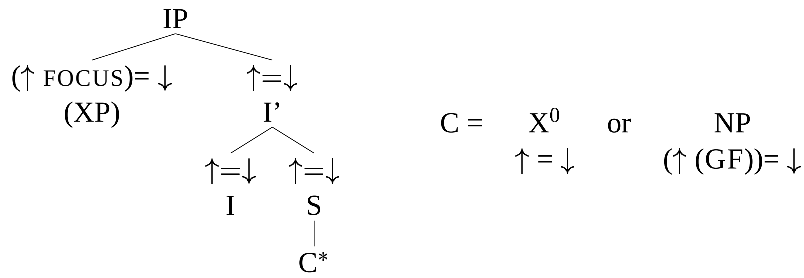
$$\text{IP} \rightarrow \underset{(\uparrow \text{SUBJ}) = \downarrow}{\text{XP}} \quad \text{I'}$$

Figure 2: Structural identification of GFs in configurational languages

Besides X-bar theoretic, endocentric c-structure principles LFG admits exocentric c-structure realisations, to account for the much more flexible word order properties of so-called 'non-configurational' languages – languages that exhibit free word order, discontinuous constituents, or null anaphora. As established by the work of, i.a., [Simpson, 1991] and [Nordlinger, 1998], extensive morphological marking is the most striking characteristics of these 'non-configurational' languages. Here, the identification of grammatical functions is predominantly determined morphologically, by principles that associate morphological marking, such as case or verbal affixes with functional information (cf. Fig. 3).

The complementary, but graded distribution of predominantly morphologically vs. predominantly structurally determined identification of grammatical functions across a wide spectrum of language types is described as "morphology competing with syntax": languages exhibit different mixtures of morphological and/or structural marking of functional information, yielding a continuous scale along the dimension of (non-)configurationality (cf. [Nordlinger, 1998]).

[Nordlinger, 1998] provides a typologically motivated LFG analysis of non-configurational languages that accounts for head-marking and dependent-marking languages in a uniform way. Morphological marking is viewed as *constructive*, being able to define a syntactic context. The constructional nature of case is formalised by way of inside-out designators that define an embedding functional context. This analysis accounts for the morphology-driven identification of grammatical



Dependent-marking: (↓ CASE)= K ⇒ (↑ GF)= ↓
Head-marking: (↓ AGR)= (↑ GF AGR) ⇒ (↑ GF)= ↓ [Nordlinger, 1998]

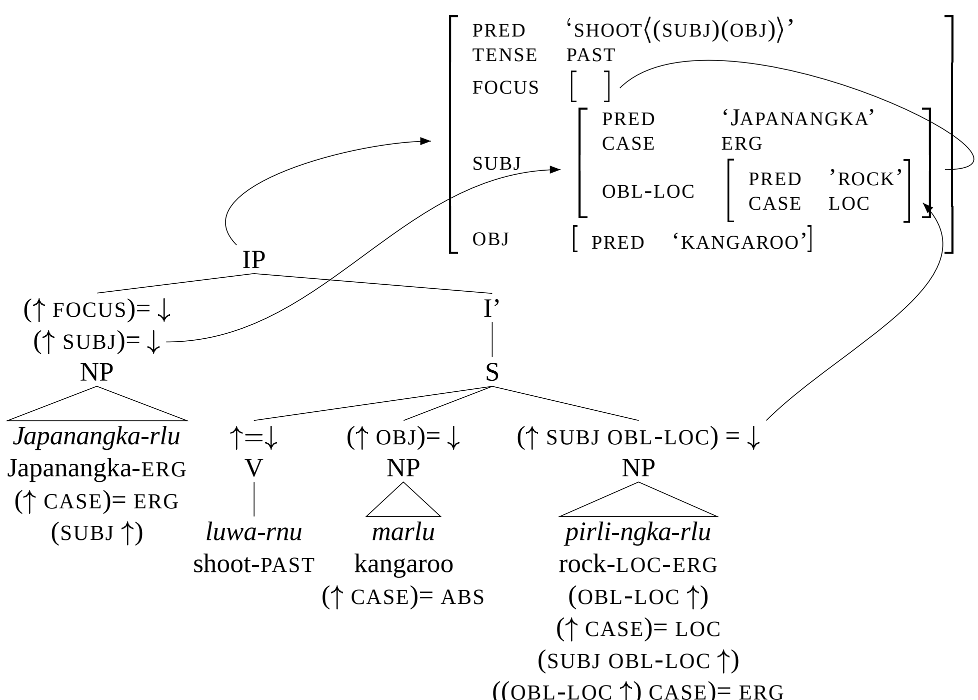
Figure 3: Exocentric phrase structure and morphological identification of GFs

functions, and the flexible word order properties typically found in these languages.

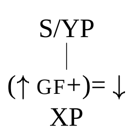
Especially striking are case stacking phenomena in dependent-marking languages, where a constituent encodes its embedding syntactic context by way of multiple case marking. This is illustrated in (1.a), an example from Warlpiri. The case marking on *pirli-ngka-rlu* (rock-LOC-ERG) marks it as a LOCative phrase that is functionally embedded within the (ERGative-marked) subject, which in (1.a) is discontinuously realised.

(1) a. *Japanangka-rlu luwa-rnu marlu pirli-ngka-rlu*
japanangka-ERG shoot-PAST kangaroo rock-LOC-ERG
'Japanangka shot the kangaroo on the rock' ([Simpson, 1991])

b.



c.



with GF a variable over grammatical functions

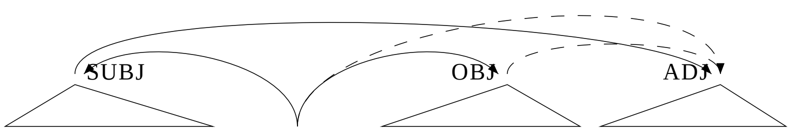
According to Nordlinger's theory of constructive case, in (1.b) the stacked cases on *pirli-ngka-rlu* introduce the inside-out equations (OBL-LOC ↑) and (SUBJ OBL-LOC ↑).[1] Jointly with the ERGative case marking on 'Japanangka', which projects the SUBJ function, this enforces the locative phrase to be analysed as a modifier of the discontinuous subject, to be read as: 'Japanangka on the rock'.

The formal LFG analysis of constructive case necessitates a considerable relaxation of functional descriptions on c-structure categories. The functional descriptions of the NP phrases displayed in (1.b) are mere instantiations of very general (underspecified or disjunctive) functional descriptions as given in (1.c). In languages where grammatical functions are primarily determined by constructive case marking, both the choice of grammatical function, and – with stacking – the depth of functional embedding is determined by the morphological marking on lexical items. The instantiation of underspecified functional path descriptions as in (1.c) is obtained through resolution of the morphologically triggered inside-out functional descriptions (cf. (1.b)).

2.2 Strategies for Ambiguity Resolution

The complementary mechanisms for functional marking in configurational vs. non-configurational languages go along with different strategies for ambiguity resolution. Case marking in general and case stacking on discontinuous phrases in particular provides an excellent means for ambiguity resolution in non-configurational languages – while not necessarily leading to fully disambiguated analyses.[2] Configurational languages, by contrast, can to a certain extent, employ structural means for the resolution of ambiguities. In (2) and (3) we illustrate these distinct strategies for ambiguity resolution by morphological vs. structural encoding.

(2) displays the possible attachments for the case-marked constituents in our Warlpiri example (1).[3] The adjunct's attachment is fully determined by stacked case marking: the ERGative case enforces functional attachment of the LOCative phrase to the SUBJect, disallowing alternative readings with attachment to the OBJect or the verb.

(2)


Japanangka-ERG	shoot-PST	kangaroo(-ABS)	rock-LOC-ERG
Japanangka-rlu	*luwa-rnu*	*marlu*	*pirli-ngka-rlu*

[1] This is defined by way of the *Principle of Morphological Composition* (cf. [Nordlinger, 1998]).

[2] In (i) the stacked cases on *coolamon*, coolamon-LOC-DAT, unambiguously identify the locative phrase as functionally embedded within the dative-marked object – 'the baby in the coolamon'. In (ii), *coolamon* bears default ABSolutive case. In the absolutive reading, the coolamon is to be analysed as embedded within the OBJect – 'the food in the coolamon'. Since absolutive is a default case, it can be interpreted as optional, which leads to the (implausible) analysis of *coolamon* as a verbal adjunct – 'the giving is in the coolamon'.

(i.**)** Karnta-ngku ka-rla kurdu-ku miyi yi-nyi parraja-rla-ku.
woman-ERG PRES-3DAT baby-DAT food(ABS) give-NPST coolamon-LOC-DAT
'The woman is giving food to the baby (who is) in the coolamon.

(ii.**)** Karnta-ngku ka-rla kurdu-ku miyi yi-nyi parraja-rla.
woman-ERG PRES-3DAT baby-DAT food(ABS) give-NPST coolamon-LOC(ABS)
'The woman is giving the baby food (which is) in the coolamon. [Nordlinger, 1998]

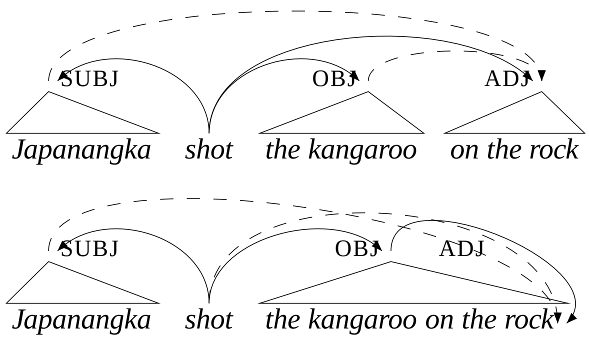
[3] Solid lines display available dependencies, while dashed lines indicate unavailable readings.

In a configurational language like English, a reading where *on the rock* is functionally embedded within a discontinuous SUBJect phrase is unavailable for the corresponding sentence (3). By contrast, configurational languages exhibit a systematic structural/functional attachment ambiguity: *on the rock* can be analysed as an independent phrase, and, accordingly, must be analysed as an adjunct of the verb as in (3.a), or as c-structurally embedded within the phrase *the kangaroo* as in (3.b), in which case it is determined, by principles of structure-function mapping, as functionally embedded within the OBJect.

This kind of structural/functional ambiguity cannot be resolved without further semantic or contextual information, or world knowledge.

(3) a.

b.



In sum, the distinct strategies for identification of grammatical functions in configurational and non-configurational languages – structural vs. morphological identification – lead to distinct configurations and strategies for ambiguity resolution. We will come back to this observation in Section 4, when considering constraints for modifier attachment in a chunk-based analysis of German.

3 From Shallow Parsing to LFG F-Structures

In this section, we briefly review the complementary natures of shallow as opposed to linguistically motivated 'deep' syntactic analysis in computational linguistics. We characterise the problem of integrated shallow and deep syntactic analysis, and present a novel account to integrate these complementary types of analyses, by the design of an LFG projection architecture for shallow syntactic analysis.

We build on an existing cascaded shallow parsing architecture that combines a stochastic topological field parser for German with chunk parsing [Frank et al., 2003a].[4] To the output of this parser we apply a variant of previously developed methods for f-structure projection from context-free grammars and trees in [Frank et al., 2003b], in order to project LFG f-structures from these flat, chunk-based topological trees.

In Section 4 we examine how to bridge the fundamentally distinct natures of a chunk-based c-structure analysis and a corresponding full-fledged f-structure projection with fully specified attachments. This will bring us back to the fundamentally distinct disambiguation strategies of configurational vs. non-configurational languages and their analysis in an LFG framework. In particular, we will show how to adapt Nordlinger's LFG analysis of case-stacking languages to the projection of f-structures from chunk-based analyses of configurational languages.

[4] This type of 'divide and conquer' approach was first proposed by [Peh and Ting, 1996]. Similar parsing architectures that combine topological field parsing with cascaded chunk parsing are described, e.g., in [Wauschkuhn, 1996, Neumann et al., 2000, Hinrichs et al., 2002, Crispi, 2003, Schiehlen, 2003].

3.1 The Shallow–Deep Mapping Problem

The two paradigms of shallow vs. deep syntactic analysis in computational linguistics are complementary in various respects:

Shallow (chunk-based) processing provides *partial analyses* by abstraction from fine-grained linguistic distinctions and contextual constraints. It is therefore *highly robust*, but *less precise and accurate*. Yet, due to the lower complexity of analysis – and thus weaker formalisms – it is *highly efficient*.

Deep syntactic processing delivers *fine-grained* analyses where constraints are resolved within larger, sometimes long-distance syntactic contexts. It is *highly precise*, but inherently *less robust*. Due to the higher complexity of analysis and formalisms employed, deep syntactic processing is *less efficient*.

Integration of shallow and deep processing Recently, attempts have been made to combine shallow and deep syntactic processing, in order to obtain the virtues of both paradigms: *fine-grainedness and precision of deep syntactic analysis* as well as *robustness and efficiency of shallow processing* – while diminishing their respective weaknesses.

Integration of shallow and deep analysis has proven successful for the integration of shallow lexical processing, to complement lexical gaps in a deep grammar ([Grover and Lascarides, 2001, Crysmann et al., 2002, Kaplan and King, 2003]). Integration at the phrasal level can be used to improve processing speed and robustness, by using information from shallow parsing to make the deep parsing process more efficient, or to recover fragments from a failed parse.

Integration at the phrasal level is, however, more complex and problematic ([Daum et al., 2003, Frank et al., 2003a, Kaplan and King, 2003]). First, since in shallow parsing phrasal attachment is not made explicit, shallow and deep analyses cannot be directly mapped to each other. This is illustrated in (4): the flat attachments in (4.b) do not match the explicit embedding structure of (4.a). Second, bottom-up chunk parsing is restricted to a limited syntactic context, and is easily trapped in configurations like (5).

(4) a. [$_{\text{CL}}$ There was [$_{\text{NP}}$ a rumor [$_{\text{CL}}$ it was going to be bought by [$_{\text{NP}}$ a French company [$_{\text{CL}}$ that competes in supercomputers]]]]].

b. [$_{\text{CL}}$ There was [$_{\text{NP}}$ a rumor]] [$_{\text{CL}}$ it was going to be bought by [$_{\text{NP}}$ a French company]] [$_{\text{CL}}$ that competes in supercomputers].

(5) Peter drinks [$_{\text{NP}}$ wine and Mary] eats oranges.

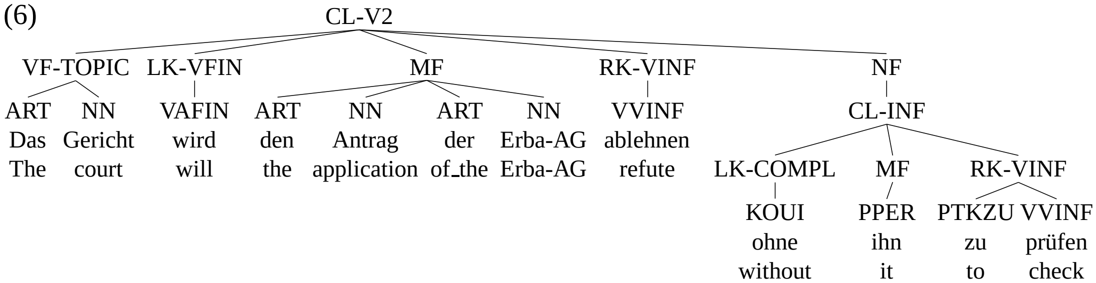
3.2 Cascaded Stochastic Topological Parsing for German

Recently, [Becker and Frank, 2002] developed a non-lexicalised probabilistic parsing approach for German that is based on the theory of topological fields.[5] The *topological field model* of (German) syntax (cf. [Höhle, 1983]) divides basic clauses (CL) into distinct fields – *pre-* (VF), *middle-* (MF), and *post-fields* (NF) – delimited by verbal or sentential markers that occupy the left (LB) and right (RB) sentence bracket positions. This model of clause structure is underspecified, or *partial* as to non-sentential constituent boundaries, but provides a linguistically well-motivated, theory-neutral model of sentence *macro-structure*.

[5] [Becker and Frank, 2002] explored a corpus-based stochastic approach to topological field parsing, by training a non-lexicalised PCFG on a topologically structured corpus that was derived from the NEGRA treebank. Measured

As seen in (6), the topological trees abstract away from non-sentential constituency – phrasal fields MF and VF (pre- and middle-field) expand to flat sequences of PoS tags. By contrast, they perfectly render the clausal skeleton and embedding structure of complex sentences. Parameterised node labels encode larger syntactic contexts, or ‘constructions’, such as clause type (CL-V2, -SUBCL, -REL), or inflectional patterns of the verb cluster (RB-VINF,-VFIN, -VPART,..).

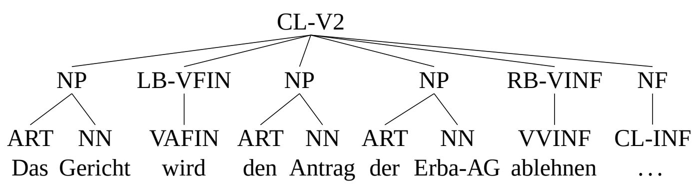
(6)



Due to its linguistic underpinning, the topological field model provides a pre-partitioning of complex sentences that is highly compatible with deep syntactic analysis, and thus maximally effective to increase parsing efficiency if interleaved with deep syntactic analysis. Partiality regarding the constituency of non-sentential material ensures robustness, coverage, and processing efficiency. These properties make topological structures perfect candidates for tight integration with deep syntactic analysis.

By cascaded chunk parsing of flat phrasal fields (VF,MF,NF) – using an off-the shelf chunk parser – we can further refine the topological tree structures to combine explicit sentential embedding with sub-sentential chunk constituents (7).

(7)



In [Frank et al., 2003a] (cascaded) stochastic topological parsing was employed for phrasal integration with a German HPSG grammar, to achieve improvement of parsing efficiency – using hand-coded mappings to bridge between distinct constituency of flat topological structures on the one hand, and the more fine-grained linguistic structures as encoded in an HPSG grammar on the other. In this integration architecture, the pre-partitioning of sentences by way of topological field parsing led to significant efficiency improvements of the HPSG parser, while purely chunk-based information was rather ineffective, or even harmful, due to the mapping problem sketched in (4).

3.3 F-structure Projection from Topological Trees

In this paper, we explore an architecture for integration of shallow and deep analysis, where the aim is to derive *maximally constrained* ’deep’ syntactic representations from shallow analyses, to

against an evaluation corpus, the parser achieves nearly 100% coverage. Accuracy measures of labelled precision and recall are around 93%. The rate of perfect matches (i.e., full tree identity as compared to the gold standard evaluation corpus) is around 80% (see [Becker and Frank, 2002] for detailed evaluation).

[Veenstra et al., 2002] follow a similar approach, but restrict evaluation to (LB/RB) field *demarcations*, whereas [Becker and Frank, 2002] measure labeled constituency, i.e. the complete embedding structure.

obtain compatibility between independent shallow and deep parsing processes at the representational level.[6] We thus need to design an architecture for LFG f-structure construction that applies f-structure projection principles to the output of cascaded topological parsing. Despite the underspecified nature of the underlying shallow analysis, the resulting f-structures should be maximally constrained, and compatible with f-structures produced by classical 'deep' LFG parsing.

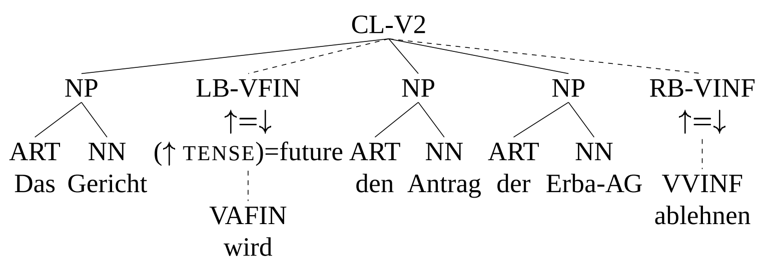
Due to the flat chunk-based constituent analysis, special attention needs to be payed to the problem of reconciling chunk analyses with explicit embedding structures as delivered by deep syntactic representations. Thus, the challenge of this approach is to project full-fledged, maximally specified (disjunctively) embedding f-structures from flat, chunk-based constituent structures.

To realise this architecture, we apply previously established methods for automatic annotation of context-free treebank (grammar)s with LFG f-structures. In particular, we can enrich context-free trees or grammars with f-structure projection principles or f-descriptions, to be resolved in a subsequent constraint resolution phase. Different variants of this method have been developed in [Frank, 2000, Sadler et al., 2000, Frank et al., 2003b, Cahill et al., 2002].[7]

Here we employ a variant where the output of the shallow parser, a *context-free tree*, is enriched with *functional descriptions*. These functional descriptions are resolved by deterministically reparsing the 'sentence grammar' that is read off the annotated topological tree.[8]

F-structure annotation operating on trees provides access to non-local syntactic contexts or 'configurations' (i.e., subtrees of depth greater than one), which is especially suited for annotation of flat, chunk-based trees from shallow analysis. This is illustrated in (8). In German, the tree configuration seen in (8) – a finite form of the auxiliary "werden" (VAFIN) in the left sentence bracket position (LB) combined with an infinitival main verb (VVINF) as last verbal element in the right sentence bracket cluster (RB-VINF) – is indicative of future tense. The bits of information that charaterise this 'configuration' are distributed over two levels of embedding. In a tree-based annotation approach we can state a general annotation principle that tests the tree for such a configuration, and associates the corresponding left (LB-VFIN) and right sentence bracket positions (RB-VINF) with f-descriptions ↑=↓ and (↑ TENSE)=future, as displayed in (8).[9]

(8)



[6]A similar approach is pursued in related work of [Copestake, 2003], for integration of shallow and deep analysis at the level of semantic representations.

[7]Note that projection of LFG f-structures from a grammar encoding topological field structures is not novel either. A hand-coded topological field grammar for German LFG has been presented in [Clement et al., 2002].

[8]This is effectively a combination of tree-based annotation in [Frank, 2000] and the reparsing architecture of [Sadler et al., 2000].

[9]In [Frank, 2000] annotation principles applying to trees are defined by way of a tree description language with basic predicates for tree branches (`arc`), precedence relations (`prec`), and lexical leaf nodes (`lex`). The arguments of `arc` and `lex` record the node identifiers, category labels and lexical form of these nodes. Annotation rules are processed by a term rewriting system, which takes as input the term description for a given tree, and checks it for satisfaction of the

Interaction of morphological and functional constraints F-structure annotation principles can be defined to encode general structure-function mapping principles as displayed in Figs. 1 and 2 (cf. [van Genabith et al., 2001]). Yet, in a language like German, a non-configurational language with moderate case marking and – accordingly – moderately free word order, structural position is not indicative of grammatical function information. Instead, morphological information can provide *partial* functional identification. Thus, we can define annotation principles that (disjunctively) associate morphologically marked NPs with grammatical functions, as illustrated in (9).[10] These annotation principles are clearly reminicent of Nordlinger's general description of morphological identification of grammatical functions in dependent-marking languages in Fig. 3.

(9)
$$\mathrm{NP}_{nom\vee acc} \Rightarrow \{ \begin{array}{l} (\uparrow \text{SUBJ})=\downarrow \\ (\downarrow \text{CASE})= \text{nom} \\ \mid\ (\uparrow \text{OBJ})=\downarrow \\ (\downarrow \text{CASE})= \text{acc}\ \} \end{array} \qquad \mathrm{NP}_{dat\vee gen} \Rightarrow \{ \begin{array}{l} (\uparrow \text{OBJ}_{\Theta})=\downarrow \\ (\downarrow \text{CASE})= \text{dat} \\ \mid\ \{ (\uparrow \text{OBL}_{\Theta})=\downarrow \\ \quad \mid (\uparrow \text{GF+ ADJ})=\downarrow \} \\ (\downarrow \text{CASE})= \text{gen}\ \} \end{array}$$

$$\mathrm{NP}_{acc} \Rightarrow \begin{array}{l} (\uparrow \text{OBJ})=\downarrow \\ (\downarrow \text{CASE})= \text{acc} \end{array}$$

Applied to the case-marked NP constituents in (10), the annotation principles in (9) yield a tree decorated with functional annotations. By reparsing the given tree structure, we obtain a highly disjunctive f-structure.[11]

This disjunctive f-structure can be further resolved by applying general well-formedness conditions for functional structures. Functional bi-uniqueness, e.g., eliminates the disjunctive context $a2$, given that the OBJect function for *Antrag* is in the TRUE context. This yields the partially resolved structure (11.a).[12]

By use of subcategorisation information from external lexica, we can further restrict the number of readings, by checking for completeness and coherence conditions. In (11.b), with *ablehnen* subcategorising for SUBJ and OBJ, contexts $b1$ and $b2$ are eliminated by violation of coherence.[13]

left-hand side conditions of an annotation rule. New predicates can be introduced on the right-hand side of a rule, here indicated by the prefix '+'.

The configuration marked in (8) by dashed lines is concisely stated in terms of tree description predicates on the left-hand side of (i). The predicate `f_desc` records the annotation of nodes with f-descriptions, here the functional descriptions for future tense.

(i.) arc(A,'CL','V2',B,'LB',_), arc(B,_,_,C,'VAFIN',_), lex(C,_,'werden'),
arc(A,'CL','V2',D,'RB','VINF'), arc(D,_,_,E,'VVINF',_)
⇒ +f_desc(B,'↑=↓ (↑ TENSE)=future'),
+f_desc(D,'↑=↓').

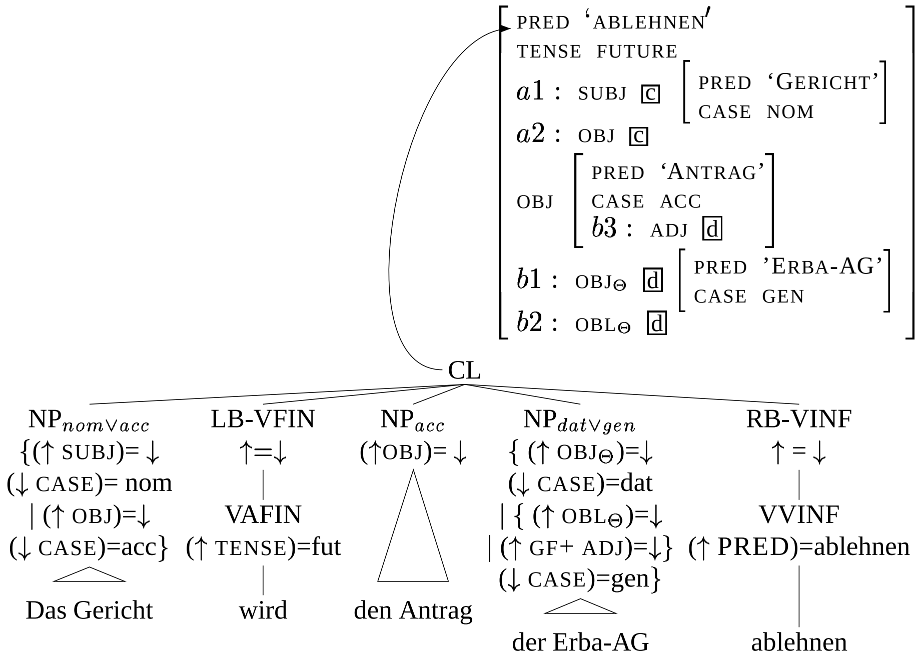
[10]The equations for genitive-marked NPs make use of an uncertainty path description GF+, defining the NP as a possessor adjunct of some accessible function GF+. For more detail see below and Section 4.

[11]We represent disjunctive f-structures as f-structure charts where context variables $a1, a2, ..b1, b2, ..$ identify disjunctive readings (cf. [Maxwell and Kaplan, 1989]). For ease of exposition, we don't represent adjuncts as set-valued features here. We discuss special problems – and solutions – for the analysis of set-valued adjuncts in Section 4.2.

[12]If the annotations do not provide lexical subcategorisation information, as in (10) and (11.a), reparsing must be relaxed to allow violation of the coherence condition.

[13]Alternative accounts that assign function-argument structure on the basis of cascaded shallow parsing, such as [Wauschkuhn, 1996, Hinrichs and Trushkina, 2002, Crispi, 2003, Schiehlen, 2003] exploit similar strategies of morphologically guided function assignment. In contrast to these approaches our analysis is based on independently motivated functional syntactic principles, and supported by algorithms for resolution of functional constraints. Functional constraints can be specified in a declarative formalism that allows to express non-local dependencies.

(10)



(11) a. Partial disambiguation by function–argument bi-uniqueness

$$\left[\begin{array}{ll}
\textsc{pred} & \text{`}\textsc{ablehnen}\text{'} \\
\textsc{tense} & \textsc{future} \\
\textsc{subj} & \left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{Gericht}\text{'} \\ \textsc{case} & \textsc{nom}\end{array}\right] \\
\textsc{obj} & \left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{Antrag}\text{'} \\ \textsc{case} & \textsc{acc} \\ b3: \textsc{adj} & \boxed{\text{d}}\end{array}\right] \\
b1: \textsc{obj}_{\Theta} & \boxed{\text{d}}\ \left[\begin{array}{ll}\textsc{pred} & \text{'}\textsc{Erba-AG}\text{'} \\ \textsc{case} & \textsc{gen}\end{array}\right] \\
b2: \textsc{obl}_{\Theta} & \boxed{\text{d}}
\end{array}\right]$$

b. Partial disambiguation by coherence and completeness conditions

$$\left[\begin{array}{ll}
\textsc{pred} & \text{`}\textsc{ablehnen}\langle(\textsc{subj})(\textsc{obj})\rangle\text{'} \\
\textsc{tense} & \textsc{future} \\
\textsc{subj} & \left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{Gericht}\text{'} \\ \textsc{case} & \textsc{nom}\end{array}\right] \\
\textsc{obj} & \left[\begin{array}{ll}\textsc{pred} & \text{`}\textsc{Antrag}\text{'} \\ \textsc{case} & \textsc{acc} \\ b3: \textsc{adj} & \boxed{\text{d}}\ \left[\begin{array}{ll}\textsc{pred} & \text{'}\textsc{Erba-AG}\text{'} \\ \textsc{case} & \textsc{gen}\end{array}\right]\end{array}\right]
\end{array}\right]$$

Uncertain attachment from flat structures While (11.b) seems fully disambiguated, there is in fact a final source of ambiguity that we disregarded up to this point: the annotation of a genitive NP as an embedded possessive modifier, by the functional uncertainty equation (↑ GF+ ADJ)= ↓:

$$\begin{array}{lll}
\text{NP}_{gen} & \Rightarrow & \{\ (\uparrow \textsc{obl}_{\Theta})=\downarrow \\
 & & \ \mid (\uparrow \textsc{gf+ adj})=\downarrow\ \} \\
 & & (\downarrow \textsc{case})=\text{gen}
\end{array}$$

This functional uncertainty equation accommodates for the embedding of a genitive marked NP chunk as a possessive adjunct of a discontinuously realised NP or PP chunk, here the NP *Antrag* that was identified as OBJ. Yet, in its current form the equation allows the modifier to be embedded within *any* of the locally accessible grammatical functions. Thus, by instantiating GF+ to SUBJ, we finally obtain the f-structure (12), with the additional disjunct $b4$. Attachment to the discontinuously realised SUBJect (*Gericht*) is, however, not a valid reading of the sentence.

(12)
$$
\left[\begin{array}{ll}
\text{PRED} & \text{`ABLEHNEN}\langle(\text{SUBJ})(\text{OBJ})\rangle\text{'} \\
\text{TENSE} & \text{FUTURE} \\
\text{SUBJ} & \left[\begin{array}{ll} \text{PRED} & \text{`GERICHT'} \\ \text{CASE} & \text{NOM} \\ b4: \ \text{ADJ} & \boxed{d} \end{array}\right] \\
\text{OBJ} & \left[\begin{array}{ll} \text{PRED} & \text{`ANTRAG'} \\ \text{CASE} & \text{ACC} \\ b3: \ \text{ADJ} & \boxed{d} \left[\begin{array}{ll} \text{PRED} & \text{'ERBA-AG'} \\ \text{CASE} & \text{GEN} \end{array}\right] \end{array}\right]
\end{array}\right]
$$

4 Projecting LFG F-Structures from Chunks

The novel aspect of our cascaded shallow-to-deep parsing architecture is the annotation of chunk-based constituent structures to project LFG f-structures that exhibit explicit (while possibly disjunctive) embedding relations between phrases that are not as such represented in the flat c-structure backbone. As seen in the previous section, this can be obtained by annotating potentially embedded phrases with uncertainty path descriptions – similar to what we find in non-configurational languages that license discontinuous constituents (cf. Section 2, example (1.c)).

However, unlike case-marking languages where embedding relations between discontinuously realised phrases are indicated by way of (stacked) case marking, chunk analyses for configurational languages are artificial constructs, lacking extensive morphological marking to identify potential attachment relations. However, as discussed in Section 2.2, example (3), configurational languages exhibit structural adjacency constraints on adjunct embedding. Functional uncertainty equations that accommodate for potential embedding of adjunct chunks must therefore be constrained to obey adjacency conditions that rule out ungrammatical readings, such as the reading $b4$ in (12), with attachment of the modifier to a discontinuously realised SUBJ in the sentence vorfeld position.

4.1 Functional Embedding from Flat C-Structures

Strict and parallel embedding – adjacency constraints NP or PP chunks that are not selected by a subcategorising head, i.e. free-floating modifier chunks, can be functionally attached to a preceding chunk in one of two ways: by strict or parallel embedding, as illustrated in (13.a) and (13.b), respectively. The structural restrictions for functional attachment to a preceding (or following) chunk constituent are illustrated in (13.c) – with dashed lines indicating illicit readings. As can be observed from the corresponding deep syntactic bracketings in the glosses, functional attachment of a modifier chunk to some other chunk constituent is restricted to configurations where – in the corresponding deep syntactic representation – the attached constituent and its functional antecedent phrase are contained within a minimal contiguous phrase. That is, in the corresponding deep syntactic representation the functionally embedded constituent must be c-structurally embedded within the phrase to which it is functionally attached.

(13) a. Das Gericht wird [den Antrag] [des Chefs] [der Erba-AG] ablehnen
The court will [the application [of the head [of the Erba-AG]]] refute

b. Das Gericht wird [den Antrag] [der AG] [auf Steuerbefreiung] ablehnen
The court will [the application [of the AG] [for tax exemption]] refute

c. [Das Gericht] wird [den Antrag] [der AG] [auf Befreiung] [von Steuern] ablehnen
[The court] will [the application [of the AG] [for exemption [from tax]]] refute

We will model this contiguity restriction of the corresponding 'deep' syntactic constituent structure by defining the functional attachment of a modifier chunk as 'anaphoric' to the functional embedding path of its directly preceding left (resp. following right) sister node.

In analogy to the $\uparrow$ and $\downarrow$ metavariables, the left/right-pointing arrow in a functional description refers to the f-structure of the left/right-adjacent sister node of the current node.[14] Similar to standard inside-out functional descriptions, where (GF$*$ $\uparrow$) identifies an uncertain embedding path of grammatical functions, starting from the f-structure of the mother of the current node, we can make use of the left/right-pointing arrow for inside-out descriptions starting from the f-structure of the left/right-adjacent sister node of the current node.

$\leftarrow$	f-structure of the left-adjacent sister node of the current node
(GF$*$ $\leftarrow$)	inside-out functional path starting from left sister of current node
(PATH $\leftarrow$)	id., with PATH = GF$*$

Version I With this formal device, we can annotate potentially embedded NP/PP chunks as stated in (14). The annotation refers to the f-structure ($\leftarrow$) and functional embedding path of the left-adjacent constituent by the inside-out designator (PATH $\leftarrow$), with PATH a variable for the chosen instantiation of the uncertain embedding path GF$*$. The adjunct is then defined as embedded relative to this embedding path, by ($\uparrow$ PATH ADJ)= $\downarrow$.

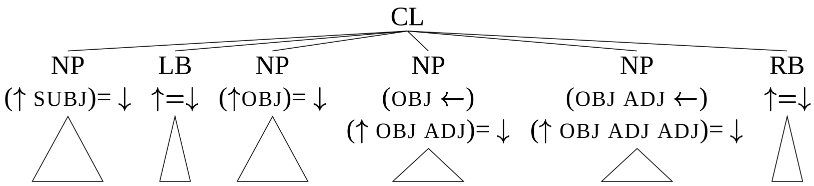
(14)
NP/PP
($\underline{\text{PATH}}$ $\leftarrow$)
($\uparrow$ $\underline{\text{PATH}}$ ADJ)= $\downarrow$

This analysis naturally precludes functional emeddings that violate the c-structural contiguity condition in a corresponding deep syntactic analysis: As each potentially embedded chunk is forced to pick up the functional embedding path of its directly adjacent sister node, functional embedding is required to proceed in a cascade, effectively preventing crossing dependencies.

However, the annotation in (14) only allows for strict embeddings of sequences of chunks, as illustrated in (15). Parallel embedding relations as in (13.b) are precluded: given the embedding of the first NP adjunct under the OBJ function (as in (15)), the second adjunct NP can only be embedded relative to the left sister's embedding path OBJ ADJ. For parallel embedding (= high attachment) of the second adjunct NP, however, the left-sister's embedding path would have to be OBJ. Thus, parallel embedding is not captured by the annotation in (14).

[14] The left/right-pointing arrow was used, e.g., in [Nordlinger, 1998] for an alternative definition of the *Principle of Morphological Composition*.

(15)



Version II We slightly modify the previous version, to accommodate for variable strict or parallel embedding of adjunct chunks. This is obtained by splitting the functional embedding path of the adjacent sister node into variable, possibly empty subpaths: a shared embedding path, and a variable path suffix that may be omitted, or skipped for the embedding of the adjunct chunk in question, to allow for parallel embedding relative to a common prefix embedding path.

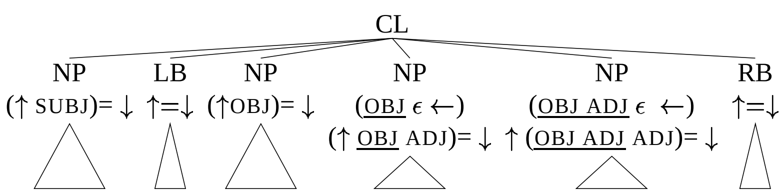
That is, in (16) we identify the functional embedding path of the adjacent sister node by the inside-out designator (PATH GF∗ ←), splitting it into variable prefix and suffix subpaths. The adjunct's embedding is then defined with reference to the prefix path, by (↑ PATH ADJ)= ↓, which is thus shared between the adjacent sister and the current adjunct chunk.

(16)
NP/PP
(PATH GF∗ ←)
(↑ PATH ADJ)= ↓

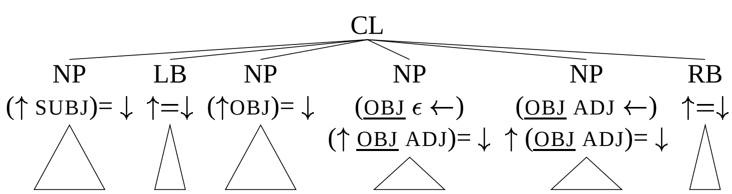
This allows for variable strict and parallel embedding for sequences of chunks, depending on the choice for the suffix GF∗: We derive strict embedding by setting GF∗ to the empty string. Parallel embedding (of variable depth) is obtained by choosing the suffix GF∗ to be nonempty.

Based on this analysis, annotation of sequences of chunks as in (17) yields alternative readings for strict (17.a) vs. parallel (17.b) embedding.

(17) a.



b.



The analysis is illustrated in a more abstract way in Figs. 4 and 5. Here we contrast the structure-function associations for traditional (hierarchical) c-structures with those for flat c-structures of non-embedded sequences of chunks.

Strict functional embedding from flat sequences of chunks as in Fig. 4 can be modelled rather straightforwardly, by transposing the hierarchical analysis of functional embedding to a sequence-based approach. Thus, a given chunk ch_n in a sequence of chunks $ch_1 ... ch_n$ can be strictly embedded relative to the function GF_{n-1} projected by its preceding constituent ch_{n-1}, by referring to the

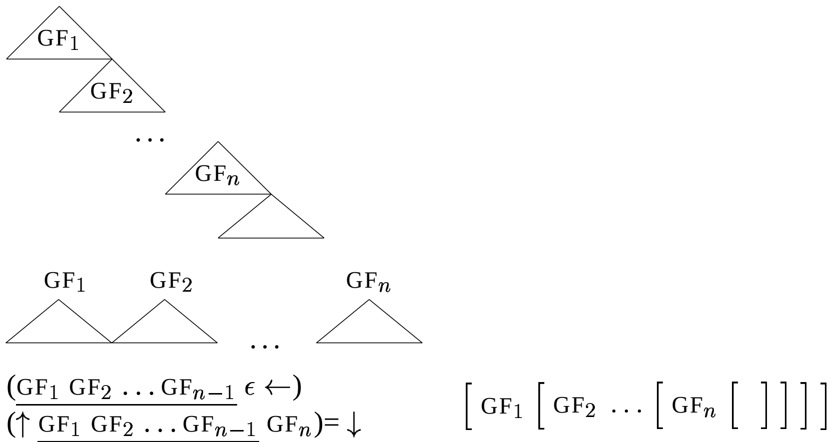


Figure 4: Strict embedding from flat structures

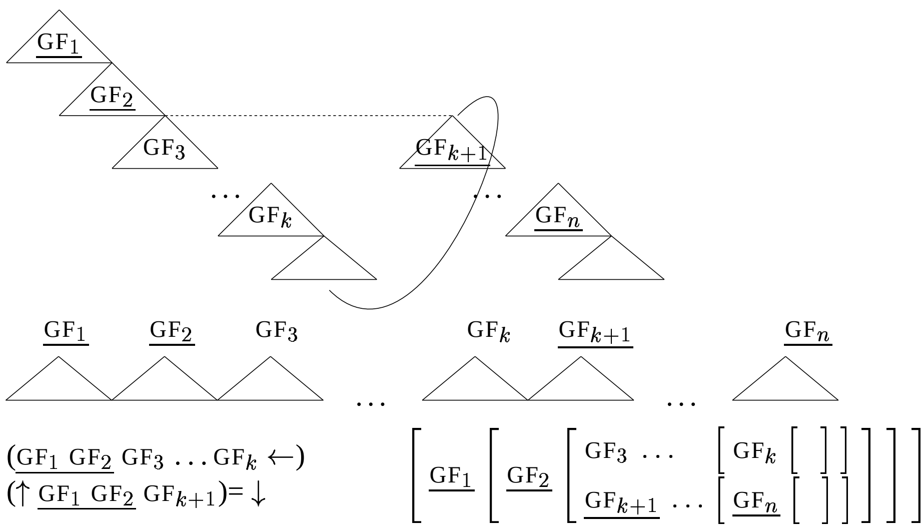


Figure 5: Parallel embedding from flat structures

functional embedding of this adjacent constituent, as in (16) with GF$*$=ϵ. We obtain a strict embedding relation that is in accordance with the corresponding deep syntactic contiguity condition.

Parallel functional embedding from flat sequences of chunks as illustrated in Fig. 5 is less straightforward. In a hierarchical c-structure, a constituent c_{k+1} that is high attached to some constituent c_2 is in general directly c-structurally embedded within this latter constituent. In a sequentialised, flat sequence of constituents, we cannot directly access the corresponding chunk ch_2, but somehow need to 'skip' the intervening (strictly embedded resp. preceding) series of chunks $ch_3...ch_k$, to be able to state direct functional embedding of GF_{k+1} relative to GF_2.

Both configurations are captured by the annotation in (16). By using the full functional embedding path of the left-adjacent constituent we obtain strict embedding of a given adjunct chunk; by 'skipping' a variable-length suffix of its adjacent constituent, we access a higher functional embedding level for parallel attachment of the given adjunct's f-structure. If PATH is instantiated to the empty string, we obtain high attachment of the modifier at the level of its local clause nucleus.

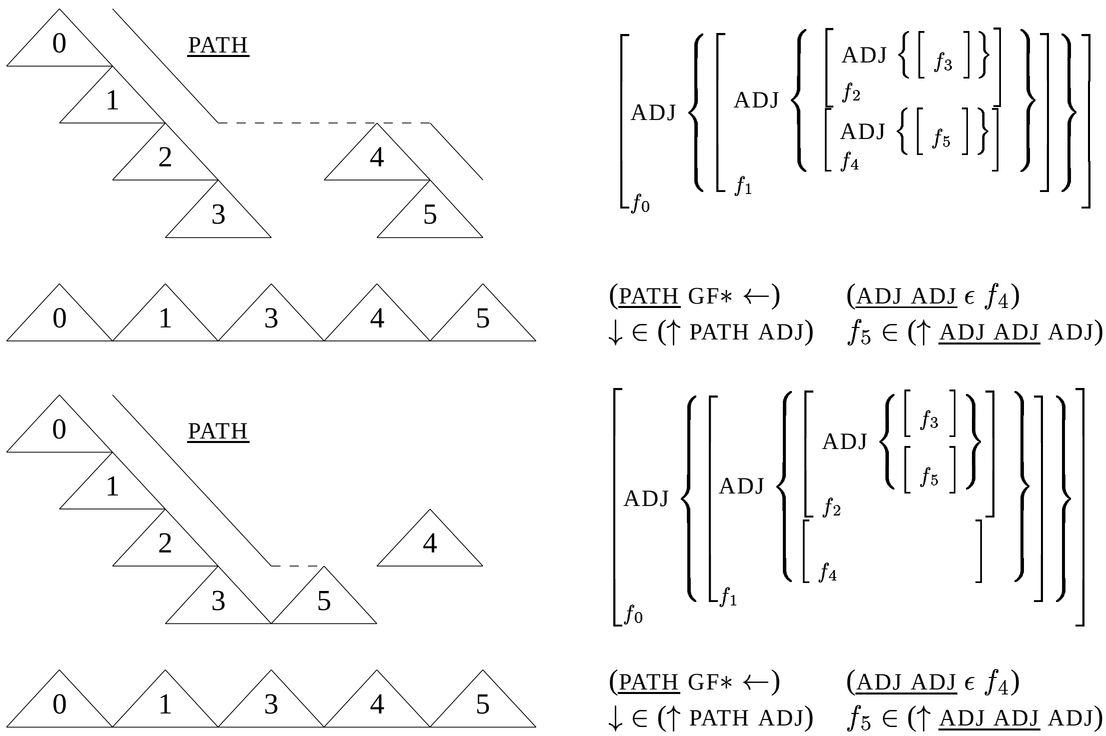


Figure 6: Adjunct sets: indeterminate reference to set elements

Contiguity In this analysis it is (i) the access to the f-structure of the left/right-adjacent sister node via the left/right-pointing arrow, and (ii) the shared (prefix) functional embedding path for strict and parallel embedding that jointly prevent functional attachment of a modifier to a constituent that – in a corresponding deep syntactic representation – would be non-contiguous.

For each modifier, functional embedding is required to be stated relative to the functional embedding path of its directly adjacent sister node. This prevents direct access to a grammatical function that is *not a prefix* of the sister's embedding path, such as the SUBJ in (17), or the OBJ in case the first modifier is attached to the verb. Thus, functional embedding relations that violate the contiguity condition are ruled out by the fact that the functional embedding of a node is strictly dependent on the functional embedding of its left- or right-adjacent node: it is possible to skip the lower parts of the sister's functional embedding, to yield high attachment, but it is impossible to select a distinct embedding path which is not contained in the path of the adjacent sister node.

4.2 The Nitty-Gritty: Adjunct Sets

Up to this point our analysis ignored the complicating details of a set-based analysis of ADJuncts. While we can easily modify the annotations in (16) to define adjuncts as set-valued functions (i.e., by ↓ ∈ (↑ PATH GF∗)), there is in fact a deeper problem lurking in the analysis of Version II, which is due to the inherent non-determinism of outside-in reference to elements of a set.

The problem is illustrated in Fig. 6, where we focus on the attachment of chunk ch_5 with the associated f-structure f_5. In the upper configuration, we define f_5 to be embedded as an ADJunct of the f-structure f_4 (of chunk ch_4), by picking up the embedding path of its left sister ch_4 (i.e., starting from f_4), and instantiating PATH to ADJ ADJ. The resulting f-structure corresponds to the attachment configuration displayed in the corresponding hierarchical structure.

Now, since f_1 and f_2 are set-valued, the description $\downarrow \in (\uparrow$ ADJ ADJ ADJ) on chunk ch_4 of the flat c-structure analysis alternatively defines the f-structure displayed in the lower part of Fig. 6. Here, f_5 is attached to f_2. We end up with an f-structure that corresponds to a hierarchical structure where the constituent is attached to the wrong antecedent – violating the contiguity condition.

Version III This unwarranted indeterminacy can be avoided if the embedding is strictly defined by inside-out functional equations. In fact, we can reformulate (16) by avoiding the outside-in equation that leads to indeterminate reference. Splitting the inside-out embedding path of the left-/right-adjacent sister into prefix PATH and suffix SKIP-PATH, it is effectively only the suffix SKIP-PATH (= GF*) that is needed to define parallel or strict embedding of chunks: setting SKIP-PATH to the empty string yields strict embedding; a nonempty SKIP-PATH defines the depth of functional embedding that is 'skipped' to define parallel attachment to a 'higher' constituent. Thus, uncertain modifier attachment from a flat sequence of chunks now reads as in (18). Applied to the example of Fig. 6 the description $f_5 \in$ ((GF* f_4) ADJ), with GF*=ϵ yields the (single) intended embedding of f_5 as an ADJunct of f_4.

(18) $\underset{\downarrow \in ((\text{SKIP-PATH} \leftarrow)\ \text{ADJ})}{\text{NP/PP}}$ with SKIP-PATH = GF$*$.

5 Conclusion

We presented an LFG architecture that bridges the gap between flat, chunk-based shallow parsing and deep syntactic analysis, by defining LFG f-structure projection from chunk-based topological trees. We argued that f-structure projection from chunk-based structures is conceptually related to the LFG analysis of non-configurational languages. While related, chunk analyses for configurational languages are artificial constructs that lack extensive morphological marking. Instead, we showed how structural adjacency constraints for functional embedding that are most typical for configurational languages can be modeled by inside-out functional descriptions – similar to morphologically guided attachment of discontinuous constituents in non-configurational languages.

In contrast to previous approaches to shallow dependency parsing that apply collections of syntactic 'heuristics', our projection architecture builds on a well-established linguistic formalism and well-defined syntactic principles. In particular, we could show that linguistic insights from typological syntactic research can be applied to model and formalise the kind of underspecification that is characteristic of shallow parsing approaches employed in computational linguistics.

An integration model that provides compatible representations for shallow and deep analysis allows for flexible combination and cross-validation of concurrent systems [Copestake, 2003]. Moreover, due to compatible representations, disambiguation models developed for 'deep' LFG grammars can be applied to resolve remaining ambiguities from chunk-based processing.

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Appendix

An example from a toy implementation in the XLE grammar development and processing system:

Das Gericht wird den Antrag des Chefs der Erba-AG ablehnen
The court will the application of the head of the Erba-AG refute

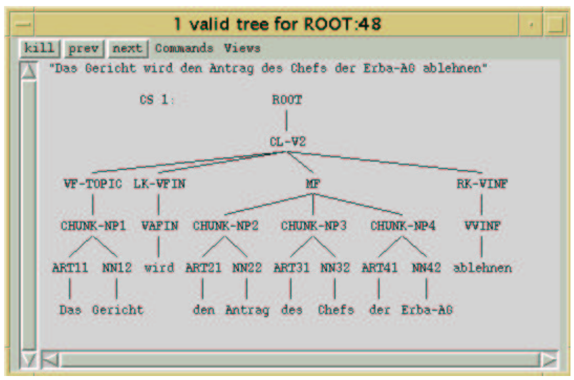

Figure 7: C-structure from cascaded topological and chunk parsing

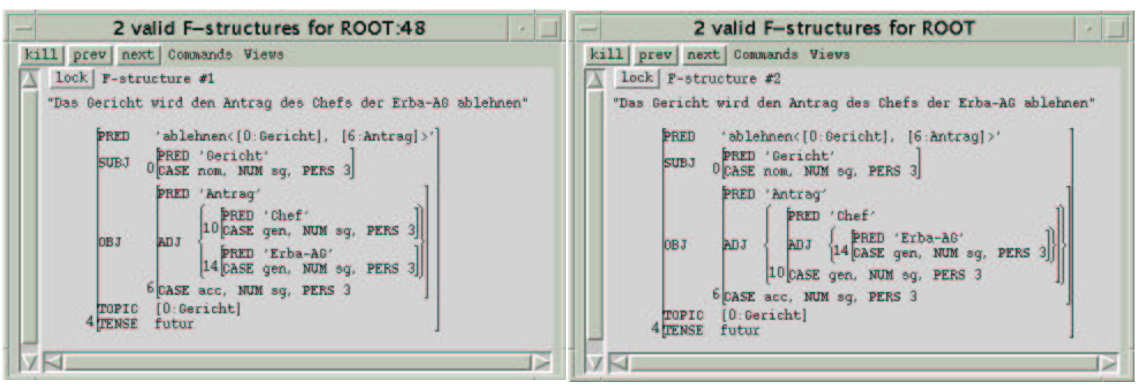

Figure 8: F-structures 1 and 2 for parallel and strict embedding

Low-Level Mark-Up and Large-scale LFG Grammar Processing

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Proceedings of the LFG03 Conference
University at Albany, State University of New York
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2003

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Abstract

It is commonly believed that shallow mark-up techniques such as part-of-speech disambiguation or low-level phrase chunking provide useful information that can improve the performance of natural language processing systems, even those that ultimately require deeper levels of analysis. In this paper, we discuss three types of shallow mark-up: part of speech tagging, named entities, and labeled bracketing. We show how they were integrated into the ParGram LFG English grammar and report on the results of parsing the PARC700 sentences with each type of mark-up. We observed that named-entity mark-up improves both speed and accuracy and labeled brackets also can be beneficial, but that part-of-speech tags are not particularly useful.

1 Introduction

It is commonly believed that shallow mark-up techniques such as part-of-speech (POS) disambiguation or low-level phrase chunking provide useful information that can improve the performance of natural language processing systems, even those that ultimately require deeper levels of analysis.[1] This should be the case to the extent that they reduce ambiguity while still preserving the correct POS or bracketing.

These shallow mark-up techniques typically operate independently of the deeper analysis machinery. They take input strings in normal orthography and modify those strings by adding diacritic marks to record information. We discuss three types of shallow mark-up: part of speech tagging, named entities, and labeled bracketing. These are illustrated in (1)–(3) and will be discussed in detail below.

(1) Part of Speech Tagging

a. I/PRP saw/VBD her/PRP duck/VB.

b. I/PRP saw/VBD her/PRP$ duck/NN.

(2) Named Entities

a. <person>General Mills</person> bought it.

b. <company>General Mills</company> bought it.

(3) Labeled Bracketing

a. [NP-SBJ I] saw [NP-OBJ the girl with the telescope].

b. [NP-SBJ I] saw [NP-OBJ the girl] with the telescope.

1.1 Hypothesis and Experiments

In this paper, we explore the hypothesis that:

> Ground-truth shallow mark-up reduces ambiguity and increases speed without decreasing accuracy.

[1]This research has been funded in part by contract # MDA904-03-C-0404 awarded to Stuart K. Card and Peter Pirolli from the Advanced Research and Development Activity, Novel Intelligence from Massive Data program.

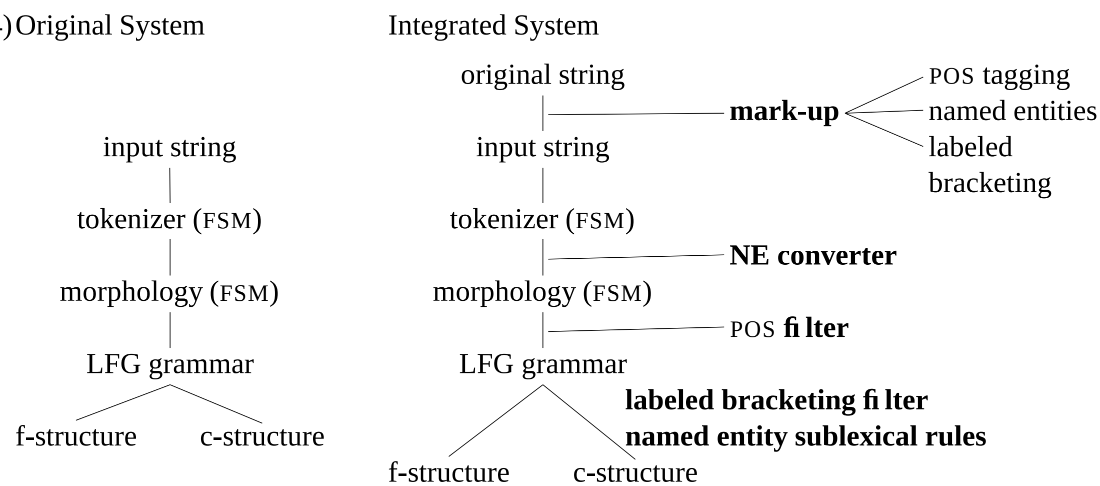
We would like to thank Stefan Riezler for help in conducting the experiments described here.

We tested this hypothesis by applying a combination of an existing broad-coverage grammar and robust parsing system to four versions of 700 sentences drawn from the hand-annotated Wall Street Journal treebank constructed at the University of Pennsylvania (Marcus et al., 1994). We compared parsing speed and accuracy for sentences with the three kinds of mark-up exemplified in (1)–(3) against a baseline of sentences without any mark-up at all. These experiments aimed at determining the best-case benefit of different kinds of mark-up in that we make use of the ground-truth annotations of the WSJ corpus, essentially simulating the fictional situation of error-free pre-processors that take no time at all to run. This provides an upper-bound on the accuracy and time benefits that could be achieved with any practical mark-up technology.

In our experiments this hypothesis is confirmed for named entity mark-up and there is also some benefit for labeled bracketing, but we observed little value for POS tagging. In the conclusion, we suggest some further refinements of the experiments to be explored in future work.

1.2 The XLE System

In this paper, we also address the problem of how to modify an existing system of morphological and syntactic analysis so that it respects the restrictions provided by independent low-level mark-up components. In our existing system (the XLE grammar development platform (Maxwell and Kaplan 1993)), tokenizing and morphological analysis are performed by finite-state transductions (Beesley and Karttunen 2003) arranged in a compositional cascade. The resulting morphological analysis is presented to an efficient parsing system for broad-coverage LFG grammars, the ParGram grammars described by Butt et al. (1999, 2002). The basic system organization is shown in (4).

(4)


2 Integrating Low-level Mark-Up

We confront the following issue: how can a system defined to operate on ordinary sentences be extended to handle input with diacritical mark-up so that the set of syntactic analyses is limited to those consistent with the specified mark-up. This devolves into two questions:

(5) a. How does the mark-up move through the sequence of components so that it reaches the level at which its constraints are imposed?

b. How are those constraints imposed?

In this section we discuss the integration of POS tagging, named entities, and labeled bracketing into the ParGram English grammar used by the XLE system.

2.1 Part of Speech Tagging

POS tags are not relevant to tokenization, but the tokenizing transducer must be modified so that the POS tags do not interfere with the other patterns that the tokenizer is concerned with (commas, quotes, etc.).[2] The proper effect of a POS tag is to reduce the number of outputs from the morphological analyzer. Consider the words *likes* and *walks* in (6a), which have the POS mark-up in (6b) (other POS tags are not shown in (6b)).

(6) a. She likes to go on walks.

b. She likes/VBZ to go on walks/NNS .

The morphological analyzer normally would produce two outputs for each of these words (plural noun and third-person singular verb) of which only one is appropriate in this context, the verbal interpretation for *likes* and the noun interpretation for *walks*.

Obtaining the desired behavior requires a specification of the morphological output sequences that are consistent with a given POS tag. In this case, we must specify that VBZ is consistent with +Verb +Pres +3sg but not compatible with +Noun, and that NNS is consistent with +Noun +Pl but not +Verb. This is done by a mapping table that states legal correspondences between POS tags and the morphological analyzer tags. Some sample mappings between the WSJ Penn Treebank tags and our morphology tags are shown in (7). Some POS tags correspond to more than one set of morphological tags, e.g. NNS in (7).

Given this mapping table, we produce a finite-state machine that filters the normal output of the morphological transducer. The filtering machine, for example, allows pairs of lemmas and morphological indicators to be followed by VBZ if and only if the indicators are compatible with the allowable sequences drawn from the table. Thus the indicator +Noun is not allowed in front of VBZ. The filtering machine also maps the POS tags to epsilon, so that they do not appear in its output. This machine is then put in a cascade with the tokenizer and morphological analyzer. The overall effect is that the tags in the input are preserved by the tokenizer, pass through the morphological analyzer, and then cause incompatible morphological-indicator sequences to be discarded. Thus only the contextually appropriate interpretations of *likes* and *walks* survive, and these are all that the syntactic grammar has to operate on.

[2] A tokenizer splits a string into words or tokens. Minimally, this involves splitting off punction marks. In our system, tokenization also involves determining which words should be lower cased (e.g., sentence initial words are optionally lowered cased). Finally, our tokenizer deals with haplology; for example, it optionally inserts commas before sentence periods. A sample input string with some possible tokenizations is shown in (i). Note that tokenizers can produce multiple outputs for a single input string; the tokenization used by the grammar to parse the sentence in (i.a) is that in (i.b).

(i) a. Input string:
They walked the dog, a poodle.

b. Splitting, decapping, haplology:
they walked the dog , a poodle , .

c. Splitting, decapping:
they walked the dog , a poodle .

d. Splitting, haplology:
They walked the dog , a poodle , .

(7) **Mapping POS Tags to Morphological Tags**

POS tag	Morphological tag(s)	Interpretation
IN	+Prep	*preposition*
	+Conj +Subord	*subordinating conjunction*
JJR	+Adj +Comp	*comparative adjective*
NNS	+Noun +Pl	*plural noun*
	+Noun +SP	*noun that can be singular or plural (sheep)*
	+Abbr	*plural abbreviation*
	+Num +Fract +Pl	*plural fraction*
	+Meas	*measure phrase*
VBG	+Verb +PresPart	*present participle*
	+Verb +Prog	*progressive verb*
	+Aux +Prog	*progressive auxiliary*
VBN	+Verb +PastPart	*past participle*
	+Verb +PastBoth	*past participle or past tense*
VBZ	+Verb +Pres +3sg	*present third singular verb*
	+Aux +Pres +3sg	*present third singular auxiliary*
WRB	+Adv +IntRel	*interrogative or relative adverb*

2.2 Named Entities

Next consider named entities, multi-word sequences that refer to particular entities, such as people or companies.[3] The named entities appear in the text as XML mark-up, as in (8).

(8) <company>General Mills</company> bought it.

The tokenizer was modifi edto include an additional tokenization of the strings whereby the material between the XML mark-up was treated as a single token with a special morphological tag on it, as in (9a). Here the underscore represents the literal space occurring in the middle of the named-entity. As a fall back mechanism, the tokenization that the string would have received without that mark-up is also produced, as in (9b).

(9) a. General_Mills +NamedEntity bought it .

b. General Mills bought it .

The morphological analyzer was then modifi edto allow the additional morphological indicator +NamedEntity to pass through. The lexicon was extended to recognize that indicator and to provide suitable f-structure features for it (e.g., person, number, proper). The grammar was changed to allow that indicator to follow nouns. In addition, an optimality mark (Frank et al. 2001) was used to prefer the named entity reading over the other reading when possible; when a parse cannot be built with the named entity reading, then the other tokenization is tried. A skeletal f-structure for (9a) is shown in (10).

[3]Common nouns, such as dates and numbers, can also be marked up as named entities, but we did not use these in our experiments. The technique for integrating these named entities into the system would be identical to that described here for proper nouns, although the lexical entries for these tags would assign slightly different features.

(10) $\begin{bmatrix} \text{PRED} & \text{'buy<SUBJ, OBJ>'} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'General\_Mills'} \end{bmatrix} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{'pro'} \end{bmatrix} \\ \text{TENSE} & \text{past} \end{bmatrix}$

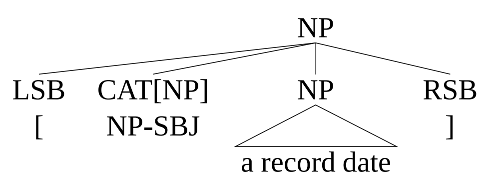
Note that the subject predicate in (10) contains the single form 'General_Mills'. This single multi-word predicate helps in parsing both because it means that no internal structure has to be built for the predicate, which improves the speed, and because predicates that would otherwise be unrecognized by the grammar can be parsed (e.g., *Cie. Financiere de Paribas*), which improves the coverage.

2.3 Labeled Bracketing

Labeled brackets are treated much like POS tags, except that they must be preserved through the morphology so that they can be interpreted as constraints on the LFG grammar. The grammar was modified so that it parses the labeled brackets as part of the c-structure. These brackets not only force the material between them to be constituents, but they also dictate which c-structure categories are possible. For example, the NP-SBJ label only allows NP constituents. This bracketing helps to eliminate attachment ambiguities. A sample labeled bracketed sentence is shown in (11), and the c-structure of the bracketed NP is shown in (12). Additional examples of labeled bracketing are shown in (13).

(11) [NP-SBJ A record date] hasn't been set.

(12)



(13) a. [NP-SBJ Lloyd's] only recently reported [NP its financial results for 1986].

b. [NP-SBJ The hall's few computers] are used mostly [VP to send [NP messages]].

c. [NP-SBJ Moody's Investors Service Inc.] said [SBAR [NP-SBJ it] lowered [NP the debt ratings of certain long-term debt held by [NP-LGS this company]]].

In addition, the lexical entries for the labels use inside-out function application to specify the grammatical function of the constituent. For example, the entry for NP-SBJ in (14) specifies that the f-structure corresponding to that constituent must be a SUBJ.

(14) NP-SBJ CAT[NP] (SUBJ $\uparrow$).

The categories chosen for this experiment and their corresponding grammatical function constraints are shown in (15). These categories were chosen because they encode core grammatical functions. Note that the lexical entries for these labels will also constrain the c-structure of the constituent, as described above.

(15) **Labels Used in Labeled Bracketing**

Label	F-structure constraint	Role in clause
NP	(OBJ ↑)	*direct object*
	(OBJ-TH ↑)	*secondary object*
NP-SBJ	(SUBJ ↑)	*subject*
S-NOM-SBJ	(SUBJ ↑)	*clausal subject*
SBAR-SBJ	(SUBJ ↑)	*clausal subject*
SBAR-NOM-SBJ	(SUBJ ↑)	*clausal subject*
NP-LGS	(OBL-AG ↑)	*demoted subject of passive*
S-NOM-LGS	(OBL-AG ↑)	*demoted clausal subject of passive*
ADJP-PRD	(XCOMP ↑)	*predicative adjective*
ADV-PRD	(XCOMP ↑)	*predicative adverb*
NP-PRD	(XCOMP ↑)	*predicative nominal*
PP-PRD	(XCOMP ↑)	*predicative prepositional phrase*
S-PRD	(XCOMP ↑)	*predicative clause*
S-NOM-PRD	(XCOMP ↑)	*predicative clause*
SBAR-PRD	(XCOMP ↑)	*predicative clause*

C-structure constraint only (no f-structure constraint):
NP-EXT, NP-TMP
SBAR, SBAR-TMP, SBAR-ADV
PP
VP

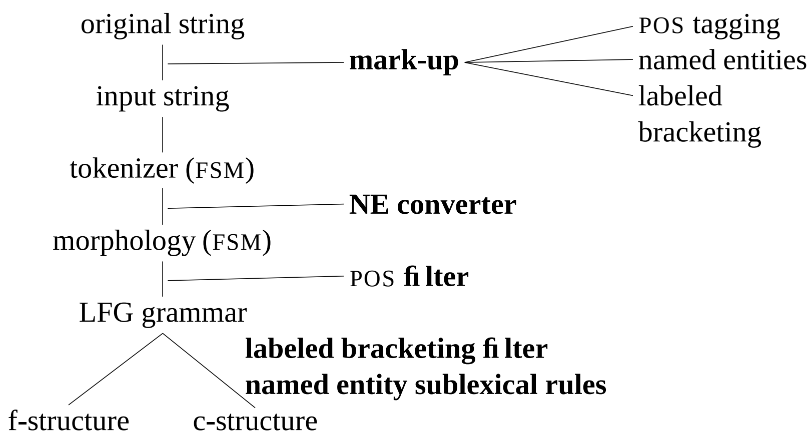
2.4 The Combined System

POS tagging, named entities, and labeled bracketing can be combined in the input, as in (16). As described above, the POS tags (VBZ, VBN) are filtered before the grammar parses the marked up input, and the named entities (<company> . . . </company>) are processed then as well, while the labeled brackets ([NP-SBJ . . .]) are filtered by the grammar.

(16) [NP-SBJ <company>American Cyanamid Co.</company>] has/VBZ n't been/VBN bought/VBN .

The integrated system is diagramed in (17), repeated here from (4). A preprocessing step has been added to insert the shallow mark-up into the input string, the FSTs have been altered to filter the POS tags and the named entities, and the grammar has been slightly modified to parse the labeled bracketing and the named entities tags. As with the original system, the output of the integrated system is the usual LFG c-structure and f-structure analyses of the input string.

(17) Integrated System



3 Accuracy of the Integrated System

We have shown how this kind of information can be integrated into a deep parsing system. That raises the question, is this information (POS, labeled brackets, named entities) reliably available, and if so, does it actually help? We first discuss the issue of reliability and then whether the gold standard mark-up helped with ambiguity, speed, and accuracy in our system.

3.1 Gold Standard Mark-Up

For the our initial experiment which is reported here, we used gold standard shallow mark-up. For the POS tagging this was obtained by extracting the POS tags from the UPenn WSJ treebank. Since this corpus was hand annotated, the POS tags are assumed to be correct. The gold standard for the named entities was created by the authors. To bootstrap our gold standard, we used an in-house version of Fact Finder, a finite-state named entity recognizer developed at PARC. Names of companies, organizations, and people were marked. The gold standard for the labeled bracketing was extracted from the UPenn WSJ treebank. As discussed above, a subset of the brackets were chosen to reflect core grammatical functions.

The reasoning behind using this gold standard mark-up was that if perfect shallow mark-up does not improve ambiguity and speed without sacrificing accuracy, then automatically produced mark-up is bound to fail. In the paragraphs below, we briefly discuss issues with using automatically produced shallow mark-up (also see section 4.2).

Many POS taggers are available, but for English they have about 96% accuracy when run on sentences drawn from the same corpus as the taggers are trained on. An error rate of 1 tag every 20 words is probably not acceptable, since on average there would be one tagging error in every 20 word sentence. Thus the utility of this requires a tagger that guarantees 100% recall of the correct tag even if it must provide several alternative outputs in cases where it might otherwise make an error. It remains to be seen whether this is sufficient to have the desired effects on processing efficiency and on reducing ambiguity.

With syntactic brackets, there is a somewhat different problem, since there is no standard online technology that provides a syntactically useful phrase-chunker. Still, this integration is helpful for doing experiments on manually labeled treebanks, such as the Penn Tree bank (Marcus et al. 1994). However, even with these, only certain bracketings are compatible with the LFG grammar. In our initial experiment, we extracted constituents which indicated core grammatical relations from the

Penn treebank (see section 2.3).

There are a number of named entity finders available, some are stochastic while others use finite-state technology. As mentioned, to bootstrap our gold standard, we used an in-house named-entity recognizer, the Fact Finder. Fact Finder is extremely fast and, unlike most other named entity recognizers, it can produce ambiguous output, as in (18). This is ideal for a preprocessing step in a system that includes deeper levels of analysis.

(18) <person><company>General Mills</company></person>

We have not made a detailed evaluation of this version of Fact Finder or of other entity finders. However, we conducted one run of our grammar on a non-gold standard version of the Fact Finder output. The results still showed an improvement over the unmarked strings. As such, we are optimistic that for at least some domains, such as newspaper texts which contain many complex proper nouns, using an entity finder as a preprocessor will improve accuracy and speed.

3.2 Results

To test the accuracy and speed of the gold-standard shallow mark-up, we ran four test suites on the integrated grammar. The first was the unmarked strings corresponding to the sentences in the PARC700 test set (King et al. 2003). This is a subset of the sentences in Section 23 of the UPenn WSJ treebank, the standard testing section. The second test suite was comprised of these same strings with gold-standard named entity mark-up. The third was these same strings with gold-standard POS tagging extracted from the UPenn WSJ treebank. Finally, the forth was these same strings with gold-standard labeled bracketing also extracted from the UPenn WSJ treebank.

We compared the resulting f-structures with the PARC700 dependency bank to determine how accurate the results were. We separated out the result for sentences that receive full parses from those that receive FRAGMENT parses, parses that are produced by the fall-back robustness mechanisms of XLE and the grammar.[4] In general, full parses are more accurate than FRAGMENT parses, since the grammatical relations that would have connected the FRAGMENTs together are not recovered.

(19) **Results on the PARC700 (WSJ)**

	%Full parses	Solutions	Best f-score	Time %
Unmarked	76	482/1753	82/79	65/100
Named Entities	78	263/1477	86/84	60/91
POS tag	62	248/1916	76/72	40/48
Labeled bracketing	65	158/774	85/79	19/31

Note: the scores with / are full parses/all parses

The table is to be read as follows. Consider the first row which describes the parse results for the unmarked-up strings (i.e., the input to the original system).

[4]The FRAGMENT grammar allows the input to be analyzed as a sequence of well-formed chunks. These chunks are specified by the grammar, for example Ss, NPs, PPs, and VPs. These chunks have both c- and f-structures corresponding to them. Any token that cannot be parsed as one of these chunks is parsed as a TOKEN chunk. The TOKENs are also recorded in the c- and f-structures. The grammar has a fewest chunk method for determining the correct parse. For example, if a string can be parsed as two NPs and a VP or as one NP and an S, the NP-S option is chosen. For an example FRAGMENT parse from the XLE analysis of the WSJ Penn Treebank, see Riezler et al. 2002.

- When parsing the PARC700, 76% of these strings got full parses.[5] That is, they have both a spanning c-structure and a well-formed f-structure. This is a measure of *coverage* for our hand-written, corpus-independent grammar.

- The full parses had an average of 482 solutions; many of the sentences had relatively few solutions while a few had a very large number of solutions. If full and FRAGMENT parses are considered, the average number of solutions was 1753. This is a measure of *ambiguity* for the parses.

- The average best f-score for full parses was 82, while that for all of the parses was 79. The best f-score is the average of precision and recall for grammatical relations (e.g., SUBJ, OBJ) for the parse of each sentence that best matched the gold-standard. This is our measure of parse *accuracy*.

- The *time* for parsing all of the sentences was set at 100% for the unmarked strings. The full parses accounted for 65% of this total time. The time for all-parse processing is always higher because of the additional effort required by our fall-back robustness techniques.

The other rows of the table show the results for input with named entities, with POS tagging, and with labeled bracketing. We discuss these in turn.

Named Entities (% full: 78; soln: 263/1477; f-score: 86/84; time: 60/91)
The named entity mark-up was the most successful of the three types of mark-up. Full coverage increased in that the number of full parses went from 76% to 78%. In addition, ambiguity dropped so that there were only 263 average solutions for the full parses. The accuracy also increased in that the f-score for full parses went from 82 to 86 and from 79 to 84 for all parses; these are substantial gains. Finally, there was a modest improvement in speed in that parsing the entire 700 sentences took only 91% of the time that parsing the unmarked strings did. We see these benefits because expensive and erroneous analyses of the internal structure of named entities are avoided.

POS **Tagging** (% full: 62; soln: 248/1916; f-score: 76/72; time: 40/48)
The POS tagging was not as successful. In particular, the number of full parses fell significantly from 76% to only 62% and the accuracy of these parses also decreased as witnessed by the average f-score of 76 for the full parses, compared to 82 for the unmarked strings. The only improvements came from ambiguity for the full parses and from speed. The speed for the POS tagging was about half of that for the unmarked strings. In the results presented here, we used full POS tagging. That is, every word was marked for POS. In future work, we hope to explore whether using only partial tagging, such as just verbs and nouns, would work better in that it would decrease the time and the ambiguity without hurting coverage or accuracy.

Labeled Bracketing (% full: 65; soln: 158/774; f-score: 85/79; time: 19/31)
The situation with the labeled bracketing was better than that of the POS tagging. The worst result was that coverage decreased from 76% full parses to only 65% full parses. However, the ambiguity decreased to only an average of 158 solutions for full parses, compared with 482 for unmarked strings, and the average best f-score for full parses increased to 85%. Even with the decline in coverage, the f-score for all parses remained at 79, the same value as for unmarked strings, suggesting

[5] Current coverage of the grammar is over 80%; this improvement should benefit both unmarked strings and ones with shallow mark-up.

that the increased number of FRAGMENT parses still retained, or even slightly improved, in accuracy. This was accomplished with a dramatic improvement in speed in that the labeled bracketed sentences took only a third of the time of the unmarked strings. Thus, if speed is important and an overall f-score comparable to the much slower unmarked parsing is acceptable (and if a reliable and efficient pre-processor for labeled bracketing is available), this kind of mark-up may be very useful.

4 Conclusions and Discussion

Our results show that further experiments need to be done as to the ultimate feasibility of integrating low-level mark-up into deep parsing. In particular, we saw that there was an immediate gain both in speed and accuracy from named entity mark-up, and there was a speed gain for labeled bracketing without serious degradation of accuracy. However, POS tagging, even when using gold standard mark-up, resulted in a significant loss in coverage and accuracy in that the number of full parses dropped from that of unmarked strings. An interesting additional experiment would be to determine what combination of types of shallow mark-up are best; for example, we could combine named entities with POS tagging of verbs.

4.1 Fall-back Techniques

One area for improvement is finding better fall-back techniques when the low level mark-up fails. Whenever the grammar cannot create an analysis which is compatible with the mark-up, the system uses a fall-back technique. These fall-back techniques involve a second parsing pass and hence can significantly slow the overall parsing time.

In the case of the named entities, the fall-back technique is to use the output of the tokenizer that ignores the named entity mark-up entirely; these two outputs were seen in (9). In our experience so far, this works quite well, in part because it is needed relatively rarely.

The fall-back for the labeled bracketing may also be working relatively well, as witnessed by the relatively low ambiguity rate even when all the parses are considered (158/774 vs. 482/1753 for unmarked strings). When the grammar cannot create a well-formed analysis for a labeled bracketed sentence, it uses the grammar's general robustness mechanism of building well-formed FRAGMENTs (see fn. 4 and Riezler et al. 2002). Note that each FRAGMENT may contain labeled brackets that are correctly parsed. At this point, we have not investigated the effect of the labeled bracketing on the FRAGMENT grammar in depth, and so there may be ways in which to decrease the ambiguity of the FRAGMENT parses further. In particular, unlike named entities, the labeled brackets are always parsed, even in the FRAGMENTs; that is, they are always part of the c-structure tree. The grammar cannot try an alternative where just the unmarked string is parsed. It is unclear whether being able to do this would be an advantage or not.

In contrast to the named entities and labeled bracketing, we have not found a good fall-back mechanism for the POS tags. In one attempt, we created a version of the grammar that allowed the grammar to ignore the POS tag restrictions if no parse could be found that obeyed them. Although this improved the accuracy to be roughly that of the unmarked strings (since effectively it allowed the grammar to parse the unmarked string), the time was extremely slow, slower than parsing the unmarked strings. We thus abandoned this approach. One possibility to then consider is to use partial POS tagging instead of full POS tagging in hopes that there will be a set of POS tags that improve ambiguity and time while not hurting accuracy.

4.2 On-the-fly Mark-up

If these results are favorable, the question remains whether on-the-fly mark-up, as opposed to mark-up extracted from a manually annotated treebank, can be used without erroneously eliminating correct parses. Some initial experiments with named entity mark-up indicate that automatic named entity mark-up still improves results over unmarked strings. As such, we are very optimistic about integrating named entity mark-up into the system.

In contrast, POS tagging is less likely to be successful. Its success will depend on whether there is some combination of tags, e.g., nouns and verbs, which give reasonable coverage with improved accuracy and ambiguity and on whether these tags are the types that POS taggers can assign with very good accuracy. This is particularly important because we have not yet found a good fall-back mechanism for when POS matching fails.

Finally, we are also optimistic about labeled bracketing, given the speed and accuracy we observed in these experiments. However, we know of no chunker or parser that can produce the type of input we need with enough accuracy, and the speed of that pre-processing might also be a serious component of overall cost. In other words, producing the mark-up itself is a serious issue. Thus, our current primary use for labeled bracketing is to test the accuracy of our grammar. That is, if we find a full parse for a given bracketing, we can be relatively certain that the grammar has assigned the sentence a correct f-structure.

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VALENCE ALTERNATIONS IN GERMAN: AN LMT ANALYSIS

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ABSTRACT: This paper proposes an LMT analysis for valence alternations in German of the form NP$_k$ V NP$_i$ [P NP$_j$] $\rightarrow$ NP$_k$ V NP$_j$ [P NP$_i$], where the indices denote referential identity. These alternations involve direct internal arguments (i.e., objects) and indirect prepositional complements, and characterize among others the behaviour of verbal predicates which participate in the so-called Locative Alternation phenomena in German.

1 Introduction

This paper focuses on valence alternations in German of the following general form:[1]

(1) NP_k V NP_i [P NP_j] $\rightarrow$ NP_k V NP_j [P NP_i]

These alternations involve direct internal arguments (i.e., objects) and indirect prepositional complements.

Such alternation patterns in German characterize among others the behaviour of verbal predicates which participate in the so-called Locative Alternation phenomena[2] (see Dowty (1991), Rappaport and Levin (1988), Levin and Rappaport Hovav (1991) on similar constructions in English).

The rest of the paper is structured as follows. In the next section (Section (2)) we will give a thorough overview of the behaviour of the relevant classes of verbs in German: the so-called *contact* predicates, the *removal* predicates, and the *impingement* predicates. In Section (3) we will present briefly previous analyses of valence alternations. Finally, in the last section (Section (4)) we are presenting the analysis of valence alternations in German that we are proposing here.

2 Locative Alternation in German: Overview

2.1 Contact Predicates in German

(2) Peter goß die Blumen mit Wasser.
Peter.N poured the flowers.A with water
"Peter watered the flowers".

(3) Peter goß Wasser auf die Blumen.
Peter.N pour.PAST.3S water.A onto the flowers
"Peter poured water onto the flowers".

(4) Peter füllte den Tank (mit Wasser).
Peter.N filled the tank.A (with water)
"Peter filled the tank (with water)".

(5) Peter füllte Wasser in den Tank.
Peter.N fill.PAST.3S water.A into the tank
"Peter filled the tank with water".

[1] The indices in (1) denote referential identity.
[2] As well as in the Dative Shift phenomena, which we do not examine here.

(2)-(5) are examples of German contact predicates which participate in the so-called locative alternation phenomena. Alternations in German with the locative verbs *füllen* (fill) and *gießen* (pour) are of the general form NP$_k$ V NP$_i$ [P NP$_j$] $\rightarrow$ NP$_k$ V NP$_j$ [P NP$_i$], where the indices denote referential identity. The main features of such verbs in German is that they are morphologically identical and that they involve two arguments: one denoting a *location* and one denoting the *locatum* (*die Blumen* (flowers)/*den Tank* (tank) and *Wasser* (water), respectively, in (2)-(5) above).

2.2 Removal Predicates in German

The *removal* predicates in German also take *locatum* and *location* arguments and they are distinguished in the following groups:

1. Predicates (like *leeren/entleeren* (empty)) which imply a change of state of the *location* argument when it is realized as the direct object of the verb:

   (6) Peter leerte den Tank.
   Peter.N emptied the tank.A
   "Peter emptied the tank".

   (7) Peter leerte das Wasser aus dem Tank.
   Peter emptied the water.A from the tank
   "Peter emptied the water from the tank".

2. Predicates which denote a contact with the *location*, as well as a change of location. These predicates may also specify the manner or the instrument related to the action of moving (*wischen* (wipe)). *wischen* does not admit a *von*-PP (of/from-PP) complement when its *location* argument is realized as the direct object (example (8)). In this case *wischen* does *not* entail the existence of a *locatum* argument. For instance, the act of wiping a board does not necessarily result in wiping something off it.

   (8) *Peter wischte die Tafel von Kreide.
   Peter.N wiped the board.A from chalk
   "*Peter wiped the board of chalk".

   (9) Peter wischte die Tafel.
   Peter.N wiped the board.A
   "Peter wiped the board".

(10) Peter wischte die Kreide von der Tafel.
Peter.N wiped the chalk.A from the board
"Peter wiped the chalk from the board".

3. *säubern* (trim) is different than *wischen* (wipe), though, in the sense that "trimming an object" necessarily means "trimming something off this object":

(11) Peter säuberte den Busch von trockenen Ästen.
Peter.N trimmed the bush.A of dry branches
"Peter trimmed the bush of dry branches".

2.3 Impingement Predicates in German

A typical impingement verb in German is *schlagen* (hit). According to Dowty (Dowty 1991), the verb *hit* (in English) does not imply any change of state for any of its arguments which may surface syntactically as direct object. The same semantic entailments also hold for the German verb *schlagen*. *schlagen* is an assymetric predicate in that when the *location* argument is realized as the direct object of the predicate the *locatum* argument is optional, but when the *locatum* argument is realized as the direct object all arguments are obligatory.

(12) Peter schlägt den Gong (mit dem Klöppel).
Peter.N hits the gong.A (with the clapper)
"Peter hits the gong with the clapper".

(13) Peter schlägt den Klöppel gegen den Gong.
Peter.N hits the clapper.A against the gong
"Peter hits the clapper against the gong".

(14) *Peter schlägt den Klöppel.
Peter.N hit.3S the clapper.A
"*Peter hits the clapper".

For verbs in the *schlagen* (hit) subclass of German, the *mit* (with) alternant (example (12)) entails that one of the arguments (i.e., the *locatum*) is understood as the instrument ("means") which is used by the actor in order to perform the action denoted by the verb. The "*gegen*" (against) alternant (see example (13)), on the other hand, entails that the *locatum* undergoes directed motion.

3 Previous Analyses of Locative Alternations

3.1 Rappaport and Levin (1988) and Pinker (1989)

Valence alternations like the ones we have presented in Section (2) have always posed an interesting theoretical challenge.

As Rappaport and Levin (1988) have shown, the locative alternation variants in English differ in entailments: the *with* variant has an entailment the locative alternant lacks (see examples (15) and (16), respectively).

(15) The farmer loaded the wagon with hay. (*with*-variant)
$\Rightarrow$ The hay was loaded on the wagon.
$\Rightarrow$ The wagon was loaded with hay.

(16) The farmer loaded hay on the wagon. (locative variant)
$\Rightarrow$ The hay was loaded on the wagon.
$\not\Rightarrow$ The wagon was loaded with hay.

Based on this, Rappaport and Levin (1988), as well as Pinker (1989), assume that the two alternants of the English locative verbs *load* and *spray* have different semantic contents and propose that the alternation is about alternate choices of object (see examples (17) and (18)).

(17) Peter sprayed the statue with paint. (*with*-variant)
ACT-ON (PETER, STATUE, BY (CAUSE (PETER, GO (PAINT, TO (STATUE)))))

(18) Peter sprayed the paint onto the statue. (locative variant)
CAUSE (PETER, GO (PAINT, TO (STATUE)))

One of the problems, though, among others, with such analyses of valence alternations is that there is no independent semantic motivation for the new meta-language predicate/keyword BY (see (17) below).

3.2 Jackendoff (1990)

Jackendoff (1990) finds neither of the above mentioned accounts totally convincing. That is, he does not find convincing that Rappaport and Levin (1988), as well as Pinker (1989), connect completiveness with the fact that the *wagon* (see example (15) above) is Patient when it is in object position, which means that in order to be “affected” it must end up fully loaded.

According to Jackendoff (1990), the association of Patient with direct object is not invariable, since (19) below, for instance, is not too bad.

(19) ? What Bill did to the truck was load books on it.

According to Jackendoff, (19) is not necessarily completive. Hence, the connection of affectedness to completiveness cannot be sustained, either.

Moreover, according to his analysis, the object of *with* in the completive form displays the determiner constraints characteristic of a Theme being located in a distributive location:

(20) Peter loaded books/some books/the books onto the wagon.

(21) Peter loaded the wagon with books.

(22) Peter loaded the wagon with ?*some books.

(23) Peter loaded the wagon with the books.

This, according to Jackendoff, suggests that the proper account of the completive reading is that it involves a distributive location: the books completely occupy the relevant space in the interior of the wagon. Thus, *load* in this frame denotes: "cause to come to be in$_d$", exactly like, for instance, *fill* (or the German verb *füllen* in example (4) in Section (2.1) above).

This leads to the following entry for *load* in the NP-*with*-NP frame that Jackendoff (1990) proposes.

(24)
$$\begin{bmatrix} \text{LOAD} \\ \text{V} \\ \quad \text{NP}_j \\ \left[\text{CAUSE}\left([\;]_i, \left[\text{INCH}\left[\text{BE}\left([\;], \left[{}_{I}\; \text{N}_d/\text{ON}_d\,[\;]_j\right]\right)\right]\right]\right)\right] \end{bmatrix}$$

In the entry in (24), the Theme is not coindexed to the syntax, and the reference object is coindexed to the direct object. As a result, the *with*-phrase in (15), for instance, is interpreted as a Theme, whose grammatical function is that of an adjunct. Hence, the hay ends up in the wagon (cf., also Rappaport and Levin (1988)).

As far as the relation between the *with* variant and the *locative* alternant is concerned, according to Jackendoff (1990), there are two conceptual structure differences between them. First is the distributive-nondistributive difference in many of the verbs (though not in *spray*, for example). The second is that in the *locative* alternant, these verbs appear to be verbs of motion rather than inchoatives, since they occur with a wide variety of Path prepositions: the use of the Path prepositions *into* and *onto* are, according to Jackendoff (1990), strong evidence that the verb in question is a GO-verb rather than an INCH BE-verb.

The relation between the *with* alternant and the *locative* variant, then, does not appear in Jackendoff's (1990) analysis to be a simple case of multiple frames.

Rather, Jackendoff (1990) proposes that some relation of elaboration is called for, along the lines of Rappaport and Levin (1988), who suggest that the *locative* alternant represents the core reading and the *with* variant is its elaboration. That is, *Peter loaded the wagon with hay* in such an account is roughly “Peter filled the wagon with hay by loading hay onto the wagon”. Another possibility would be to start with *load the wagon* as core, and consider the *locative* alternant as an elaboration of this core. On this model, *Peter loaded hay onto the wagon* is roughly “Peter put hay onto the wagon in order to load the wagon with hay”. Alternatively, Jackendoff (! earNPjackendoff:90) suggests to follow Pinker (1989), who proposes that locative alternation verbs may vary in which member of the alternation is the conceptual core.

3.3 Markantonatou and Sadler (1996)

Markantonatou and Sadler (1996) use underspecified verb entries in order to provide an (HPSG) analysis for verb alternations in English which affect specifically the choice of direct and indirect internal arguments.

Unlike Rappaport and Levin (1988), Pinker (1989) and Jackendoff (1990), in their analysis no lexical rules are implicated in relating the two different semantics they assume for the English locative verbs, which correspond to different syntactic argument structures. Instead, for their analysis they rely on the application of the rules of their linking component, the simultaneous satisfaction of different constraints and on type inference.

As an example of how their analysis works, let us take a closer look at their proposal for the English verb *load*, which, as the German verbs *gießen* and *füllen* in examples (2)-(5) in Section (2.1) above, has two alternative forms, each with an optional oblique which is existentially quantified when not syntactically realized:

(25) John loaded the hay on the wagon.

(26) John loaded the wagon on the hay.

The following is the semantic representation that Markantonatou and Sadler assume for the (active) English verb *load*:

(27)
$$
{}_{\textit{specc}}\left[\begin{array}{ll}
\text{REL} & \textit{load} \\
\text{ARG1} & \boxed{1}\,{}_{\textit{argtype}}\left[\text{OTHER } \left\{\textit{location}\right\}\right] \\
\text{ARG2} & {}_{\textit{argtype}}\left[\begin{array}{ll} \text{LINK} & \textit{causer\_ntc} \\ \text{OTHER} & \{\} \end{array}\right] \\
\text{ARG3} & \boxed{2}\,{}_{\textit{argtype}}\left[\text{OTHER } \left\{\textit{locatum}\right\}\right] \\
\text{SEM.CONS.} & {}_{\textit{contact}}\left[\begin{array}{ll} \text{REL} & \perp \\ \text{ARG1} & \boxed{1} \\ \text{ARG2} & \boxed{2} \end{array}\right]
\end{array}\right]
$$

They presuppose that

> “...the [English] verb *load* has **only one** argument for which properties relevant to linking are expressed. This argument is the argument which will eventually surface as the subject. Otherwise, *load* requires a location and a locatum argument, but it does not define any entailments over these arguments which would enforce any particular linking” (Markantonatou and Sadler (1996, p. 52)).

According to Markantonatou and Sadler, it is this lack of further specifications which permits the location-object locatum-object alternation, and which reflects the fact that the two alternants of the verb *load* in English are somehow symmetric with respect to the optionality of oblique arguments. As far as existential quantification is concerned, they assume that arguments which appear in the lexical entry of *load* as first level or embedded (second level) semantic arguments are existentially quantified.

load, according to them, also has a value specified for the attribute SEM.CONS, which indicates that there is an entailment of contact between the ARG1 and the ARG3 of the predicate *load* (the location and the locatum). Markantonatou and Sadler underline that “the fact that this is the most general type of contact will in turn ensure that the predicate can surface with both *with*-PP and *on, in, etc*-PP”.

As far as linking of the arguments of the verb *load* is concerned, Markantonatou and Sadler assume that by means of the semantic representation that they propose in (27) two options are possible: “[Either] ARG2 is linked to subject as it has no other choice, and since it is a top level argument which is not also the argument of an embedded predicate, it must be linked. [Or] ARG1 and ARG3 are not specified for any LINK values and therefore they can each link either to the object of the verb or to the object of a predicate that maps an embedded relation.... [Finally] similar argumentation can be developed if one assumes that instead of linking the

ARGs first, the system links SEM.CONS first" (Markantonatou and Sadler (1996, p. 52-53)).

Finally, the fragment of the hierarchy of *semcons* in Figure (1) below shows how the alternation characterizing the locative verbs like *load* in English is accounted for in the theory proposed by Markantonatou and Sadler, which we have presented briefly above.

$$\begin{bmatrix} \textit{contact} & \\ \text{REL} & \perp \\ \text{ARG1:} & \text{argtype} \\ \text{ARG2:} & \text{argtype} \end{bmatrix}$$

$$\begin{bmatrix} \textit{contact\_with} & \\ \text{REL: with} & \\ \text{ARG1:} & \begin{bmatrix} \text{LINK:} & \text{incr\_pp} \\ \text{OTHER} & \left\{\textsc{location}\right\} \end{bmatrix} \\ \text{ARG2:} & \begin{bmatrix} \text{OTHER:} & \left\{\textsc{locatum}\right\} \end{bmatrix} \end{bmatrix} \begin{bmatrix} \textit{contact\_ltn} & \\ \text{REL: on OR in OR...} & \\ \text{ARG1:} & \begin{bmatrix} \text{OTHER:} & \left\{\textsc{location}\right\} \end{bmatrix} \\ \text{ARG2:} & \begin{bmatrix} \text{LINK:} & \text{incr\_pp} \\ \text{OTHER} & \left\{\textsc{locatum}\right\} \end{bmatrix} \end{bmatrix}$$

Figure 1: The hierarchy of *semcons* that Markantonatou and Sadler propose for English locative verbs like *load*

3.4 Locative Alternations in the traditional Lexical Mapping Theory

In the Lexical Mapping Theory (LMT) literature the (English) locative alternations are not extensively discussed. In an effort to account for such alternations in LMT, adapting the thematic role analysis which Ackerman (1992) has proposed for locative inversion in Hungarian to the locative alternation data at hand is a natural step to take and gives results along the lines described in (28) and (29).

(28) The farmer loaded the wagon with hay. (*with*-variant)

load<	agent	theme(locatum)	location >
	-o	??	??
	SUBJ	$\text{OBL}_{with/theme}$	OBJ

(29) The farmer loaded the hay on the wagon. (locative alternant)

load<	agent	theme(locatum)	location >
	-o	-r	-o
	SUBJ	OBJ	$\text{OBL}_{on/goal}$

As shown in (28) and (29), though, such a thematic role analysis is indeed problematic because the attempt to account for two diffent linkings to the respective grammatical functions from the same array of thematic roles clearly fails.

A way out in this case might have been to assign randomly a [+r] intrinsic classification feature to one of the non-agent roles in the a(rgument)-structure in (28) above. This would have led, for instance, to an output like the following:

(30) The farmer loaded the wagon with hay. (*with*-variant)

load<	agent	theme(locatum)	location >
	-o	+r	-r
	SUBJ	$OBL_{with/theme}$	OBJ

(31) The farmer loaded the hay on the wagon. (locative alternant)

load<	agent	theme(locatum)	location >
	-o	-r	-o
	SUBJ	OBJ	$OBL_{on/goal}$

This "solution", though, does not really solve the problem, since the assumption that the theme of the *with*-variant in (30) above should be assigned the intrinsic classification feature [+r] is a stipulation.

4 The Analysis

4.1 Motivation and Basic Assumptions

The analysis we propose here addresses the problematic points that a traditional LMT account does not seem able to avoid. Specifically, the analysis we propose in the following aims at overcoming the difficulties that classical LMT analyses of valence alternations are inevitably confronted with, given that the assignment of grammatical functions in traditional LMT is based on a uniform hierarchy of thematic roles in the argument structure. Moreover, it also aims at showing that the implicational differences of the locative alternation variants are to be derived from alternative realizations, and not from alternative lexical meanings.

Thus, the following two points are crucial for the analysis we propose:

1. we rely on Rappaport and Levin's (1988) conclusion that the locative alternation variants differ in entailments, as well as on the fact that this difference in entailments is found across all locative alternation verbs in English, as well as German that we are interested in here. This is a fact which according to Rappaport and Levin (1988) suggests that the entailments in the case of locative alternation verbs are associated with the variants and not the verbs or the

different arguments these verbs support, as is for instance the case with the dative alternation in English.

2. we follow Baker (1997), Maling (2001), and Levin and Rappaport Hovav (2001) who suggest that with locative alternation verbs either the location or locatum argument shows "object" properties depending on which is object (see examples (32) and (33) which are due to Baker (1997) and Williams (1980); their counterparts in German we give in (34) and (35)).

(32) the loading of hay onto wagons / the loading of wagons with hay (nominalization)

(33) John loaded the hay onto the wagon green. / John loaded the wagon full with hay. (secondary predication; from Williams (1980))

(34) das Laden von Heu auf den Wagen / das Beladen des Wagens mit Heu

(35) Peter lud den Wagen mit Heu voll.

(36) das Gießen der Blumen mit Wasser / das Gießen vom Wasser auf die Blumen

(37) das Füllen des Tanks mit Wasser / das Füllen vom Wasser in den Tank

4.2 Locative Alternation in German: the Analysis in LMT

Thus, the LMT analysis we propose below for locative alternations in German adopts the above mentioned two points. Moreover, for the analysis we are presenting below we follow Zaenen (1993).

In brief, Zaenen (1993) addresses the general dissatisfaction with the use of thematic roles, and instead, she incorporates Dowty's (1991) theory of proto-roles into her analysis of Dutch unaccusatives, dispensing with thematic role hierarchies. The association of the LMT intrinsic classification features with the verbal head's participants is guided in Zaenen's theory by the following principles (see Zaenen (1993, pp. 150,152)):

1. if a participant has more agent properties than patient properties, it is marked -o;

2. if a participant has more patient properties than agent properties, it is marked -r;

3. assumption: if a participant has an equal number of properties, it is marked -r;

4. stipulation: if a participant has neither agent nor patient properties, it is marked -o;

5. typological principle: in languages in which SUBJ (and OBJ?) is encoded through case-marking and agreement (and not via word order) lexically case marked participants are always +r.

And the association of the LMT intrinsic classification features with the LFG grammatical functions is guided in Zaenen's theory by the following principles (see Zaenen (1993, p. 151)):

1. order the participants according to their intrinsic markings as follows:
   -o $<$ -r $<$ +o $<$ +r

2. order the GRs (grammatical functions) as follows:
   SUBJ $<$ OBJ $<$ OBJ$_\theta$ ($<$ OBL)

3. starting from the left, associate the leftmost participant with the leftmost GR it is compatible with.

Consequently, our proposal for both variants of the German locative verb *gießen* (see also Section (2.1), examples (2) and (3)), for instance, does not rely on thematic roles.

(38) Peter goß Wasser auf die Blumen. (locative alternant)

gießen$<$	agent	patient(locatum)	nonpatient(location) $>$
	-o ($\hat{\theta}$-arg)	-r	-o
	SUBJ	OBJ	OBL$_{(auf)}$

(39) Peter goß die Blumen mit Wasser. (*mit* (with)-variant)

gießen$<$	agent	patient(location)	nonpatient(locatum=means) $>$
	-o ($\hat{\theta}$-arg)	-r	-o
	SUBJ	OBJ	OBL$_{(mit)}$

Instead, conventional labels in the spirit of Zaenen (1993), such as *agent*, *patient* and *nonpatient*, are used in order to indicate that the verb supports three arguments, each of which is associated with some general lexico-semantic entailments: an agent ("external"/ "semantically-and-syntactically-most-prominent" argument (a $\hat{\theta}$ [-o] argument in LMT terms)), and two other arguments, one with patient entailments (*patient*), and one with neither patient nor secondary-patient entailments (*nonpatient*).

Consequently, *nonpatient* is correctly predicted in both cases to bear the intrinsic classification feature [-o], which maps it to the grammatical function OBL in the case of both variants of the German locative verb *gießen. patient*, on the other hand, which can be related either to the argument of the verb which denotes the locatum (see (38)) or to the argument of the verb which denotes the location (see (39)), since both may bear "object" properties, when they are not instantiated as indirect prepositional complements, as we have seen above, is intrinsically classified as [-r]. This classification maps it to the grammatical function OBJ in the case of both variants of the German locative verb *gießen.* This treatment is in accordance with the proposal of Baker (1997), Maling (2001), and Levin and Rappaport Hovav (2001) for this argument of locative alternat! ion verbs which we presented above briefly.

The same analysis holds for both variants of the German locative verb *füllen* (see also Section (2.1), examples (4) and (5)):

(40) Peter füllte Wasser in den Tank. (locative alternant)

füllen$<$	agent	patient(locatum)	nonpatient(location) $>$
	-o ($\hat{\theta}$-arg)	-r	-o
	SUBJ	OBJ	$\text{OBL}_{(in)}$

(41) Peter füllte den Tank (mit Wasser). (*mit* (with)-variant)

füllen$<$	agent	patient(location)	(nonpatient(locatum=means)) $>$
	-o ($\hat{\theta}$-arg)	-r	(-o)
	SUBJ	OBJ	($\text{OBL}_{(mit)}$)

For the *mit* (with) alternant of the verb *füllen* (example (41)), where the indirect internal argument (the PP *mit Wasser*) appears to be optional, we assume that semantically the *change-of-location* entailment associated with it carries existential import, even when the PP is not syntactically overt.

4.3 German Removal and Impingement Predicates in LMT

Extending the LMT analysis for the German *contact* predicates we have presented in Section (4.2) above to the *removal* predicates of the same language (see also the examples in Section (2.2) above), we get the following:

(42) Peter leerte das Wasser aus dem Tank.

leeren$<$	agent	patient(locatum)	nonpatient(location) $>$
	-o ($\hat{\theta}$-arg)	-r	-o
	SUBJ	OBJ	$\text{OBL}_{(aus)}$

(43) Peter wischte die Kreide von der Tafel.

wischen$<$	agent	patient(locatum)	nonpatient(location) $>$
	-o ($\hat{\theta}$-arg)	-r	-o
	SUBJ	OBJ	$\text{OBL}_{(von)}$

(44) Peter säuberte den Busch von trockenen Ästen.

säubern$<$	agent	patient(location)	nonpatient(locatum) $>$
	-o ($\hat{\theta}$-arg)	-r	-o
	SUBJ	OBJ	$\text{OBL}_{(von)}$

Finally, applying the LMT analysis for the German *contact* predicates we have presented in Section (4.2) above to the *impingement* predicates of the same language (see also the examples in Sections (2.3) above), we get the following:

(45) Peter schlägt den Klöppel gegen den Gong. (locative alternant)

schlagen$<$	agent	patient(locatum)	nonpatient(location) $>$
	-o ($\hat{\theta}$-arg)	-r	-o
	SUBJ	OBJ	$\text{OBL}_{(gegen)}$

(46) Peter schlägt den Gong (mit dem Klöppel). (*mit* (with)-variant)

schlagen$<$	agent	patient(location)	(nonpatient(locatum=means)) $>$
	-o ($\hat{\theta}$-arg)	-r	(-o)
	SUBJ	OBJ	($\text{OBL}_{(mit)}$)

For the *mit* (with) variant of the verb *schlagen* (example (46)), where the indirect argument (the PP *mit dem Klöppel*) appears to be optional, we assume, like in the case of the verb *füllen*, that semantically the *change-of-location* entailment associated with it carries existential import, even when the PP is not syntactically overt.

5 Conclusion and Outlook

In conclusion, the analysis we have proposed in Section (4) overcomes the problems that traditional LMT accounts have encountered with locative alternation verbs cross-linguistically (see, for instance, examples (28) and (29) in Section (3.4) above). It addresses the problem of grammatical function assignment for locative alternations of the *load/spray* type in a version of LMT that allows for a more fine-grained and more flexible intrinsic classification of arguments than the traditional model that builds on atomic thematic roles in a fixed hierarchy.

Specifically, in the analysis we have presented in Section (4) above

1. the implicational differences of the locative alternations in German are derived from alternative realizations, not from alternative lexical meanings;

2. both the location and the locatum arguments of the German locative alternating predicates are shown to bear "object" properties depending on which is object. This verifies that the insights of Rappaport and Levin (1988), Baker (1997), Maling (2001), and Levin and Rappaport Hovav (2001) are correct.

Moreover, the LMT analysis of locative alternations in German that we have presented in Section (4) above provides an excellent constrained treatment of grammatical constructions in LFG.

Finally, the analysis we have presented in Section (4) can extend easily cross-linguistically in order to cover locative alternating verbs in other languages, such as Modern Greek:

- Modern Greek *contact* verbs

(47) O georgos fortose to ahiro sto karo.
the farmer.N load.PAST.3S the hay.A onto-the wagon
"The farmer loaded the hay on the wagon".

(48) O georgos fortose to karo me ahiro.
the farmer.N load.PAST.3S the wagon.A with hay
"The farmer loaded the wagon with hay".

(49) I diadilotes psekasan tin mpogia sto agalma.
the demonstrators.N.PL spray.PAST.3PL the paint.A onto-the statue
"The demonstrators sprayed the paint onto the statue".

(50) I diadilotes psekasan to agalma me mpogia.
the demonstrators.N.PL spray.PAST.3PL the statue.A with paint
"The demonstrators sprayed the statue with paint".

- Modern Greek *removal* verbs

(51) O Petros adiase tin dexameni (apo to nero).
the Peter.N empty.PAST.3S the tank.A (of the water)
"Peter emptied the tank (of water)".

(52) O Petros adiase to nero apo tin dexameni.
the Peter.N empty.PAST.3S the water.A from the tank
"Peter emptied the water from the tank".

(53) O Petros katharise to thamno apo ta xera kladia.
the Peter.N trim.PAST.3S the bush.A of the dry branches
"Peter trimmed the bush of the dry branches".

(54) *O Petros skupise to tigani apo to ladi.
the Peter.N wipe.PAST.3S the pan.A from the oil
"*Peter wiped the pan of the oil".

(55) O Petros skupise to tigani.
the Peter.N wipe.PAST.3S the pan.A
"Peter wiped the pan".

(56) O Petros skupise to ladi apo to tigani.
the Peter.N wipe.PAST.3S the oil.A from the pan
"Peter wiped the oil from the pan".

- Modern Greek *impingement* verbs

(57) O Petros htipise ton frahti.
the Peter.N hit.PAST.3S the fence.A
"Peter hit the fence".

(58) O Petros htipise ton frahti me to xilo.
the Peter.N hit.PAST.3S the fence.A with the stick
"Peter hit the fence with the stick".

(59) O Petros htipise to xilo sto frahti.
the Peter.N hit.PAST.3S the stick.A onto-the fence
"Peter hit the stick against the fence".

(60) *O Petros htipise to xilo.
the Peter.N hit.PAST.3S the stick.A
"*Peter hit the stick".

Applied to Modern Greek, the analysis we have proposed in Section (4) will provide, for instance, the account presented in (61) and (62) below for the Modern Greek *contact* verbs:

(61) O georgos fortose to ahiro sto karo. (locative alternant)
the farmer.N load.PAST.3S the hay.A onto-the wagon
"The farmer loaded the hay on the wagon".

fortono$<$	agent	patient(locatum)	nonpatient(location) $>$
	-o ($\hat{\theta}$-arg)	-r	-o
	SUBJ	OBJ	OBL$_{(sto=Path-prep)}$

(62)

O georgos	fortose	to karo	me	ahiro.	(*me* (with)-variant)
the farmer.N	load.PAST.3S	the wagon.A	with	hay	

"The farmer loaded the wagon with hay".

fortono $<$	agent	patient(location)	nonpatient(locatum=means)	$>$
	-o ($\hat{\theta}$-arg)	-r	-o	
	SUBJ	OBJ	$\text{OBL}_{(me)}$	

As far as English is concerned, extending the analysis for German we have presented in Section (4) above to English *contact* verbs, for instance, we get the following:

(63) The farmer loaded hay on the wagon. (locative alternant)

load $<$	agent	patient(locatum)	nonpatient(location)	$>$
	-o ($\hat{\theta}$-arg)	-r	-o	
	SUBJ	OBJ	$\text{OBL}_{(on=Path-prep)}$	

(64) The farmer loaded the wagon with hay. (*with*-variant)

load $<$	agent	patient(location)	nonpatient(locatum=means)	$>$
	-o ($\hat{\theta}$-arg)	-r	-o	
	SUBJ	OBJ	$\text{OBL}_{(with)}$	

The analysis we have presented in this paper for locative alternations in German, as well as Modern Greek and English, needs to be further extended, and also compared with an analysis of Dative Alternation/Dative Shift constructions in the above mentioned languages. This is of utmost interest, since the difference in the entailments associated to the alternants participating in Dative Alternation/Dative Shift is not related to the variants as whole constructions, as is the case with the locative alternations we have presented in this paper, but to the verbal heads of the variants or to the different arguments that these verbal heads support.

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Generalized Tree Descriptions for LFG

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Abstract

This paper proposes a novel description format for c-structure. The explicit phrase structure rewrite rules are replaced by more general constraints in a tree description language: (weak) monadic second order logic (MSOL). Exploiting the fact that the MSOL-definable tree languages correspond to the parse trees of context-free string languages, it can be shown that the generative capacity of the LFG formalism is not altered. Applying the MSOL-based formulation of c-structure descriptions to Optimality-Theoretic LFG results in a significant clarification of the prerequisites for a computationally well-behaved Optimality-Theoretic LFG system.

1 Introduction

This paper has two main parts: in the first part (section 2), a logic-based specification scheme for LFG is proposed and discussed. The second part (section 3) sketches an application of this specification format to formal considerations within Optimality-Theoretic LFG. (Kuhn (in preparation) discusses this application in detail.)

1.1 Motivation

The point of departure for the generalized tree description format proposed here is the following: In the LFG formalism, the formally exact specification of c-structure is done by context-free rewrite rules (with generalized right-hand sides, including regular predicates like Kleene closure, etc.). Using context-free rule specification has the obvious advantage that computational results for this class can be transferred straightforwardly to the c-structure part of LFG parsing. (The regular expressions on the right-hand sides of rules can be reduced to standard context-free rules too.)

However, the rewrite-rule-based specification of c-structural regularities places fairly strong limitations on the generality of principles that are expressible from the point of view of syntactic theory. As a consequence, many theoretical generalizations over possible c-structures (and the c-structure/f-structure relation) have had no *explicit* correspondent in the formal specification of an LFG grammar. For example, the c-structure part of the IP and I′ rules is ultimately specified like in (1) or in a similar way; these rules *obey* (extended) X-bar categorial principles, but the principles are not formally expressed. In other words, the absence of nonsensical rule like (2) appears to be purely accidental.

(1) IP $\rightarrow$ ({ DP | NP | PP | CP | IP | S }) (I′)
I′ $\rightarrow$ (I) (VP)

(2) D′ $\rightarrow$ ({ N′ | VP }) P

In (3), a number of non-trivial sets of principles are listed that have been assumed in LFG.

(3) a. X-bar categorial generalizations
(e.g.: only maximal projections are allowed in specifier of XP)

b. Endocentricity (every lexical category has an extended head)

c. Annotation principles (e.g.: specifiers of functional projections are discourse functions)

d. OT constraints like Alignment constraints

Since the actual formal c-structure specification in the LFG formalism rests on simple rewrite rules, there has been a tacit assumption: Theoretical principles generalizing over c-structure, like the ones in (3), are somehow “compiled into” the actual c-structure rules. In the long run, this situation is not fully satisfactory for a formally rigorous constraint-based/description-based approach.

There are several conceivable ways for trying to make c-structure-level generalizations formally explicit:

1. Macro/template devices in the description language
2. A meta specification scheme using (multiple) inheritance hierarchies
3. C-structure principles as filters on trees
4. A "constructive" tree description logic

The first option – the use of macro/template devices in description language – has been applied in grammar writing efforts like the ParGram project (compare (Butt et al. 1999b, sec. 13.2), Butt et al. (1999a, 2003)). The XLE grammar development system for the LFG formalism[1] provides a number of different such devices (meta categories, rule macros, f-annotation templates, parametrized rules). (4) indicates how such devices can be used to make generalizations explicit and re-usable: `MaxProj` is a meta category, `FCatSpec` (for "functional category's specifier position") is a macro that can be used in various rules.

(4)
```
MaxProj  = { CP | IP | S | DP | NP | AP }.
FCatSpec = MaxProj: (^ {SUBJ|TOPIC|FOCUS})=!.
CP  --> ( @FCatSpec )  Cbar.
IP  --> ( @FCatSpec )  Ibar.
```

The primary motivation for these techniques comes from large-scale grammar development, where the generality of rule formulation is just one criterion which has to be traded off against robustness, coverage of rare and little studied constructions and other "grammar engineering" factors. Hence the macro devices are not necessarily the best choice for formalizing linguistic principles on theoretical grounds: While (Kuhn 1999b) shows that the concept of parametrized rules (using complex category symbols) can be exploited to implement a more general rule set for X-bar theory (compare (5) and figure 1), there are still limitations to the approach.

(5)
```
XP[_C]    -->  YP: (^DF)=!;   Xbar[_C]: ^=!.
Xbar[_C]  -->  X[_C]: ^=!;    YP: (^GF)=!;*.
```

In particular, the situations in which the principles hold still need to be stipulated; no axiomatic formulation of the principles is provided.

The second option for expressing c-structure generalizations is the use of (multiple) inheritance hierarchies. The best-known application of this technique are the "Immediate Dominance Schemata" of Head-driven Phrase Structure Grammar (HPSG, compare (Pollard and Sag 1994, sec. 1.5)). An approach that uses some related ideas for LFG was sketched in Kuhn 1999a; Clement and Kinyon (2003) propose a meta specification scheme for LFG, based on Tree-Adjoining-Grammar (TAG). Generally, a meta specification approach requires an augmentation of the representational system in order to be able to refer to rule elements (like, for instance, the syntactic head) throughout the various principles. This is to a certain extent against the spirit of LFG, which avoids extending representations if there is a way of reaching the same explanatory effect based on more powerful *descriptions* of the same simple representations. Thus, let us explore a different alternative in the context of this paper.

As a third option, one could formalize c-structure principles as filters on c-structure trees (similar as Completeness and Coherence for f-structure). This would require a tree description language (but

[1] `www.parc.com/istl/groups/nltt/xle/`

```
X[_F,_C,_B]  -->
     { e: _F = +f                         " FP --> (GP) (F’) "
          _B = 2;
       (X[+f,any,2]: (^DF)=!;)            "specifier"
       (X[_F,_C,1]:  ^=!;)                "head"

     | e: _F = -f                         " L’ --> (L) (FP) "
          _B = 1;
       (X[_F,_C,0]:  ^=!;)                "head"
       (X[+f,any,2]: (^GF)=!;)            "complement"

     | e: _B = 1;                         " X’ --> (X) (LP) "

       (X[_F,_C,0]:  ^=!;)                "head"
       (X[-f,_C,2]:  ^=!;)                "cohead"   }.
```

Figure 1: *Implementation of general X-bar scheme using parametrized rules (Kuhn 1999b)*

note that the $\mathcal{M}$ functor for referring to a c-structure node's mother already exists in standard LFG). To my knowledge, such a c-structure filtering mechanism has not been explored for standard LFG. Let us here follow the forth option (which is somewhat related to the previous one): using a "constructive" logic-based specification of trees instead of the explicit rewrite rules.[2]

2 Logic-based c-structure specification

2.1 The tree description logic

As an alternative to the procedurally grounded notion of context-free rewrite rules for c-structure description, let us explore the use of formulae in (Weak) Monadic Second Order Logic (MSOL) for describing the set of possible c-structure trees. MSOL is an extension of classical first-order logic including variables ranging over one-place (=monadic) predicates (or, equivalently, over sets[3]) and quantifiers over these variables. (6) illustrates the general shape of MSOL formulae (it is not particularly meaningful):

(6) $(\forall X)(\forall x, y)[x, y \in X \rightarrow (x \triangleleft^* y \vee y \triangleleft^* x)]$

Using the dominance relation $\triangleleft^*$ (which can be defined within MSOL, compare Rogers 1998),[4] (6) says that for all sets X of tree nodes, for any two nodes x, y from that set, either x dominates y or y dominates x (note that the $\triangleleft^*$ relation includes the reflexive case of a node dominating itself). If we used this sample formula as a general grammatical principle, it would force all trees to be somewhat degenerate since it only allows for nonbranching chains of nodes.

Let is look at an LFG example of constraints on c-structure: *Endocentricity* requires every category to have an extended head, where the concept of an extended head requires a very careful definition (for more background on Endocentricity compare (Bresnan 2001, sec. 7.2)). As (7) shows, the extended head requirement can be formulated straightforwardly in MSOL, using an *ExtHd* predicate, which requires further elaboration.

[2]In the context of his categorial grammar-based discussion of LFG, Muskens (2001) proposes a logic-based c-description formalism too. In the present paper however, I try to provide a formalization that differs only minimally from standard LFG.

[3]In *weak* monadic second order logic, the variables range over *finite* sets only.

[4]Furthermore, we can assume an immediate dominance relation $\triangleleft$, non-reflexive domination $\triangleleft^+$, and a precedence relation $\prec$.

(7) Endocentricity: every lexical category has an extended head

$(\forall x)[\textit{LexCat}(x) \rightarrow [(\exists y)[\textit{ExtHd}(y, x)]]$

In (8) we see the definition of *extended head* that (Sells 2001, 115) provides. This concept can be formalized as in (9), still leaving open how we formalize co-projection of two nodes ($\textit{CoProj}(x, y)$).

(8) Extended Head (formulation of Sells 2001, 115)
X is an extended head of Y if X is a lexically filled category, X corresponds to the same f-structure as Y, and every node that dominates X and is not dominated by Y also dominates Y.

(9) MSOL definition of the extended head relation

$$\begin{aligned}\textit{ExtHd}(x, y) \quad \equiv \quad & \textit{LexFilled}(x) \wedge \textit{CoProj}(x, y) \wedge \\ & (\forall z)[(z \triangleleft^{+} x \wedge \neg(y \triangleleft^{+} z)) \rightarrow z \triangleleft^{+} y]\end{aligned}$$

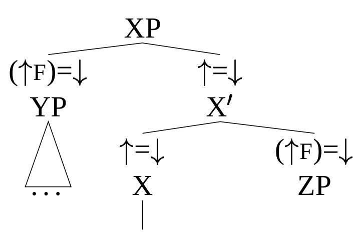
(10) $\textit{LexFilled}(x) \equiv (\exists y)[\textit{Terminal}(y) \wedge x \triangleleft^{+} y]$

There are at least two conceivable ways of defining the *CoProj* predicate:[5]

(11) (a) $\textit{CoProj}(x, y) \equiv \phi(x) = \phi(y)$

(b) $$\begin{aligned}\textit{CoProj}'(x, y) \quad \equiv \quad & (\exists P)[\textit{Connected}(P) \wedge x, y \in P \wedge \\ & (\forall z_1, z_2)[(z_1, z_2 \in P \wedge z_1 \triangleleft z_2) \rightarrow \phi(z_1) = \phi(z_2)]]\end{aligned}$$

Variant *CoProj′* (11b) includes the additional constraint that the co-projecting c-structure nodes are connected by a sequence of c-structure nodes *all* of which are mapped to the same f-structure. This excludes the case in which mapping to the same f-structure arises as an effect of independent f-structure unification, as it may arise in the following schematic configuration:

(12)


Using the simpler *CoProj* definition (11a) in the definition of *extended head* (9) would make YP an extended head of ZP, i.e., it would make this c-structural concept even less local than one ususally assumes it to be. So, presumably (11b) is the formalization that we want.

In section 2.3, we will come back to the differences between (11a) and (11b) when we address the specification of the c-structure/f-structure relation in an MSOL-based framework. We will see that the concept as defined in (11a) exceeds the generative power of standard LFG (i.e., it could not be expressed in full generality within the standard LFG formalism); we will also see how the MSOL formulation is ruled out by straightforward restrictions on simultaneous descriptions of c-structure and f-structure.

The *extended head* example shows that a precise formulation of principles on c-structure is very important. From the prose definition in (8) it is not obvious that the literal interpretation of this definition is not expressible in standard LFG.

[5]*Connected* holds of a set of tree nodes iff it is a connected subgraph of a tree (compare e.g., (Morawietz and Cornell 1999)): $\textit{Connected}(P) \equiv (\forall x, y, z)[(x \in P \wedge y \in P \wedge x \triangleleft^{+} z \wedge z \triangleleft^{+} y) \rightarrow z \in P]$

2.2 Some important properties of Monadic Second-order Logic

MSOL has been explored in detail in work on formal language theory (compare e.g. Gécseg and Steinby 1997). It has been used in formal work on syntactic formalisms, in particular for the formalization of heavily tree-based theories of syntax (e.g., Rogers 1997, 1998, 2001, Morawietz and Cornell 1999).

The following properties make it particularly attractive for linguistic formalisms:

- **Decidability.** This guarantees that the trees described by a formula can be effectively constructed.
- The class of tree sets definable with MSOL coincides with the class of parse trees for generated by **context-free grammars**.
- **Possibility of compiling tree automata.** The relation between MSOL expressions and trees (viewed as tree automata) is comparable to the relation between regular expressions and finite-state (string) automata. This means that logical tree descriptions can stay at a general abstract level, while it is ensured that a precise computational model can be compiled out.

The following subsections provide an illustration of the last point. To appreciate the usefulness of automata compilation, it is instructive to draw a parallel between the MSOL/tree automata relation and the relation between regular expressions and finite-state string automata, which is familiar from basic automata theory.

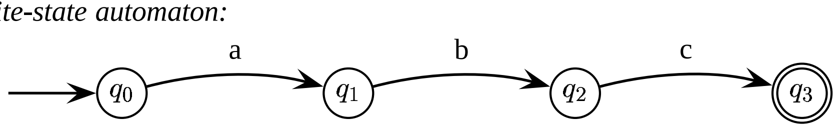
Excursion: regular expressions and finite-state (string) automata. Regular expressions and finite-state string automata are descriptively equivalent. So, generalizations about different dimensions of strings can be stated as separate regular (sub-)expressions, which can then be combined by regular expression operations such as intersection. Since the regular expression formalism is closed under these operations, we can be sure that a single finite-state automaton for computational application can be compiled from the resulting complex expressions.

This description technique makes it possible to formulate linguistic principles and their mutual relationship in a very general way, not having to worry about details of interaction in the formulation of the principles. The "compilation" into a usable computational device can be taken care of in a general mechanism.

A simple abstract example for a regular expression involving the intersection of two "principles" is given in (13).[6] (14) shows the compiled-out automaton (which in this case is extremely simple, so the reader can verify that intersection of the regular expressions has the effect of producing the same language).

(13) *Regular expression:*
$[(a^*|a\ b)\ c]\ \&\ [?^*\ b\ ?^*]$

(14) *Finite-state automaton:*



[6]The '?' in the regular expression refers to an arbitrary symbol; '&' is the intersection operation, '|' is union/disjunction. '$*$' is the Kleene star for zero to n repetitions, the brackets are used for grouping.

MSOL and finite-state tree automata. Having seen the regular expression/finite-state string automata relation, let us look at MSOL formulae and their relation to a generalization of finite-state automata: finite-state tree automata. Like in the previous situation, we find that (complex) formulae in MSOL are descriptively equivalent to tree automata. (We cannot go into a proof of this relation – the reader is referred to Gécseg and Steinby 1997, for example.)

Let us look at tree automata a little more closely. There are various sub-types of finite-state tree automata. For our purposes it suffices to consider *bottom-up tree automata*, which are defined as in (15).

(15) *Definition: Bottom-up finite-state tree automaton*

$\langle A, \Sigma, a_0, F, \alpha \rangle$:

A:	finite set of states;
Σ:	alphabet of node labels (including terminals and nonterminals);
$a_0 \in A$:	initial state;
$F \subseteq A$:	set of final states;
α:	state transition function $\alpha(b_1, \ldots, b_k, N) = b'$,
	where $k \geq 0, b_1, \ldots, b_k, b' \in A, N \in \Sigma$;
	$b_1, \ldots, b_k$ are the present states for k daughters of a node with label N;
	b' is the new state of the automaton.

In figure 2, an example bottom-up tree automaton is seen, including a sample derivation for the tree we get for *Ann knew Bill left*.

$A = \{a_0, a_1, a_2, a_3, a_4, a_5, a_6\}$;
$\Sigma = \{$S, NP, VP, V, Ann, Bill, knew, left$\}$;
$F = \{a_6\}$;
$\alpha(a_0,\text{Ann}) = a_1$,
$\alpha(a_0,\text{Bill}) = a_1$,
$\alpha(a_0,\text{knew}) = a_2$,
$\alpha(a_0,\text{left}) = a_2$,
$\alpha(a_1,\text{NP}) = a_3$,
$\alpha(a_2,\text{V}) = a_4$,
$\alpha(a_4,\text{VP}) = a_5$,
$\alpha(a_3, a_5,\text{S}) = a_6$,
$\alpha(a_4, a_6,\text{VP}) = a_5$.

Sample derivation

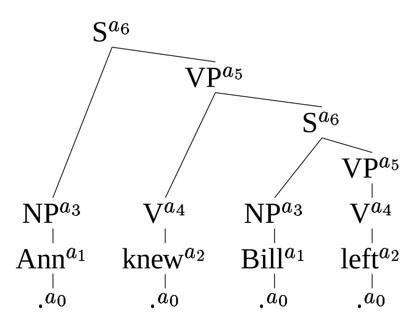


Figure 2: *Example of a bottom-up finite-state tree automaton, including a sample derivation*

A bottom-up tree automaton is very much like classical finite-state automata accepting the possible strings of terminal/nonterminal symbols *on a tree branch from leaf to root*. (So we could envisage a classical automaton traversing the left-most branch in the tree in figure 2, accepting 'Ann NP S', as it goes through states a_0, a_1, a_3, a_6. The classical finite-state automaton would have transitions $\alpha(a_0,\text{Ann}) = a_1$, $\alpha(a_1,\text{NP}) = a_3$, and $\alpha(a_3,\text{S}) = a_6$ (!).) What is special about tree automata is that we have to think of them as initially running several such branch acceptance processes in parallel. As we move from the leaves towards the root, more and more of the parallel processes get merged, using a special type of state transition $\alpha(b_1, \ldots, b_k, N) = b'$: in such a transition, k "subprocesses" (which have to be in state b_1 through b_k respectively) are merged into a single process, reading (or writing) a nonterminal symbol N. The resulting single process is then in state b'. The effect of this process merger is to accept a local subtree with mother category N and k daughters each of which has already been accepted bottom-up. So the sample tree diagram in figure 2 should be read as a trace of four parallel subprocesses, each starting in state a_0 at one of the leaves, which are then merged at various levels. The single remaining process ends in final state a_6, which is a sign that the tree we see is accepted by the tree automaton.

Due to the descriptive equivalence of MSOL and tree automata, we can assume a mechanical procedure that will produce tree automata for any MSOL formulae (i.e., in particular the complex conjunction of all grammatical principles that we want to assume). That means we do not actually have to think about which state transitions we will need in order to keep track of certain non-trivial dependencies between tree nodes (such as the extended head relation discussed above).

As pointed out above, this is very similar to the process of compiling complex finite-state automata from a linguistically perspicuous collection of regular expressions, as it is familiar from applications of finite-state technology for morphological analysis or shallow syntactic grammars.

2.3 The relation between c-structure description and f-structure description

If we want to apply MSOL for the description of LFG's c-structure we also need to adjust the expression of f-structure constraints, which are classically provided as annotations in the rewrite rules of an LFG grammar.

There are at least two possibilities:

1. We could use MSOL also to specify f-structure and c-structure/f-structure correspondence. MSOL can be used to describe graph languages and the relation between two graphs.

2. We could keep up standard LFG concept of f-annotations, using the standard ϕ-projection and making only reference to the node itself or its mother node (i.e., using only $\uparrow$ and $\downarrow$ relative to a given c-structure node).

The second option will lead to a hybrid system of MSOL formulae and subexpressions in the standard LFG feature logic.

Although the first option avoids a hybrid specification system and is thus presumably superior on aesthetic grounds, let us for now follow the second approach. The advantages of this second choice are that the specifics of the LFG f-description language can be directly inherited: the distinction between defining and constraining equations, the special interpretation of disjunction and negation, the treatment of functional uncertainty, closed sets, etc. All these characteristic would have to be reconsidered if we followed the first option, potentially leading to a notion of f-structure with quite a different character. For the second option, which is a minimal alteration of the original LFG formalism, it is fairly straightforward to show expressive equivalence with standard LFG, as I will indicate in section 2.4.

Having decided that f-descriptions will continue to be in the form of annotations to c-structure categories, we need a way of combining them with the new logic-based tree descriptions. In LFG-grammatical MSOL formulae, *f-annotation predicates* will have a special status: (16). They can either be one-place predicates, describing just the f-structure projected from a single node, or they can be two-place referring to a node and its c-structural mother.

(16) The notion of *f-annotation predicates in MSOL formulae*

a. Tree descriptions can only make indirect reference to f-structure: by including f-annotation predicates

b. In the definition of f-annotation predicates, the only reference to tree node variables may be as the argument of the ϕ projection (and possibly other projections).

Examples for f-annotation predicates and their definition in terms of classical LFG feature logic are given in (17).

(17) a. $\textit{NumSing}(x) \equiv (\phi(x)\text{NUM}) = \text{SING}$
b. $\textit{SubjEmbed}(x,y) \equiv (\phi(x)\ \text{SUBJ}) = \phi(y)$
c. $\textit{AdjunctEmbed}(x,y) \equiv \phi(y) \in (\phi(x)\ \text{ADJUNCT})$
d. $\textit{CoHead}(x,y) \equiv \phi(x) = \phi(y)$

For MSOL-based tree description, the f-annotation predicates are treated as unanalyzed assertions, similar to other descriptive category predicates like *Nominal*(x). The definitions in (17) are not resolved until a trees have been constructed according to the tree description predicates.

Using only $\phi(*)$ and $\phi(\mathcal{M}*)$ references in f-annotation predicates. An additional condition on the two-place f-annotation predicates has been left implicit so far. In standard LFG f-annotations, we normally refer to the node's f-structure and the mother node's f-structure only. For $\phi(*)$ and $\phi(\mathcal{M}*)$ there are the short-hand metavariables $\downarrow$ and $\uparrow$. If we want to keep up this restriction, we should assume the following meta constraint on f-annotation predicates:

(18) Meta constraint on two-place f-annotation predicates P:
$P(x,y) \Rightarrow x \triangleleft^{+} y$

As a consequence of this, more general f-annotation predicates spanning larger tree-structural configurations are excluded. In particular, this excludes the seemingly simpler version of the *CoProj* predicate (11a) discussed in section 2.1. Version (11b) on the other hand can easily be made compatible with this restriction (and restriction (16)), by replacing the final equation $(\phi(z_1) = \phi(z_2))$ with a call of *CoHead* as defined in (17): *CoHead*(z_1, z_2)

As it turns out, there is no way of encoding the effect of the (11a)-based formulation in full generality using the f-annotations of a classical LFG grammar. It is not possible to keep track of arbitrarily many non-local coprojection configurations. So, it is appropriate to rule out (11a) by the restrictions in this section.

Definition of the c-structure/f-structure analyses in MSOL-based LFG. We can now see how the valid c-structure/f-structure analyses for a given string has to be defined based on the new description format. There are two steps:

1. The set of c-structure candidates is obtained by constructing the set of trees that are a model for the MSOL grammar formula, conjoined with an MSOL description of the terminal string.[7] The f-annotation predicates are ignored in this step (i.e., they are assumed to be satisfiable).

2. For each c-structure candidate, the f-annotation predicate terms from all tree nodes are conjoined and resolved, instantiating the node variables to particular nodes from the tree model; then the f-constraints are resolved as in standard LFG. The Completeness and Coherence condition are applied as normal.

[7]We will shortly address one additional condition.

Note that of course, step 2. may exclude many (or all) of the original trees, to the extent that they do not support any consistent (and complete/coherent) f-structure.

The set of c-structure candidates constructed in step 1. may be infinite in the general case. This is analogous to the situation in standard LFG, where a context-free grammar could generate an infinite number of trees over a given string. By assuming the non-branching dominance condition (offline parsability; Kaplan and Bresnan 1982, 266), the number of actual c-structure candidates is reduced to finitely many, excluding configurations like the following:

(19) * XP
|
YP
|
XP
△
...

The non-branching dominance condition (offline parsability) can be expressed as an MSOL axiom schema:

(20) Non-branching dominance axiom schema

$$(\forall X) \quad [\mathit{NonBranchChain}(X) \to (\forall x, y)[x, y \in X \wedge (\textstyle\bigwedge_{P \in \mathbf{P}} P(x) \leftrightarrow P(y)) \to x = y]]$$

where

- **P** is the set of all category and f-annotation labels used in the grammar formula
- $\mathit{NonBranchChain}(X) \equiv \quad (\forall x, y)[x, y \in X \to (x \triangleleft^* y \vee y \triangleleft^* x)] \wedge (\forall x, y)[x, y \in X \wedge x \triangleleft^+ y \to (\forall z)[x \triangleleft^+ z \to (z \triangleleft^* y \vee y \triangleleft^* z)]]$

Hence, simply postulating axiom (20) for all MSOL-based LFG grammars will guarantee decidability of the parsing problem for the new description format.

2.4 Equivalence with LFG expressiveness

Based on the hybrid specification of c-structure (using MSOL) and f-structure (using standard LFG feature descriptions) discussed in the previous section, we can convince ourselves pretty easily that the MSOL-based variant of the LFG formalism is neither more nor less expressive than standard LFG, i.e., the following equivalence holds:

(21) Class of standard LFG languages = class of MSOL-based LFG languages

For a given standard LFG grammar, we can construct an equivalent MSOL grammar, and vice versa. If we are given a standard LFG grammar, we can formulate MSOL formulae for each rewrite rule by directly describing the local tree configurations, using the immediate dominance relation $\triangleleft$ and precedence ($\prec$).[8] The f-annotations for each daughter category can be expressed directly, using

[8]Regular expressions on the right-hand side of LFG rules can also be captured fully by MSOL. For example, the Kleene star in the rewrite rule 'NP →DET ADJ* N' can be captured by saying:

$(\forall x)\mathrm{NP}(x) \to (\exists y_1 y_2 Y)[\mathrm{DET}(y_1) \wedge x \triangleleft y_1 \wedge \mathrm{N}(y_2) \wedge x \triangleleft y_2 \wedge (\forall z) z \in Y \to x \triangleleft z \wedge \mathrm{ADJ}(z) \wedge y_1 \prec z \prec y_2]$

(This formulation assumes that 'DET ADJ* N' is the only right-hand side for NP; if there were more possible right-hand sides, a disjunction over all of them would have to be used.)

f-annotation predicates which conform to (16) and (18), since the original annotations make only reference to ↑ and ↓, and there are only finitely many different f-annotations in a standard LFG grammar.

For a given MSOL-based grammar specification, a classical LFG can be obtained by first converting the MSOL description into an equivalent tree automaton (which can be done due to the equivalence discussed in section 2.2). The f-annotation predicates are treated as unanalyzed labels, similar to the category labels. The resulting tree automaton (compare (15) and figure 2) can be converted into a rewrite grammar by introducing a non-terminal category for each state and constructing the productions for the non-terminals by using all state transition terms that have the corresponding state as their target. Now, the f-annotation predicates can be converted into standard LFG f-annotations. The meta-constraint on f-annotation predicates (18) in MSOL-based LFG ensures that we can express the annotations in standard LFG.

Since in standard LFG and in MSOL-based LFG, the f-constraints are resolved in the same way, the equivalence at the rewrite rule level that we just sketched is all that is needed to show that equivalence (21) holds.

2.5 Discussion: Increased generality of descriptions

As the previous section showed, the expressive power of the LFG formalism is not increased by moving to MSOL-based c-structure desciptions (we have *descriptive equivalence*). So what is the benefit of the new format?

The answer is that we can now express principles generalizing over c-structure as explicit constraints that would otherwise have required a significantly blown-up representation. (Now, the compiled-out tree automata will contain the fine-grained distinctions, but these tree automata have a purely technical status; our theory is formulated at the level of MSOL tree descriptions.)[9]

This formalization expands the *description-based spirit of LFG* to c-structure specification (replacing a slightly derivational residual). With the hybrid system, the important computational properties of standard LFG carry over to the new system.

Computational considerations. Presently, the possibility of compiling out tree automata for an MSOL grammar formula is solely viewed as a theoretical tool, guaranteed by equivalences holding for the class of tree languages. But it may also be possible to devise computational procedures that perform the compilation for actual grammar specifications. There is a computational tool for such compilations, which was originally developed for hardware verification: the MONA system Klarlund and Moller (2001), Morawietz and Cornell (1999). As the experiments by Morawietz and Cornell show, the size of the tree automata gets extremely large when applied to non-trivial grammar formulae, at least in the heavily tree-based theoretical framework they were investigating. However, it may be possible to exploit properties of the special case of LFG grammar formulae to facilitate the compilation.

Potential further directions. While the focus on equivalence with standard LFG in the present paper motivated the use of a hybrid description system, it would be very interesting to explore a purely MSOL-based description of both c-structure and f-structure. A comparison with the hybrid approach may reveal interesting aspects of LFG and feature grammars in general.

[9] A further application of the generalized tree descriptions, besides in the formalization of theoretical principles holding on c-structure and the c-structure/f-structure mapping, might be treebank annotation principles as proposed by (Frank 2000). The framework discussed in the present paper could be used as a formal basis for Frank's generalized f-structure annotations.

3 An application: constraint specification in OT-LFG

Besides the application within classical LFG, the MSOL-based formulation of c-structure descriptions results in a significant clarification of the specification of computationally well-behaved OT-LFG systems. Kuhn's (2002, 2003) proof of the decidability of optimization for a suitably restricted OT-LFG system (based on Kaplan and Wedekind's (2000) context-freeness results) relies on OT constraints being "expressible local to a c-structure subtree". The relevant "locality" criterion is hard to pin down rigorously without a general tree description language: e.g., non-local dependencies are allowable as long as the information can be percolated through the tree using a finite set of category symbols. By demanding that all OT constraints are expressed in MSOL we get a very clear characterization of the "locality" criterion, and the context-free-grammar-guided decidability proof becomes much more perspicuous.

Section 3 of this paper attempts to present the computational issues addressed in the decidability proof of Kuhn (2002, 2003) in an accessible way and sketches the application of the logic-based c-structure specification proposed in the previous section in the context of this proof (compare Kuhn (in preparation)).

3.1 A brief introduction to OT-LFG

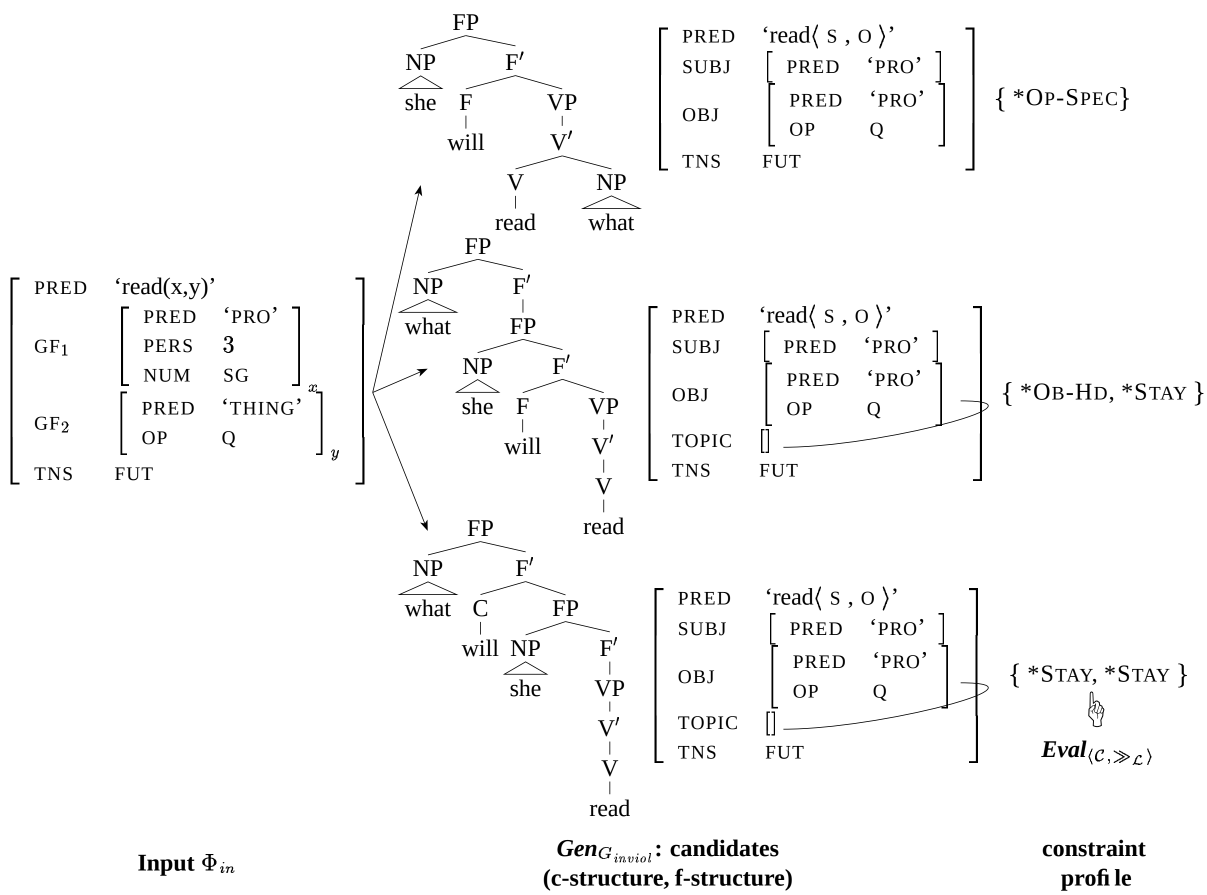


Figure 3: *The OT-LFG architecture: a graphical overview*

Figure 3 provides a graphical overview of OT-LFG as originally proposed by Joan Bresnan (e.g., in

Bresnan 2000) and discussed in detail in (Kuhn 2003). A general underlying LFG-style grammar defines the set of possible candidate representations. For a given input (a partially specified f-structure), the actual candidate set is defined as those c-structure/f-structure pairs for whose f-structure is subsumed by the input structure, without adding any semantic information.

The competing candidates are compared in terms of the violations of OT constraints that they incur. A (violable) OT constraint is a description of a subconfiguration (c-structure/f-structure, or a combination of both) of the candidate representations.

In figure 3, the constraint violation for each candidate are shown as a multiset of violation marks for the constraints OP-SPEC, OB-HD and STAY.[10] The language-specific ranking of the constraints determines which of the candidates is the most harmonic realization, making it the predicted grammatical realization of the underlying input.

3.2 Undecidability for unrestricted OT and the basis of a decidable system

The set-up of a syntactic OT system just sketched makes it possible to have an infinite number of competing candidates in a specific candidate set. As we will see, this is not in itself an unsolvable computational problem, but it *can* lead to a problem if the system is not otherwise restricted in a suitable way. We discuss the problem in the following; the solution of (Kuhn 2003), which is also assumed here, will be to allow for infinite candidate sets, but demand that constraints are not arbitrarily powerful.

The schematic example in figure 4 illustrates the computational problem that infinite candidate sets may pose without further restrictions on the formalism. (For a formally precise discussion of the issue, see Kuhn 2003, ch. 4.) Let us assume (i) that we have an underlying candidate generation grammar that licenses recursive structures like the Y-trees in figure 4. Moreover (ii), there is some high-ranking constraint (C_1) which we find to be violated in "small" structures, participating in the recursive construction.

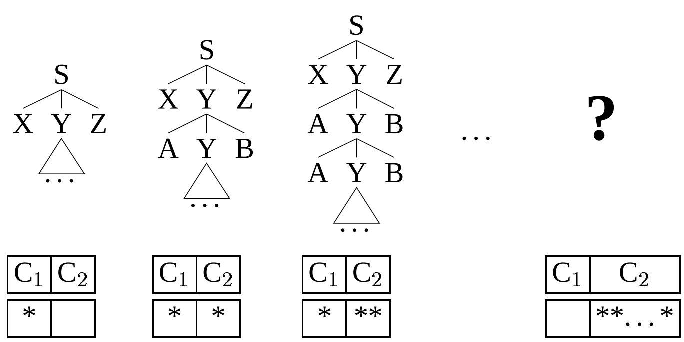


Figure 4: *Schematic depiction of the intuitive problem with infinite candidate sets*

Now we have to decide whether or not there is a way of avoiding the violation of C_1 – one possibility is to look at larger recursive structures. The constraint violation might be triggered by the "small" structures and could possibly go away. Let us furthermore say that the violation does not go

[10]Grimshaw's definitions for these constraints are the following (compare Grimshaw 1997, 374):

OP-SPEC	Syntactic operators must be in specifier position.
OB-HD	(Obligatory Head) A projection has a head.
STAY	Trace is not allowed.

For their translation into the OT-LFG framework, see (Bresnan 2000) and (Kuhn 2003, ch. 4).

away within the first n larger candidates we look at, using the recursion. Now the issue is: if there are infinitely many larger structures using the recursion, can we ever be sure that the C_1 violation *cannot* be avoided?

One may ask whether this type of problem is of any linguistic relevance for Optimality-Theoretic syntax. Maybe we could restrict the set of allowable candidate generation grammars, excluding recursion without a reflex in f-structure (which would make the problem disappear)? However as I will argue in the following subsection, this is not a viable option if we are interested in providing a formalization of the core idea of the Optimality-Theoretic approach, which is to derive cross-linguistic grammatical differences as an effect of constraint reranking. There is linguistic support for infinite candidate set.

3.2.1 Linguistic motivation for infinite candidate sets

Obviously, there can be no direct empirical support for the need of an infinite candidate set: there will always be just a finite set of winners (typically just a single winner). However, if we find a systematic OT explanation that relies on ranked constraints operating on a subset of candidates which are related to each other since they include more or fewer instances of otherwise unlimited recursion (which has no f-structure reflex), this will be a good indication that infinite candidate sets should not be excluded *a priori*.

The use of stacked functional projections in the extended projection architecture of Grimshaw (1997) is such an example. On top of the lexical VP projection, an arbitrary number of stacked FP projections is allowed (two of which will correspond to the classical IP and CP projections). If we translate this to an LFG setting, all of the functional categories will act as f-structure co-heads (following Bresnan 2001, ch. 6-7), so there is no f-structural nesting corresponding to the stacking in c-structure. This means that we will indeed get infinitely many candidates for any candidate set involving a lexical verb, as indicated in figure 5.

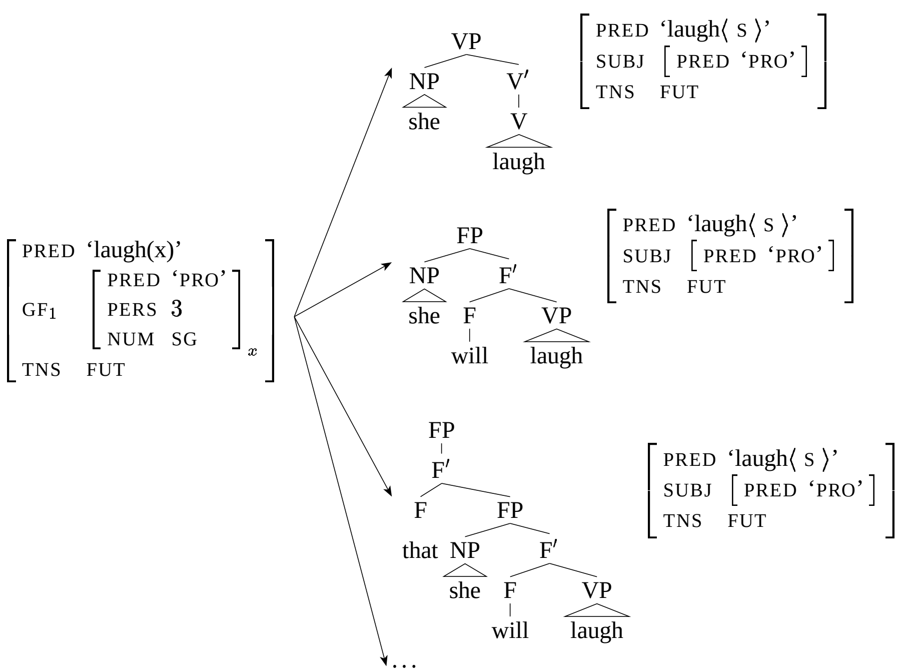


Figure 5: *Infinite candidate set for a given f-structure due to stacking of functional projections*

In Grimshaw's analysis, the assumption of not just zero, one, or two, but arbitrarily many functional projections is justified by the derivation of English data with embedded clauses including an operator (compare Grimshaw 1997, 399ff). Constraint interaction leads to a winner (for English) which actually includes three functional projections. This indicates that a prior stipulation of a maximal depth for functional projection stacking (while technically still possible, using 3 or 4 as the limit) goes against the explanatory impact of the OT approach.

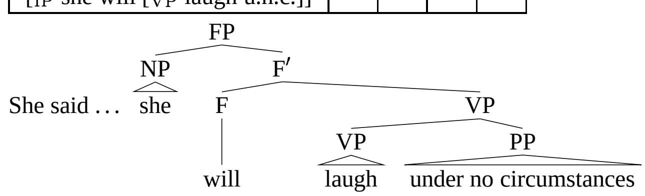
Structure (22) shows what would be the LFG correspondent of the input that Grimshaw (1997, 399ff) assumes; (23) presents a sequence of candidates for this input (only the c-structure is shown). In general, we should think of all candidates in OT-LFG as arising simultaneously in an abstract competition that does not involve the actual generation of the candidates in a cognitively real device. However, for pedagogical reasons this particular example presents the candidates in a sequential way, along with the tableau of candidates considered "so far". The sequence of presenting the candidates follows the order of increasing recursive stacking, suggestive of the abstract example given in figure 4. This should suggest that it is not a computational possibility to do the candidate generation first (for an infinite set of candidates!) and check the constraint violations afterwards; a concrete algorithm will have to interleave the two abstract processes of (i) candidate generation and (ii) constraint marking/harmony evaluation. For more details on example (22)/(23), see (Kuhn 2003, 185ff).[11]

(22) *Input*

$$\begin{bmatrix} \text{PRED} & \text{'say(x,y)'} \\ \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PERS} & 3 \\ \text{NUM} & \text{SG} \end{bmatrix}_x \\ \text{GF}_2 & \begin{bmatrix} \text{PRED} & \text{'laugh(x)'} \\ \text{GF}_1 & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PERS} & 3 \\ \text{NUM} & \text{SG} \end{bmatrix}_x \\ \text{MOD} & \begin{bmatrix} \text{PRED} & \text{'U. N. C.'} \\ \text{OP} & + \end{bmatrix} \\ \text{TNS} & \text{FUT} \end{bmatrix}_y \end{bmatrix}$$

(23) a.

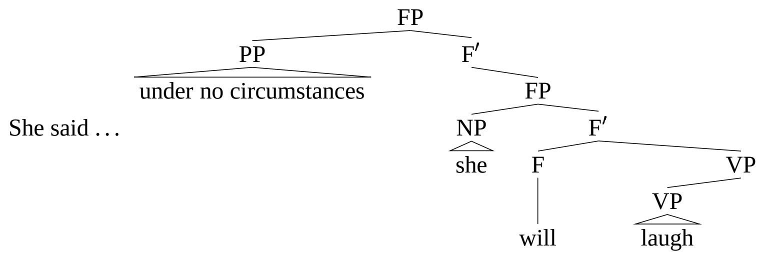
	PURE-EP	OP-SPEC	OB-HD	STAY
[$_{\text{IP}}$ she will [$_{\text{VP}}$ laugh u.n.c.]]		*		



b.

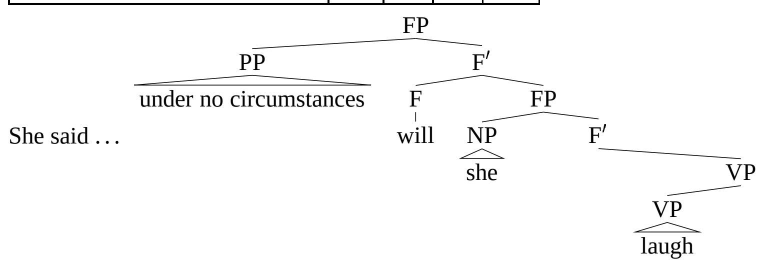
	PURE-EP	OP-SPEC	OB-HD	STAY
[$_{\text{IP}}$ she will [$_{\text{VP}}$ laugh u.n.c.]]		*		
[$_{\text{XP}}$ u.n.c. [$_{\text{IP}}$ she will [$_{\text{VP}}$]]	*		*	*

[11]The PURE-EP constraint is defined as follows (Grimshaw 1997, 394): "No adjunction takes places to the highest node in a subordinate extended projection; and no movement takes place into the highest head of a subordinate extended projection." For the other constraints, compare footnote 10.



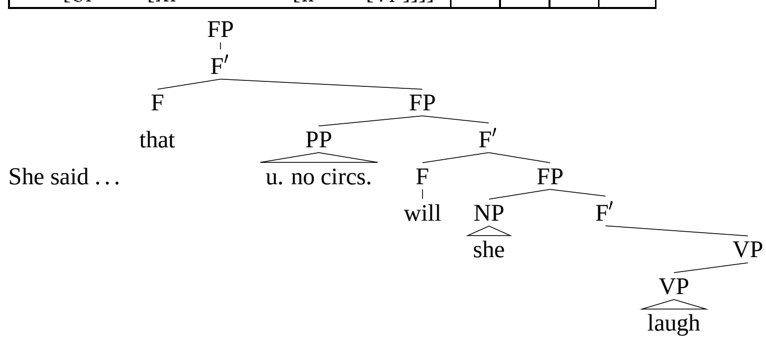
c.

	PURE-EP	OP-SPEC	OB-HD	STAY
[IP she will [VP laugh u.n.c.]]		*		
[XP u.n.c. [IP she will [VP]]	*		*	*
[XP u.n.c. will [IP she [VP]]	*			**



d.

	PURE-EP	OP-SPEC	OB-HD	STAY
[IP she will [VP laugh u.n.c.]]		*		
[XP u.n.c. [IP she will [VP]]	*		*	*
[XP u.n.c. will [IP she [VP]]	*			**
☞[CP that [XP u.n.c. will [IP she [VP]]]]				**



Note that the ultimate winner with its three levels of stacked FPs avoids all violations of high-ranking constraints, in contrast to the "smaller" candidates candidates considered "earlier on". The winning candidate only violates the low-ranking STAY constraint.

3.2.2 Decidability despite infinity of the candidate set

The example in the previous subsection showed that from the point of view of linguistic modeling, infinite candidate sets should not be excluded *a priori*. As it turns out, infinity of the candidate set is not a problem by itself. As long as there are finitely many equivalence classes of candidates to deal with, the problem will be manageable. (Kuhn 2003) presents a decidability proof for OT generation based on a constraint concept in which all constraints are anchored in a local tree configuration. This makes it possible to discard infinitely large equivalent classes of candidates as impossible winners and leaves only a finite set for comparison.

The construction is based on the following result of Kaplan and Wedekind (2000): Generation from a given f-structure (within classical LFG) produces a context-free language. Kaplan and Wedekind present a construction that exploits the strict f-structural constraints imposed by the goal of generating from a particular f-structure. These constraints are folded into the c-structure symbols, creating a large but finite set of category symbols that take over the role of all f-structural restrictions in a normal LFG grammar (for the particular given f-structure for which strings are generated). Ultimately, no f-annotations are needed anymore, and we get a context-free grammar that generates exactly those strings which the original LFG grammar accepted for the given f-structure.

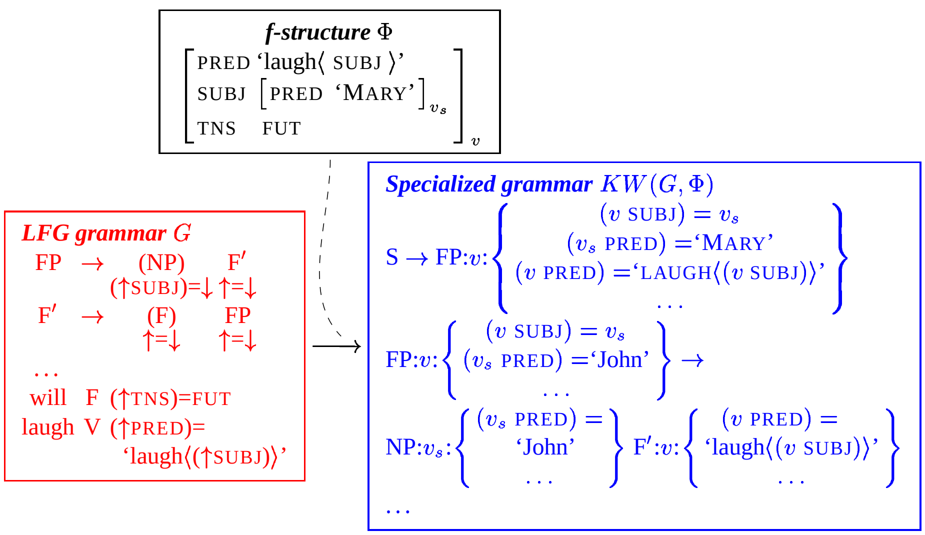


Figure 6: *Illustration of the construction of Kaplan and Wedekind (2000)*

Figure 6 provides a schematic illustration of Kaplan and Wedekind's construction (see their paper or (Kuhn 2003, ch. 6) for details). Given an LFG grammar G and an f-structure Φ, a specialized context-free grammar is constructed which we may call $KW(G, \Phi)$. The augmented c-structure categories in this grammar have the form XP:$v_{x_1 \ldots x_n}$:Γ. Γ encodes a set of instantiated f-constraints percolated bottom-up.[12] The consistency of all the f-constraints that are percolated up to the root symbol (and Completeness/Coherence) is checked by a selective introduction of productions for a new start symbol. (This is feasible since the existence of a fixed Φ guarantees that there is a finite set of possible f-constraint instantiations for the grammar.)

Kuhn (2000, 2003) exploits the "KW construction" for showing that generation-based optimization in OT-LFG is decidable, based on two assumptions:

1. Each candidate's f-structure is identical to the OT input (modulo addition of a bounded amount of information);

2. All OT constraints can be anchored local to a c-structure category.

[12]The expressions following the first colon – v, v_s – are used to fix the instantiation of the metavariables ↑, ↓ to specific paths taken from Φ (such as the empty path, or the path SUBJ, or COMP SUBJ etc., in large f-structures); all possible combinations of such fixed instantiations are created.

For the locality restriction, there has not been a fully satisfactory formulation so far. The logic-based formulation of tree constraints brought forward in section 2 of the present paper will actually fill this gap.

Technically, Kuhn's (2003) application of the KW construction for OT-LFG involves an additional step of transforming the LFG grammar used for candidate generation (G_{inviol}) into a version that includes explicit markings of locally incurred constraint violations as part of an expanded c-structure category format. We may refer to the result of transforming a grammar in this way as $O_{\mathcal{C}}(G)$.

When the KW construction is applied to $O_{\mathcal{C}}(G_{inviol})$ for a candidate generation LFG grammar G_{inviol} and an underlying input f-structure Φ_{in}, we get a context-free grammar $KW(O_{\mathcal{C}}(G_{inviol}), \Phi_{in})$ (this is illustrated schematically in figure 7). This resulting context-free grammar may still include recursive rules (thus generating infinitely many strings). But the structures created by traversing a chain of recursive rules are at most as harmonic as a smaller candidate already generated (this is a consequence of having encoded all local constraint violations in the category symbols). So there is an effective way of generating the full set of winners. (In well-behaved OT systems this will be a small finite set, but even if there are infinitely many candidates for the optimal constraint profile, we get a context-free grammar that produces exactly those winners.)

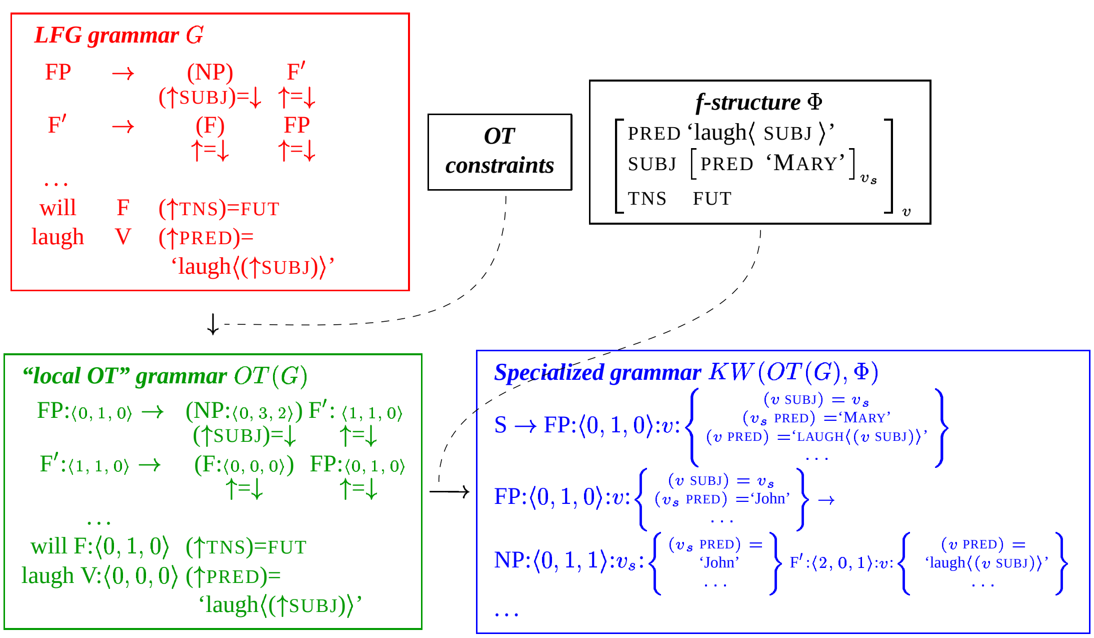


Figure 7: *Illustration of the decidability construction for OT-LFG generation*

Summing up the result of (Kuhn 2003, ch. 6), the specialized grammar $KW(OT(G), \Phi)$ is guaranteed to generate the optimal OT candidates in its non-recursive part. This guarantees decidability of generation-based optimization.[13]

3.3 The constraint locality condition

As was pointed out above, the constraint locality condition assumed in the decidability proof of (Kuhn 2003) has had no fully satisfactory formulation so far. Under the assumption that OT constraints have

[13]It does not guarantee decidability of the recognition/parsing problem for expressive optimization systems. This requires further assumptions about contextual recoverability or a bidirectional optimization scheme (Kuhn 2003, sec. 6.3).

one of the implicative forms in (24), the generation construction sketched in the previous section can be formulated.

(24) a.
$$\begin{array}{ccc} N & \Rightarrow & N' \\ S & & S' \end{array}$$

where N, N' are descriptions of nonterminals of G_{inviol}; S, S' are standard LFG f-annotations of constraining equations with $\uparrow$ as the only f-structure metavariable.

b.
$$\begin{array}{ccc} \begin{array}{ccc} & N & \\ \hline \rho & M & \sigma \\ & S & \end{array} & \Rightarrow & \begin{array}{ccc} & N' & \\ \hline \rho' & M' & \sigma' \\ & S' & \end{array} \end{array}$$

where N, N', M, M' are descriptions of nonterminals of G_{inviol}; N, N' refer to the mother in a local subtree configuration, M, M' refer to the same daughter category; $\rho, \rho', \sigma, \sigma'$ are regular expressions over nonterminals; S, S' are standard f-annotations as in (24a).

However, for non-trivial c-structural OT constraints, a conversion of the c-structure representation had to be assumed, prior to formulating the constraints. An example from (Kuhn 2003, 97) is given in (25).

(25) IPccxhy vs. IPccxhn: *c-commanding extended head yes/no*

C′	→	C	IPccxhy
C′	→		IPccxhn
IPccxhy	→	(XP)	I′ccxhy
IPccxhn	→	(XP)	I′ccxhn
I′ccxhn	→	(I)	(VP)
I′ccxhy	→	(I)	(VP)

As has been noted, even non-local conditions can be encoded, using a GPSG-style slash feature as part of the c-structure categories. But at the same time this reveals a certain problem: it is not entirely transparent what the actual limitations are that are imposed by the constraint locality condition.

Although reformulations of the c-structure rules along the lines of (25) could be devised for a given construction and given OT constraints, there has been no mechanical way of getting from the constraint formulation to the required representation.

3.4 Using a logic-based formulation of constraints

A (MSO) logic-based formulation of OT constraints resolves the issue addressed at the end of the previous section. OT constraints can be formalized as MSOL formulae with a free variable (ranging over tree nodes). F-structure constraints can be included, using the hybrid specification technique discussed in section 2.3.[14] (26) is an example of an MSOL-based formulation of the constraint OB-HD, making use of the *ExtHd* predicate defined above and a predicate *XBar0* that can be defined in an obvious way.

(26) OB-HD (Bresnan 2000, (21))

Every projected category has a lexically filled [extended, JK] head.

$\mathit{ObHd}(x) \equiv \neg \mathit{XBar0}(x) \rightarrow [(\exists y)[\mathit{ExtHd}(y, x)]]$

[14]OT constraints addressing f-structure may include only constraining equations.

For the decidability construction discussed in section 3.2.2, the full cross-product of local constraint (non-)violations can now be expressed by a disjunction of such open formulae $C_i(x)$; we can use this disjunction to introduce "constraint violation label" predicates $\langle n_1, n_2, \ldots, n_k\rangle(x)$, where $n_i \in \{0, 1\}$ (multiple violations of the same constraint will always originate from different nodes).

(27)
$$\begin{array}{l}(C_1(x) \wedge C_2(x) \wedge \ldots C_k(x)) \leftrightarrow \langle 0, 0, \ldots, 0\rangle(x) \vee \\ (\neg C_1(x) \wedge C_2(x) \wedge \ldots C_k(x)) \leftrightarrow \langle 1, 0, \ldots, 0\rangle(x) \vee \\ (\neg C_1(x) \wedge \neg C_2(x) \wedge \ldots C_k(x)) \leftrightarrow \langle 1, 1, \ldots, 0\rangle(x) \vee \\ \vdots \\ (\neg C_1(x) \wedge \neg C_2(x) \wedge \ldots \neg C_k(x)) \leftrightarrow \langle 1, 1, \ldots, 1\rangle(x)\end{array}$$

The constraint violation labels defined in this way can be used directly to control the generation of "non-recursive" trees in the KW-construction step.

So, we can conclude that the MSOL-based constraint formulation clarifies the formal preconditions for decidability of optimization to a great extent: Any constraint expressible as an open formula $C_i(x)$ of MSOL will be usable in an OT-LFG system without jeopardizing decidability of OT generation. For nonlocal dependencies it is no longer necessary to manually construct a c-structure level representation like the one in (25) that takes care of the step-by-step relationship. The theoretical results on the relation between MSOL and tree automata (and thus the tree skeleton of context-free string languages) ensure that there will be a way of compiling out the grammar.[15]

4 Conclusion

In the first part of this paper (section 2), I argued that MSOL-based tree descriptions make it possible to express theoretical principles generalizing over c-structure in a direct descriptive way (which is not possible under the standard LFG characterization of c-structure). If the relation between c-structure and f-structure is realized by a hybrid description scheme (inheriting the standard LFG feature logic for f-structural constraint resolution), descriptive equivalence of standard LFG and the new c-description format follows in a fairly straightforward way. As the second part of the paper illustrated (section 3), open formulae in MSOL provide an elegant way of characterizing the locality condition of OT-LFG constraints, which is required to guarantee decidability of generation-based optimization with infinite candidate sets. A more thorough discussion is provided in Kuhn (in preparation).

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[15] Just like alluded to in section 2.5, in the OT-LFG context too computational tools like MONA (Klarlund and Moller 2001, Morawietz and Cornell 1999) may be used to perform this compilation.

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Universal and Language Particular Constraints in OT-LFG

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Abstract: Optimality Theory claims that all typological variations can be explained in terms of language particular differences in the ranking of universal constraints. Based on patterns in verb morphology, and the phenomenon of OCP, this paper argues for another source of typological variation, namely, that of language particular manifestations of universal constraint cores, or constraint schemas, and thereby supplementing the mechanism of constraint ranking with that of constraint generation.

1. The nature of constraints in OT

The expression of the regularities in a system involves the statement of laws (rules, constraints, principles, conditions) and of their interaction. In the 'Aspects' theory of syntax, regularities of language structure were stated as language particular laws, and their interactions were expressed in terms of ordering. In Lexical Functional Grammar (Bresnan 1982, 2001), these regularities were stated as a combination of universal and language particular laws, and their interactions in terms of structure building. In Optimality Theory (Prince and Smolensky 1993), all regularities are stated as universal laws, and their interactions are expressed in terms of language particular ranking.

In adopting the position that all laws in human languages are universal, OT makes the further claim that all structural differences between languages can be deduced from the combination of universal constraints and language particular specifications of (a) the ranking of the constraints, and (b) the idiosyncratic properties of lexical items. The OT enterprise is to show that apparent complexity in human languages is the result of the interaction of a number of simple ingredients, namely, the universal constraints.

The purpose of this paper is to suggest that while this claim is clearly an attractive and desirable one as a methodological guiding principle, it may also be too strong to be taken as a theoretical claim. There exist structural differences within and across languages that nudge us to relax the OT claim, and allow for the expansion of the language particular possibilities. In place of a conception of inviolable and violable universal constraints, we argue for a conception of invariant and variable universal constraint cores to express regularities of language structure. Such a modification of the theory would involve universal constraints that are underspecified, such that the language particular component would 'fill in' the underspecified information, in addition to providing the ranking of the constraints and the idiosyncratic properties of lexical items.

Our goal is to argue for language particular constraints that are built out of the universal core, to illustrate how fully specified constraints can be generated from an underspecified core, and to show that in addition to constraint ranking, constraint generation is a source of typological variation.

2 Constraints in Malayalam verb morphology

Regularities in morphological structure constitute the most serious challenge to the claim that all constraints are universal. It is fairly obvious that there exist language particular aspects to morphological structure that are not necessarily a function of constraint ranking. Such differences, however, have generally been assumed to stem from the idiosyncratic properties of language particular morphemes. In what follows, we will examine this assumption on the basis of a case study of the verb morphology of Malayalam, and demonstrate that given certain assumptions of what counts as a universal constraint, the claim that all constraints are universal is untenable.

2.1 Word-internal c-structure and f-structure

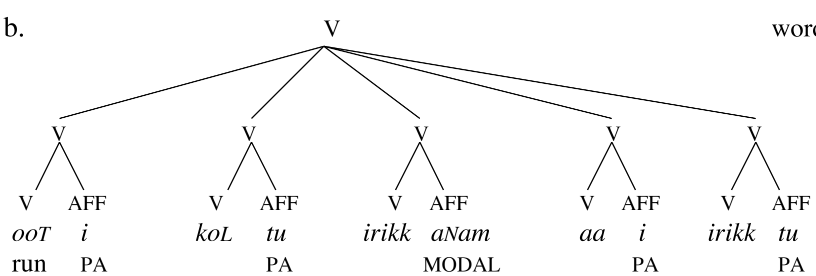
We begin with an example that illustrates a multi-stem sequence in Malayalam verbs:

(**1**) *kuTTi* oo*TikkoNTirikkaNamaayirunnu*.
child should have continued to run
The child should have kept running.

The morphological break up of the verb in (1) can be given as (2a), with the word internal c-structure as given in (2b), and the corresponding f-structure as in (2c): [1], [2]

(**2**) a. ***ooTikkoNTirikkaNamaayirunnu*** morphological break up of the verb
ooT-i-koN-T-irikk-aNam-aa-i-irun-nu
run-**PA**-*KOL*-**PA**-*IRIKK*-**MOD**-*AA*-**PA**-*IRIKK*-**PA**
run - in the process of - should have been

b. word internal c-structure[3]



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[1] The following abbreviations are used in the glosses:

PA:	Past	PR:	Present	FU:	Future
MOD:	Modal	NF:	Non-finite	REL:	Relative clause marker

The forms glossed in upper case italics as *KOL, IRIKK,* and *AA*, are grammaticalized counterparts of the verb stems that mean 'fit', 'sit', and 'be/become' respectively.

[2] See Asher & Kumari (1997) for a description of the structure of Malayalam, and Mohanan & Mohanan (forthcoming) for an extensive discussion of the facts and analysis of Malayalam verb morphology.

[3] What we have called word-internal c-structure in (2b) (also Mohanan and Mohanan forthcoming) is the same as what the recent LFG literature refers to as m-structure (Butt et al 1996, Sadler & Spencer 2001, Frank & Zaenen 2002).

c.
$$\begin{bmatrix} \text{PRED 'run' (SUBJ)} \\ \text{TENSE: PAST} \\ \text{MODAL: OBLIGATION} \\ \text{PROG: +} \\ \text{CONT: +} \end{bmatrix}$$
word internal f-structure

Representations of the type illustrated in (2) raise the following questions. What are the regularities governing word-internal c-structure in Malayalam? How do we predict these regularities from a set of statements in UG? What are the regularities governing the correspondence between word-internal c-structure and f-structure? For instance, the verb form in (1) contains four occurrences of morphological past ((2b)) corresponding to a single occurrence of syntactic past ((2c)). Should the regularities in such correspondences be expressed as universal constraints, as language particular constraints, as a combination of the two, or as stipulations on lexical items? In classical LFG, the pairing between c-structure and f-structure in the phrasal domain is handled by annotations on language particular phrase structure rules. Given that in OT-LFG, language particular rules are replaced by universal constraints, the device of annotations needs re-thinking.

2.2 Tense and negation

Malayalam has a three-way tense system, with past, present, and future tenses, as illustrated in (3). The nonfinite affixes in the language are illustrated in (4):

(**3**)	a.	*ooTi*	b.	*ooTunnu*	c.	*ooTum*
		run-PA		run-PR		run-FU
		'ran'		'runs'		'will run'
(**4**)	a.	*ooTaan*	b.	*ooTuka*	c.	*ooTaaR-*
		run-NF1		run- NF2		run- NF3
		'to run'		'running'		'about to run'

The tense affixes interact with the negation marker *illa*, as shown in (5):

(**5**)	a.	*ooTiyilla*	b.	*ooTunnilla*	c. *	***ooTumilla***	d.	*ooTilla*
		run-PA-NEG		run-PR-NEG		**run-FU-NEG**		run-NEG
		'didn't run'		'isn't running'				'won't run'

Notice that (5c), where the negation marker follows the future tense affix, is unacceptable; future negation is expressed by (5d), without a future tense marker. It should be noted that a verb form without a tense marker (e.g., *ooT*) cannot be the sole verb in a sentence, except in the context of negation and that the V+NEG form without the future afix cannot be interpreted as anything other than future tense. These observations about the interaction between tense and negation can be summarized as the generalizations in (6):

(**6**) a. V+FUT+NEG is an illformed c-str representation. (c-structure gap: (5c))
b. V+NEG in c-str corresponds to [PRED, FUT] in f-str. (c-str/f-str mismatch: (5d))

Thus, the negative marker *illa* imposes c-structure restrictions on the verb, not reflected in its f-structure ((6a)), which calls for statements of mismatch between c-structure and f-structure ((6b)).

The generalizations in (6) can be expressed in terms of the lexical specifications on the negative marker, as in (7), together with the constraints in (8) and (9):

(**7**) -*illa* 'NEG': (a) mother = [+tense]
(b) sister = [–tense]

(**8**) a. Every c-structure feature complex must be associated with a corresponding f-structure feature complex, and vice versa.

b. An unassociated f-structure carrying a paradigmatic contrast is paired with an available well-formed unassociated c-structure.

(**9**) a. All elements of a paradigm must be expressed.
b. Paradigmatic contrasts must be preserved.

We assume that (7a) and (7b) are language particular stipulations on lexical entries, while (8)-(9) are universal statements. (7b) correctly disallows the form in (5c). (7a) provides the interpretation of V+NEG as tensed.[4] Given the independently available past and present forms in (5a, b), the constraints in (9) derive the interpretation of (5d) as future negative.

2.3 Tense and relative clauses

Like negation, the relative clause marker –*a* in Malayalam imposes morphological restrictions on tense marking. The relative clause construction is illustrated in (10b, c), embedding (10a):

(**10**) a. *kuTTi* *weegam* *ooTi* / *ooTunnu*
child fast run-PA / run-PR
the child who ran fast

b. *weegam* *ooTiy**a*** *kuTTi*
fast run-PA-**REL** child
the child who ran fast

c. *weegam* *ooTunn**a*** *kuTTi*
fast run-PR-**REL** child
the child who runs/will run fast

[4] The specification "mother = [+tense]" in (7a) can translated as ↑tense= +. LFG doesn't currently have a notation for 'sister = X'.

Observe that unlike (10b), (10c) is ambiguous between present and future tense readings. Related to this is the fact that the relative clause suffix *-a*, like the negative suffix *-illa*, cannot co-occur with the future tense suffix *-um*, as shown by (11a). Nor can it co-occur with a tenseless verb, as shown by (11b). In this, it is unlike the negation marker:

(**11**)	a. *	*ooTuma*	b. * *ooTa*
		run-FU-**REL**	run-**REL**

Thus, the two constructions differ in how the c-structure gap is filled. While the future negative is expressed by a tenseless verb combining with the NEG marker, the future relative clause has no distinct form: the present tense verb form expresses both present and future ((10c)). These generalizations can be captured in terms of the lexical stipulations in (12) and supplementing the universal constraints in (8) and (9) with the default constraint in (13):

(**12**)	*-a*	'COMP':	(a)	mother	=	[+tense]
			(b)	sister	=	[+tense, –fut]

(**13**) Default: c-structure features are identical to the f-structure features. (faithfulness)

2.4 Multiple morphological tenses

In Malayalam, aspectual, modal, and voice contrasts are expressed by a sequence of verb stems within a single verb form. This results in more than one tense affix appearing in a verb, as illustrated in (14):

(**14**) a.	*ooTumaayirunnu*	* *ooTiyaayirunnu*	* *ooTunnaayirunnu*
	ooT-um-aa-i-ir-ikk-tu	ooT-i-aa-i-ir-ikk-tu	ooT-unnu-aa-i-ir-ikk-tu
	run-**FUT**-*AA*-**PA**-*IRIKK*-**PA**	run-**PA**-*AA*-**PA**-*IRIKK*-**PA**	run-**PRES**-*AA*-**PA**-*IRIKK*-**PA**
	used to run		

b.	*ooTukayaayirikkum*	*ooTaaraayirikkum*
	ooT-uka-aa-i-ir-ikk-um	ooT-aaR-aa-i-ir-ikk-um
	run-**INF**-*AA*-**PA**-*IRIKK*-**FUT**	run-**NF**-*AA*-**PA**-*IRIKK*-**FUT**
	will be in the process of running	will be about to run.

The verb form in (14a) carries the future tense affix, and two instances of the past tense affix. The unacceptable forms in (14a) show that the non-final future marker cannot be replaced by any of the other tense markers. Notice also that the non-final future affix in c-structure does not contribute syntactic FUT to the f-structure. Likewise,(14b) illustrates that the non-final past tense marker does not contribute syntactic PAST to the f-structure. That only the final tense marker contributes the syntactic tense is true of all verb forms in Malayalam.

The examples in (15)-(18) illustrate the use of various affixed verb stems to express a range of durative meanings.

(**15**) a. *kuTTi* *ooTunnu*.
child-N run-**PRES**
The child runs.

b. *kuTTi* *ooTi*.
child-N run-**PA**
The child ran.

(**16**) a. *kuTTi* *ooTukayaakunnu*.
child-N run-INF-*AA*-**PRES**
The child is running.

b. *kuTTi* *ooTukayaayirunnu*.
child-N run-**INF**-*AA*-**PA**-*IR*-**PA**
The child was running.

(cf: *ooTukayaayi*.
run-**INF**-*AA*-**PA**
is about to run.)

(**17**) a. *kuTTi* *ooTikkoNTirikkunnu*.
child-N run-**PA**-*KOL*-**PA**-*IR*-**PRES**
The child keeps running.

b. *kuTTi* *ooTikkoNTirunnu*.
child-N run-**PA**-*KOL*-**PA**-*IR*-**PA**
The child kept running.

(**18**) a. *kuTTi* *ooTikkoNTirikkukayaakunnu*.
child-N run-**PA**-*KOL*-**PA**-*IR*-**INF**-*AA*-**PRES**
The child is "keeping on running".

b. *kuTTi* *ooTikkoNTirikkukaayaayirunnu*.
child-N run-**PA**-*KOL*-**PA**-*IR*-**INF**-*AA*-**PA**-*IR*-**PA**
The child was "keeping on running".

(cf. *ooTikkoNTirikkukaayaayi*.
run-**PA**-*KOL*-**PA**-*IR*-**INF**-*AA*-**PA**)

The examples in (15)-(18) further show mismatches in c-structure/f-structure correspondences, which warrant a closer look. Note that as in the case of negation and relative clauses, the c-structure features of these verb forms are not automatically projected into f-structure. To unearth the constraints governing the correspondences, we must juxtapose the two sets of features in (15)-(18) as in (19)-(22) respectively, where the meanings of past (time), pres(ent time), prog(ression), and cont(inuation) are associated with f-structure contrasts. The labels *AA*, *KOL* and *IR* (the roots of the grammaticalized verbs 'be', 'fit', and 'sit' respectively) below are place holders for appropriate c-structure features:

		INPUT		OUTPUT	
(**19**)	a.	pred pres	→	pred pres	f-str
				V-PRES	c-str
	b.	pred past	→	pred past	f-str
				V-PAST	c-str
(**20**)	a.	pred prog pres	→	pred prog pres	f-str
				V-INF-*AA*-PRES	c-str
	b.	pred prog past	→	pred prog past	f-str
				V-INF- *AA* -PAST-*IR*-PAST	c-str
(**21**)	a.	pred cont pres	→	pred cont pres	f-str
				V-PAST-*KOL*-PAST- *IR* –PRES	c-str
	b.	pred cont past	→	pred cont past	f-str
				V-PAST-*KOL*-PAST- *IR* –PAST	c-str
(**22**)	a.	pred cont prog pres	→	pred cont prog pres	f-str
				V-PAST-*KOL*-PAST- *IR* -INF- *AA* –PRES	c-str
	b.	pred cont prog past	→	pred cont prog past	f-str
				V-PAST-*KOL*-PAST- *IR* -INF- *AA* -PAST- *IR* –PAST	c-str

The roots *KOL* and *AA* IN (19)-(22) carry the meanings of continuation and progression respectively. The root *IR*, an expletive in these forms, serves a purely morphological function. The morphological break up of the output candidates of these examples, given in (23)-(26) below, separates the meaning-carrying elements (bold face) from the expletive morphology:

(**23**) a. [**V-PRES**]$_{pres}$
b. [**V-PAST**]$_{past}$

(**24**) a. [**V**-INF] [***AA***-**PRES**]$_{prog\text{-}pres}$
b. [**V**-INF] [***AA***-PAST-*IR* -**PAST**] $_{prog\text{-}past}$

(**25**) a. [**V**-PAST [***KOL***-PAST-*IR*- **PRES**]$_{cont\text{-}pres}$
b. [**V**-PAST] [***KOL***-PAST- *IR*- **PAST**]$_{cont\text{-}past}$

(**26**) a. [**V**-PAST] [***KOL***-PAST-*IR*-INF]$_{cont}$ [***AA***-**PRES**]$_{prog\text{-}pres}$
b. [**V**-PAST] [***KOL***-PAST-*IR*-INF]$_{cont}$ [***AA*** -PAST-*IR*-**PAST**]$_{prog\text{-}past}$

We informally state in (27) the restrictions that govern the choice and sequencing of elements in the verb morphology of Malayalam as exhibited in (15)-(18):

(**27**) a. A verb stem is in the [PAST] tense form before another verb stem.
b. A verb stem is in the [INF] form before a progressive verb stem.
c. Within the continuative, the *KOL* stem requires an *IR* stem after it.
d. Within the progressive past, the *AA* stem requires an *IR* stem after it.

The restrictions in (27a, b) are not lexical specifications on individual morphemes, but general conditions on how stems with certain c-structure features combine. In other words, they are constraints abstracted away from particular morphemes. In contrast, (27c) and (27d) may be viewed as distributional restrictions of specific morphs (strict subcategorization), analogous to restrictions such as "*–ity* requires an adjective as its left sister" and "*un—* requires an adjective or verb as its right sister" in English morphology. Alternatively, they may be viewed as constraints on universally specified lexical classes that *KOL*. *AA* and *IR* belong to (*a la* Bresnan and Nikitina 2003).

The regularities expressed in (27) are not unlike the familiar constraints on auxiliaries that we find in English such as those in (28):

(**28**) A verb stem is in:
a. the bare infinitival form after a modal verb.
e.g., *Sue will go/*goes/*went/*gone/*going*.
b. the *–ing* form after a progressive verb stem.
e.g., *Sue is going/*go/*goes/*went/*gone*.
c. the *–en* form after a perfective or passive form.
e.g., *Sue has gone/*go/*goes/*went/*going*.

To the extent that the specific restrictions in (27) are found only in Malayalam, and those in (28) are found only in English, neither of them can be legitimately regarded as universal constraints.

Examples of word-internal c-structure constraints that are f-structurally unmotivated are found not only in the verbal system but also in the nominal system of Malayalam. The examples in (29) below illustrate the phenomenon in the case system, where the form of the nominal that case marking attaches to is determined by the final phonological segment of the stem:

(**29**)

		NOM	ACC	DAT	COM	GEN	INSTR
a.	'rat'	eli	eliye	elik'k'∂	eliyooT∂	eliyuTe	eliyaal
b.	'flower'	puu	puuwine	puuwin∂	puuwinooT∂	puuwinte	puwinaal
c.	'tree'	maram	marattine	marattin∂	marattinooT∂	marattinte	marattinaal

In (29a) is given a straightforward example where the case marking attaches to the bare nominal stem, which is identical to the nominative form. The special morphological constraints needed for the paradigms in (29b, c) can be stated as (30a, b) respectively:

(**30**) a. When the stem ends in *u*, the morph *-in* must be attached to the host of case marking.
b. When the stem ends in *m*, the morphs *-tt+in* must be attached to the host of case marking.

The constraints in (30) apply to the class of (non-nominative) case affixes.

2.5 Word-internal c-structure: language particular or universal?

In the context of OT, it would be useful to distinguish between constraints that are ACTIVE and those that are SUPPRESSED. For any given input to which a particular constraint is applicable, the constraint is active when there is no outranking constraint that conflicts with it, and is suppressed if a competing constraint outranks it. Given this distinction, a constraint is GLOBALLY ACTIVE in a language if, for all inputs, it has no outranking constraint that conflicts with it. It is GLOBALLY SUPPRESSED if, for all inputs, a competing constraint outranks it.

In the previous section, we took the position that the c-structure constraints in (27) and (28) are not universal, on the grounds that each of them is obeyed only in that particular language. The same remarks would apply also to (30). Technically speaking, it is indeed feasible to postulate them as universal constraints that are outranked by either a faithfulness constraint or a complementary constraint in every other language, such that they are globally suppressed in every language but one. Given the freedom to postulate such constraints, the claim that all constraints are universal becomes empirically vacuous. To avoid such vacuity, we suggest a methodological guideline on what can be legitimately considered a universal:

(31) To qualify as a universal, a constraint should be active in at least a few unrelated languages.

The effect of (31) is that to qualify as a universal constraint, the pattern it expresses should be cross-linguistically recurrent. The constraints in (27), (28), and (30) are not universal unless they satisfy (31).

3 Towards a theory of constraints in OT

OT is essentially a theory of constraint interaction. As the discussion in section 2 suggests, a theory of constraint interaction needs to be supplemented by a theory of constraints that tells us what kinds of constraints are legitimate. In this section, we argue that such a theory should also include a sub-theory of constraint generation, and sketch the rudiments of a theory that generates language particular constraints as variable manifestations of a universal constraint core.

3.1 The concept of universals

The methodological requirement in (30) calls for a clarification of the concept of universals as we understand it in current linguistic theory. First, we need to recognize different degrees of ‘universality’ in the observed cross-linguistic regularities. Some universals are cross-linguistically invariant, while others exhibit variability in their instantiation. Among the invariant patterns, we find exceptionless *absolute universals* (e.g., disjoint reference), *strong universals* that hold in nearly all languages, though with a few exceptions (e.g., subject condition, violated, for instance, in Hindi), and *recurrent universals* that repeatedly found across languages (e.g., clause-bound anaphora).

Universals with variable instantiations are of two types. In some, variation is a matter of choice from a small set of options provided in the principle itself (the leading idea in the Principles and Parameters program). An example of *principle-and-parameters universals* is the constraint that the antecedent of a reflexive must be the most prominent element along dimension x. The relevant dimension for 'prominence' may be argument structure (logical subject, as in Hindi and Marathi), grammatical function structure (grammatical subject, as in Hindi, Malayalam, Japanese, Malay, and so on), discourse syntax (topic, as in Malay), or discourse semantics (logophoric center, as in Malayalam and Japanese).

In other variable instantiations, the variability lies in the manifestation of a single abstract archetype, where a single constraint schema is manifested as a number of constraints with family resemblances. An example of *archetype-and-manifestations universals* is the passive construction, which exhibits a universal core (the logical subject is not the grammatical subject), but has variable manifestations. For instance, in German and English, the logical subject is demoted, but not in Tagalog. German allows passives without a grammatical subject (impersonal passives), while English and Tagalog do not. Passives in Japanese and Mandarin have an adversity specification, but not those in English or Malayalam.

The typology of universal constraints sketched above suggests that there may be two sources for typological variation across languages. Some variations stem from the interaction of constraints, while others stem from the instantiation of a universal. OT seeks to use a single mechanism, that of constraint ranking, to derive all typological variation. In the light of the above discussion, the OT position calls for closer scrutiny.

3.2 Deriving language particular manifestations

If we accept the idea of universal archetypes and language particular manifestations of constraints, it follows that while a constraint is language particular in the sense that it is observed only in one language, or a set of related languages, it may nevertheless be derived from a universal schema. Let us re-examine the facts of verb morphology in Malayalam from this perspective.

Let us first take the association between c-structure and f-structure. Given the constraints internal to the c-structure of Malayalam verbs, the f-structure interpretation of the relevant syntactic features can be made to follow from the universal principles of c-structure/f-structure correspondence given in (8), (9) and (13). What we need, in addition, are the universal principles that identify the location of the syntactic finite tense, which we state as (32a, b):

(**32**) a. The verb sequence in a finite clause has one and only one syntactic FINITE TENSE.

b. Syntactic FINITE TENSE is borne by the unit at the edge. [edge: left/right]

The consequence of (32a, b) is that verbs that are not at the edge are NON-FINITE. Typological variation deriving from (32), and the faithfulness constraint in (13), can be illustrated as follows:

	Malayalam	English
(32a)	not violated	not violated
(32b)	right edge	left edge
(13)	violated	not violated

Is it possible to pursue a similar approach to the constraints internal to c-structure? As remarked earlier, it is possible to take the position that regularities governing the distribution of individual morphs are expressed as stipulations on morphs, not as constraints. If so, the regularities in (27c, d) can be expressed as language particular stipulations on morphs (as in the case of the stipulation that *–ity* in English requires an adjective as its left sister).

However, (27a, b), and (28b, c), and (30a, b) cannot be dealt with as lexical stipulations; they must be expressed as constraints, or as patterns derived from the interaction of constraints. In the absence of a demonstration that these patterns are expressible as universal constraints (subject to (31)), or are derivable from the interaction of universal constraints, they are a counterexample to the claim that all constraints are universal. An alternative would be to derive the patterns from a universal constraint core; we have yet to determine whether this is feasible.

3.3 Underspecified constraints and constraint generation

Let us take a closer look at the strategy of deriving language particular constraints from a universal schema. Consider the following ranking of constraints proposed for the English dative alternation in Bresnan and Nikitina (2003):

(**33**) OO-PRIMACY>> FAITH-LATINATE (REC) >>$\text{FAITH}_{\{yell\}}$, $\text{FAITH}_{\{drag\}}$ >> HARMONY (1,2)
>> $\text{FAITH}_{\{fax\}}$, $\text{FAITH}_{\{throw\}}$ >> … >> $\text{FAITH}_{\{give\}}$ (REC) >> *STRUCT

Of the constraints referred to in (33), FAITH-LATINATE (REC), $\text{FAITH}_{\{yell\}}$, $\text{FAITH}_{\{drag\}}$, $\text{FAITH}_{\{fax\}}$, $\text{FAITH}_{\{throw\}}$ and $\text{FAITH}_{\{give\}}$ (REC) are variants of the same constraint that differ only in the domain of application of the constraint, specified as a lexical class. Bresnan and Nikitina express the constraint schema that underlies the different constraints in (33) as (34):

(**34**) FAITH (REC): Express the recipient role of a verb with distinct marking (case or adposition).

The redundancies in the formulation of the constraints in (33) can be eliminated by factoring out the domain specification of the constraint from the underspecified core constraint in (34):

(**35**)

Universal constraint schema (underspecified)		Language particular constraints (fully specified)
FAITH (REC)	→	FAITH-LATINATE, $\text{FAITH}_{\{yell\}}$, $\text{FAITH}_{\{drag\}}$, and $\text{FAITH}_{\{give\}}$ …

We show in Mohanan & Mohanan (2003) that the unity underlying the diverse manifestations of archetypal phonological patterns like place assimilation, voicing assimilation, and intervocalic lenition are best captured by separating their universal core from the variable language particular manifestations. We also propose a mechanism for constraint generation that adds the specifications of locus (undergoer), trigger, domain, and outcome value to the constraint schema, thereby deriving the fully specified language particular constraints from the universal core.

Place assimilation of nasal stops, for instance, is found in almost all human languages. In languages like English, all stops assimilate, including oral stops; in languages like Malayalam, but only nasals (not oral stops) assimilate. In English, only coronals undergo assimilation in the domain of the foot, though both coronals and non-coronals undergo assimilation within a syllable; in Malayalam, both coronals and non-coronals undergo assimilation within a phonological phrase. The trigger in English must be non-coronal, whether in the domain of a foot or a syllable; in Malayalam, both coronals and non-coronals can be triggers. The unity and variability of place assimilation in these languages are expressed by the following analysis:

(**36**) Universal core:
Stop consonants (nasals and plosives) agree in their place of articulation with the following consonantal segment.

(**37**) Language particular specifications

	locus	trigger	domain	language
a.	[–nasal]	[+stop]	phon. phrase	Malayalam
b.	—	[–cor]	syllable	English
c.	[+cor]	[–cor]	foot	English

Having illustrated the idea of constraint generation with an example from phonology, we now turn to a similar example that spans phonology, morphology, and syntax.

3.4 OCP as a universal constraint schema

The Obligatory Contour Principle (OCP), originally proposed as a prohibition against adjacent identical tones (Leben 1973, Goldsmith 1976), and subsequently extended to other phonological elements (McCarthy 1986), has found further extensions into a prohibition against adjacent identical morphological and syntactic elements as well (Yip 1987, 1998, T. Mohanan1994, Fong and Anttila 2000), with the result that the core pattern of OCP can be stated as in (38):

(**38**) * Adjacent □□ in D.
(= Adjacent identical elements of the specified type are prohibited in the specified domain.)

An example of OCP in English that must make reference to morphological information is the prohibition against the co-occurrence of the plural and possessive *-(e)s*, illustrated in (39):

(**39**) a. *the child* d. *the child's*
b. *the children* e. *the children's*
c. *the boy's* f. * *the boys's*

The ungrammaticality of (39f) would follow if we assume that OCP applies to the morph { z } in English:

(**40**) Locus of (38) in English: morph: -*z*

The disjunctive coordinator –*oo* 'or' and the conjunctive coordinator –*um* 'and' in Malayalam, both of which attach to the last word of every constituent they coordinate, exhibit a similar phenomenon. These coordinators are illustrated in (41b) and (41c) respectively:

(**41**) a. *kuTTi* *ooTi*
child ran
The child ran.

b. *kuTTiyoo* *ammayoo* *ooTi*
child-or mother-or ran
The child or the mother ran.

c. *kuTTiyum* *ammayum* *ooTi*
child-and mother-and ran
The child and the mother ran.

Given in (42) are examples of clefts in Malayalam, where (42b) involves a disjunction:

(**42**) a. kuTTiyaaN∂ ooTiyaat̲∂.
child-is run-it
It was the child who ran.

b. kuTTiyoo ammayoo aaN∂ ooTiyaat̲∂.
child-or mother-or is run-it
It was either the child or the mother who ran.

The morph –*oo* in Malayalam also functions as a *yes-no* interrogative marker when attached to the verb, as in (43a, b), where (43b) is a clefted question:

(**43**) a. *kuTTi* *ooTiyoo?*
child ran-Q
Did the child run?

b. kuTTiyaaNoo ooTiyaat̲∂?
child-is-Q run-it
Was it the child who ran?

c. * kuTTiyooaaN∂ ooTiyaat̲∂?
child-Q-is run-it

Consider now a clefted disjunctive interrogative construction, illustrated in (44a):

(**44**) a. kuTTiyaaNoo ammayaNoo ooTiyat̲∂?
child-is-Q/or mother-is-Q/or ran it
Was it the child or the mother who ran?

b. * kuTTiyaaN**oo-oo** ammayaN**oo-oo** ooTiyat̲∂
child-is-Q-or mother-is-Q-or ran it

The unacceptability of (44b) is evidence for the prohibition of the co-occurrence of the question marker *–oo* and the disjunction marker *–oo*.

The morph *–um*, a conjunctive coordinator illustrated in (41c), also functions as a universal operator in Malayalam, illustrated in (45b), where it signals the meaning 'all of X'. In the presence of an over quantifier 'all', as in (45c), the universal operator is obligatory, as shown by the ungrammaticality of (45d):

(**45**) a. n̲aal∂ kuTTikaL
four children

b. naal∂ kuTTikaLum
four children-□
All the four children.

c. ellaa kuTTikaLum
all children-□
All (the) children.

d. * ellaa kuTTikaL
all children

Now consider the interaction between the conjunction *–um* and the universal operator *–um*:

(**46**) a. ellaa kuTTikaLum ellaa ammamaarum
all children- and/□ all mothers-and/□
All (the) children and all (the) mothers.

b. * ellaa kuTTikaLumum ellaa ammamaarum
all children- and-□ all mothers-and-□

Once again, the unacceptability of (46b) can be explained by the prohibition against the co-occurrence of the conjunction *–um* and the universal operator *–um*. The two prohibitions, illustrated in (44b) and (46b), follow from the language particular specifications in (47):

(**47**) Locus of (38) in Malayalam: (i) morph: *-oo*
(ii) morph: *-um*

The constraints in (40) and (47) hold on specific morphs, which are language particular units. Hence, the constraints themselves could not be universal. We must therefore assume that only the schema in (38), from which these constraints are generated, is universal.

A more complex instance of OCP is that Case OCP, recurrently found across languages. The generalization governing Case OCP in Hindi (T. Mohanan 1994) is as stated in (48):

(**48**) Hindi: Identical case formatives in adjacent phonological words that are associated with participants of the same predicate are prohibited within a phonological phrase.

This generalization, which applies to all case morphs, can be expressed as in (49):

(**49**) Locus of (38) in Hindi:

case formative
|
argument
|
phonological word

Domain of (38):

f-structure clause
|
phonological phrase

In Japanese, unlike in Hindi, Case OCP applies only to the accusative case marker *-o* internal to an S node. Malayalam, unlike both Japanese and Hindi, exhibits no Case OCP. If we accept the methodological principle in (31), then Case OCP in Hindi, whether stated as an underived complex constraint in (48), or as a constraint derived from the combination of the simple underspecified core in (38) and the language particular specifications in (49), is not a universal constraint.

4. Concluding remarks

If we accept the analysis of verbal morphology and of OCP, we must acknowledge a source of typological variation other than the one due to differences in the language particular *ranking* of universal constraints, namely, variation due to differences in the language particular *specification* of the underspecified elements in universal constraint schemas. Adopting this position leads to the possibility of supplementing the device of *constraint ranking* with that of *constraint generation* in a theory that provides an account of the emergence of language particular constraints, thereby yielding typological differences between languages in terms of differences in the way constraints are assembled from universal ingredients. Such a theory would allow for two types of constraints, namely, (i) universal constraints, and (ii) language particular constraints that emerge from (are built out of) universal ingredients.

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Input, Output Candidates, Markedness Constraints, and Ineffability in OT-LFG

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Abstract: This paper tries to clarify the concepts of inputs, output candidates, faithfulness constraints, and markedness constraints in Optimality-Theoretic syntax in the context of the multidimensional architecture in Lexical Functional Grammar, and to explore the consequences of the clarification of these concepts to the problem of ineffability. We propose that multidimensional markedness constraints expressing the correspondences between syntactic and semantic representations correctly derive at least some instances of ineffability without appealing to bi-directional optimization.

1 Introduction

The central ingredients of O(ptimality) T(heory) (Prince and Smolensky 1993) are (i) representations of inputs and (optimal) output candidates, (ii) expressive (meaning-to-form) and interpretive (form-to-meaning) optimization; and (iii) universal constraints (universally inviolable *GEN* constraints, violable *faithfulness* constraints that express the default correspondence between input and output candidates, and violable *markedness* constraints that express recurrent cross-linguistic patterns) and their language-particular ranking. The purpose of this paper is to try to clarify the concepts of input, output candidates, and markedness constraints in OT syntax in the context of the idea of multidimensional structure in Lexical Functional Grammar, and of the notion of 'constructions', and to explore the consequences of the clarification of these concepts to the problem of ineffability.

Three ideas play a crucial role in our exploration, and in addressing the problem of ineffability. The first is the assumption of computational monotonicity in the relation between inputs and output candidates, which translates in OT as the Prohibition of Structure Change, and can be stated as: Structure change is prohibited in the process of optimization. The substance of this prohibition is assumed in both LFG (Bresnan 2001) and OT syntax (Grimshaw 1997). The second assumption is that output candidates are representations of constructions rather than of linguistic signs. By constructions, we mean complex multi-dimensional representational units covering both meaning and form, acting as a locus of universal constraints. Examples of constructions would include such linguistic units as the 'active', 'passive', 'causative', 'applicative', 'cleft', '*wh*-question', 'relative clause', 'complex predicate', 'noun incorporation', and so on. Third, markedness constraints express not only regularities within a dimension of structure but also correspondences across dimensions. The second and third of these ideas, though not explicitly stated in the literature, are implicit in OT analyses, including OT-LFG.

Within OT, the phenomenon of ineffability has been viewed as a problem. An OT grammar only picks winning outputs, and must always pick a winning output. The problem is that there are instances of inputs that yield no acceptable output. (Pesetsky 1997) Solutions to the problem of ineffability have typically been based on bi-directional optimization (Legendre et al. 1998, Legendre 2001, Smolensky 1998). Having assumed that the representation of meaning in the input need not be preserved in the representation of meaning in the optimal output, these solutions permit unfaithful meanings. This, however, runs counter to the Prohibition of Structure Change, which is fundamental to any non-derivational/non-transformational model of linguistic theory. Combining the ideas of constructions and cross-dimensional markedness constraints may allow us to derive most instances of ineffability from multidimensional markedness constraints, without violating computational monotonicity.

The paper is structured as follows. Section 2 clarifies the nature of inputs and output candidates, and section 3 looks at the relation between them. Sections 4-7 explore the consequences of the multidimensional LFG architecture for the concepts of inputs, output candidates, faithfulness constraints, and markedness constraints in OT-LFG. Section 8 examines the problem of ineffability within this perspective, and proposes that markedness constraints expressing the correspondences between syntactic and semantic representations correctly derive at least some instances of ineffability without appealing to bi-directional optimization.

2 Inputs and output candidates

There are two intuitions about inputs and output candidates. One is based on performance, that is, the processes of language production and language comprehension. If we take this view, an input in expressive optimization is the pre-linguistic message in the mind of a speaker, and the output is the waveform that the speaker produces, with a production procedure deriving the output from the input. In interpretive optimization, the input would be the waveform, and the output, the message that a listener receives, a comprehension procedure deriving the output from the input. This would be the maximally global notion of input and output.

The other intuition, which we adopt in this paper, is based on competence, neutral to production and comprehension. Within the competence perspective, an input would be one aspect, or 'slice', of language structure, and the output would be another 'slice' that one can infer from the input. For the situations in which we take semantic representations as the input and syntactic representations as the output, there are two possible ways to view inputs:

(**1**) a. Given two linguistic signs (words, sentences, or texts) whose meanings are distinct within or across languages, their input representations must be distinct.

b. Given two constructions (classes of linguistic signs with shared form and meaning) whose meanings are distinct within or across languages, their input representations, must be distinct.

The examples in (2) bring out the difference in the implications of choosing between (1a) and (1b):

(**2**)	a.	i. Jay baked a shrimp.	ii. Jay broiled a shrimp.	iii. Jay bought a shrimp.
	b.	i. Jay baked a prawn.	ii. Jay broiled a prawn.	iii. Jay bought a prawn.
	c.	i. Jay baked a cow.	ii. Jay broiled a cow.	iii. Jay bought a cow.
	d.	i. Jay baked some/*a beef.	ii. Jay broiled some/*a beef.	iii. Jay bought some/*a beef.

In the above examples, the significant difference across the rows lies in the object: *shrimp*/*prawn*/*cow* vs. *beef*. The difference across the columns lies in the verb: *bake*, *broil*, and *buy*. Some of these differences, for instance, that between *bake* and *broil*, and between *shrimp* and *prawn*, are important for distinguishing between entities/events in the world, but not between different structures of the grammar. On the other hand, the meaning contrast between *bake* and *buy* is important also for distinguishing between different structures. For instance, *bake* and *broil*, unlike *buy*, allow resultatives.

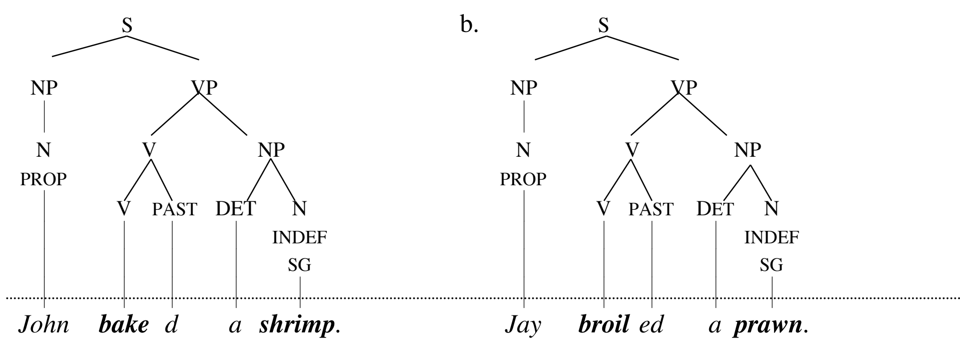
The position in (1a) would demand distinct semantic inputs for each of the examples in (2). In contrast, (1b) would assign the same input to (2ai, ii; bi, ii), as they do not express structurally distinct meanings. Based on the assumption that the grammatically relevant event structure of *bake* and *broil* is distinct from that of *buy*, (1b) would distinguish the input for (2ai, ii; bi, ii) from the input for (2aiii, biii). Likewise, since *shrimp*, *prawn*, and *cow* in (2a-c) are countable, unlike *beef* in (2d), (1b) would distinguish the input for (2a-c) from that for (2d).[1]

If two sentences have distinct meanings, the source of their difference may lie either in their structural meanings or their purely lexical meanings that are not structurally relevant. If two constructions have distinct meanings, the source of their difference must lie in their structural meanings. The choice of (1b), therefore, requires that structurally distinct meanings be represented in the semantic input, but not purely lexical meanings.

Adopting (1a) would entail inventing a universal set of semantic atoms capable of representing the meaning contrasts expressed by all the morphemes/words in all the human languages of all times. This demand is clearly too ambitious if not unrealistic. We therefore adopt the more modest version in (1b), which demands a universal set of semantic atoms capable of representing the meaning contrasts expressed by the grammatical constructions in all the human languages of all times.

Turning to output candidates, note that parallel remarks apply to them as well: the structural representations of (2ai, ii) and (2bi, ii) are non-distinct at the morphological and phrasal levels in terms of c-structure. Take (2ai) and (2bii) for illustration:

(**3**) a. b.



[1] Whether or not (2c) should be distinguished from (2a, b), i.e., whether or not *shrimp*/*prawn* are structurally distinct from *cow*, is an open question, which we will not address here.

(3a) and (3b) are non-distinct in terms of a-structure and f-structure as well. Thus, *John baked a shrimp* and *Jay broiled a prawn* have identical inputs, and identical optimal outputs. Distinctions in the material below the dotted line in (3) do not make for distinct output candidates.[2]

Now, if we accept position (1b), we must conclude that inputs and output candidates not linguistic signs; they are linguistic structures, each structure being instantiable by a number of linguistic signs. In other words, a linguistic structure may be thought of as representing a class of linguistic signs. When such a linguistic structure is multidimensional, and forms a unit that represents a class of linguistic signs, we refer to it as a construction.

While units like segment, syllable, foot, lexical category phrasal category, grammatical function, clause, semantic role, and event are representational units on a single dimension of representation, we view a construction as a representational unit that spans more than one dimension of representation. Intuitively, we may say that a construction is a complex unit that includes semantics and morpho-syntax, and can in principle include phonology as well. Terms like passive, noun incorporation, and cleft refer to categories of such units. From this point of view, we may say that mono-dimensional representational units like prepositional phrase and clause are constructional fragments. Like other complex representational units, the well-formedness of a construction is governed by constraints on linguistic representations. [3]

3 The input-output relation

Having said that inputs and output candidates are linguistic structures, we must ask: what is the relation between input and output representations? When trying to answer the question, however, it is important to also ask: "input and output for what purpose?" The output in OT phonology, for instance, would include phonological distinctive features, but the output in OT syntax has no need for phonological distinctive features. Likewise, inputs and outputs of OT pragmatics, OT sociolinguistics, and OT stylistics would differ from those of OT syntax.

The optimality-theoretic conception of grammar is that of the optimal pairing of meaning and form. Given this position, two alternative characterizations of output representations, as stated below, are possible:

(4) a. An output candidate in both expressive and interpretive optimization is a representation of both meaning and form.

b. An output candidate in expressive optimization is a representation of form alone, and in interpretive optimization is that of meaning alone.

---

2 This means that inputs and outputs in OT syntax do not contain the structurally irrelevant content of lexical morphs.

3 This notion of 'construction' is perhaps closest to that in Croft's (2001) radical construction grammar, even though embedded in a very different kind of syntactic theory. As we see it, the notion of construction in construction grammar (Fillmore et al. 1988, Goldberg 1995, Kay and Fillmore 1999, among others) is a way of welding together the general and the idiomatic (exceptional) in a seamless way. This conception includes language particular constructions such as the *let alone* and *What's X doing Y* constructions, and seems to be distinct from our notion, unless it includes universal constructions such as passive, causative, cleft, noun incorporation, and so on.

Taking expressive optimization as inferring form from meaning, and interpretive optimization as inferring meaning from form, we can schematize the pairing of form and meaning in (4a) and (4b) as (5a) and (5b) respectively:

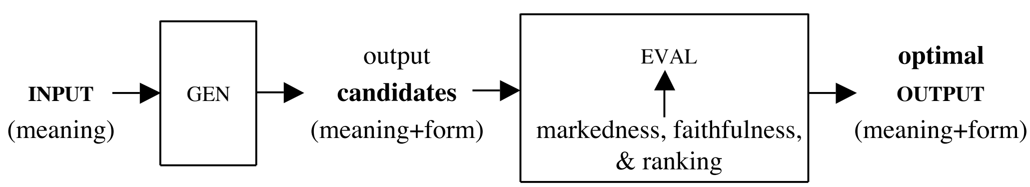
(**5**)

		input		output
a.	Expressive optimization (inferring form from meaning):	meaning	→	meaning / form
	Interpretive optimization (inferring form from meaning):	form	→	meaning / form
b.	Expressive optimization (inferring form from meaning):	meaning	→	form
	Interpretive optimization (inferring form from meaning):	form	→	meaning

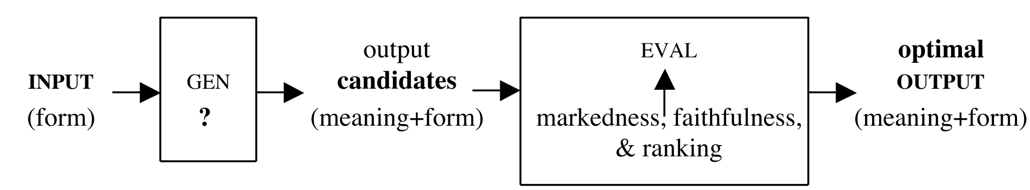
In (5a), an output candidate in expressive as well as interpretive optimization is a representation of both meaning and form. This is the conception of the relation between inputs and ouput candidates in OT-LFG (Bresnan 2000, Sells 2001a, b, Kuhn 2003). This view is also consistent with the Principle of Containment in OT phonology (McCarthy and Prince 2001), which states that an input representation is a proper subset of the output representation. Most analyses in phonology, however, adopt (5b) in practice, assuming that underlying representations are not contained in the output representations (in expressive optimization).

The idea that a grammar is a pairing between form and meaning is present in almost all models of generative grammar. But the architecture of the pairing varies from theory to theory. Given that the input is retained in the output in OT-LFG, the model that emerges from (5a) can be articulated as (6):

(**6**) a. Expressive optimization



b. Interpretive optimization



Given this model, *ineffability* can be characterized as the absence of an optimal output in expressive optimization, and *uninterpretability* as its counterpart, namely, the absence of an optimal output in interpretive optimization. In the same vein, *free variation* would be the presence of multiple optimal outputs for the same input in expressive optimization, and *ambiguity* the presence of multiple optimal outputs for the same input in interpretive optimization. *Optionality* then is simply a special form of free variation in which an element of representation in one optimal output is optionally absent in the other.

4 Multidimensionality of structure

Given (6), an input is a partial representation of a multidimensional structure, and an output candidate a fuller representation. This position allows us to view OT constraints as expressing a set of relations between different parts of an output representation (cf. HPSG: Pollard and Sag 1993). Now, what is the consequence of combining this idea with the idea of multidimensional (co-present) structures in the LFG architecture?

The major (not necessarily exhaustive) dimensions of information in grammar relevant for the pairing of form and meaning are the different aspects of form (PF) (including phonetic representation, underlying representation, morphs, word internal c-structure, and sentence level c-structure); the ‘syntax’ that mediates between form and meaning (including f-structure and a-structure); and the different aspects of meaning (LF) (including word internal semantics, sentence level semantics, discourse meanings). The table below summarizes these dimensions of structure:

(**7**) Multidimensionality of the structure of linguistic signs in LFG:

word/sentence/text	phonology	phonetic representation underlying representation
	syntax	c-structure f-structure a-structure
	semantics	sem-structure

The dimensions in (7) yield the following input-output relations in OT-LFG:

(**8**)

Input		Output		
lexical sem-structure	→	a-structure	+	lexical sem-structure
a-structure	→	a-structure	+	lexical sem-structure
a-structure	→	a-structure	+	f-structure
f-structure	→	a-structure	+	f-structure
f-structure	→	f-structure	+	phrasal sem-structure
phrasal sem-structure	→	f-structure	+	phrasal sem-structure
f-structure	→	f-structure	+	c-structure
c-structure	→	f-structure	+	c-structure

Implicit in (8) is the assumption that given any two dimensions of structure □ and □, we can take a to be the input and □+□ the output. The output representation includes the part contained in the input, as well as additional specifications.

In (8), the output representations contain multidimensional information, and the input-output relations involve a correspondence relation between two dimensions. Another possible relation between inputs and output candidates is one in which the input is an underspecified representation along the same dimension of representation as the fully specified output candidate. The examples in (9) illustrate the two kinds of input-output relations:

(**9**) a. Along the same dimension:

	input		output	
i)	[+nasal]	→	[+nasal, +son, +voice]	phonology
ii)	P, NP	→	P > NP	c-structure

b. Across dimensions:

i)	ARG_1, ARG_{-2}	→	ARG-1 ARG-2	a-structure
			SUBJ OBJ	f-structure
ii)	SUBJ, OBJ	→	SUBJ OBJ	f-structure
			NP	
			NP VP	c-structure
			S	

5 Choice of relevant candidates for a given semantic input

We have so far assumed that the input in global expressive optimization is the representation of meaning. Given a semantic input, how do we identify the competing output candidates that the analysis must consider? We suggest that these competing output candidates are the equivalent grammatical constructions provided by universal grammar as alternative expressive options that share the same core meaning. As an illustration, consider an analysis of the sentence in (10):

(10) *Jan sent Sue Eric Schlosser's 'Fast Food Nation.'*

Suppose we take the semantic structure in (11) as a core (but incomplete) input for (10) for the meaning-form mapping.

(**11**) Input representation for (10):

[x CAUSE [y MOVE-TOWARDS z]]

Given the representation in (11), we must consider at the least the following representations as output candidates. (In the examples in the right hand column, we use the abbreviation *FFN* for *Eric Schlosser's 'Fast Food Nation'* for convenience):

(**12**)

	<u>Output candidates</u>	<u>Examples</u>
a.	[x CAUSE [y MOVE-TOWARDS z]] [ARG$_X$ PRED ARG$_Y$ ARG$_Z$] [SUBJ$_X$ PRED OBJ$_Y$ OBJ$_Z$] [NP$_X$ > VERB > NP$_Z$ > NP$_Y$]	(*Jan sent Sue FFN*.)
b.	[x CAUSE [y MOVE-TOWARDS z]] [ARG$_X$ PRED ARG$_Y$ ARG$_Z$] [SUBJ$_X$ PRED OBJ$_Y$ OBL$_Z$] [NP$_X$ > VERB > NP$_Y$ > P > NP$_Z$]	(*Jan sent FFN to Sue*.)
c.	[x CAUSE [y MOVE-TOWARDS z]] [ARG$_X$ PRED ARG$_Y$ ARG$_Z$] [SUBJ$_X$ PRED OBJ$_Y$ OBL$_Z$] [NP$_X$ > VERB > P > NP$_Z$ > NP$_Y$]	(*Jan sent to Sue FFN*.)
d.	[x CAUSE [y MOVE-TOWARDS z]] [ARG$_X$ PRED ARG$_Y$ ARG$_Z$] [SUBJ$_X$ PRED OBJ$_Y$ OBL$_Z$] [NP$_Y$ > NP$_X$ > VERB > P > NP$_Z$]	(*FFN Jan sent to Sue*.)
e.	[x CAUSE [y MOVE-TOWARDS z]] [ARG$_X$ PRED ARG$_Y$ ARG$_Z$] [SUBJ$_X$ PRED OBJ$_Y$ OBL$_Z$] [NP > BE > NP$_Y$ > [NP$_X$ > VERB > P > NP$_Z$]]	(*It was FFN that Jan sent to Sue*.)
f.	[x CAUSE [y MOVE-TOWARDS z]] [ARG$_X$ PRED ARG$_Y$ ARG$_Z$] [SUBJ$_X$ PRED OBJ$_Y$ OBL$_Z$] [NP$_{\text{-wh}}$ > NP$_X$ > VERB > P > NP$_Z$] > BE > NP$_Y$]	(*What Jan sent to Sue was FFN*.)
g.	[x CAUSE [y MOVE-TOWARDS z]] [ARG$_X$ PRED ARG$_Y$ ARG$_Z$] [ADJCT$_X$ PRED SUBJ$_Y$ OBL$_Z$] [NP$_Y$ > VERB > P > NP$_Z$ > P > NP$_X$]	(*FFN was sent to Sue by Jan*.)
h.	[x CAUSE [y MOVE-TOWARDS z]] [ARG$_X$ PRED ARG$_Y$ ARG$_Z$] [SUBJ$_X$ PRED OBJ$_Y$ OBJ$_Z$] [NP$_X$ > VERB > NP$_Y$ > NP$_Z$]	(* *Jan sent FFN Sue*.)

i. [x CAUSE [y MOVE-TOWARDS z]]
[ARG_X PRED ARG_Y ARG_Z]
[$SUBJ_X$ PRED OBJ_Y OBJ_Z]
[NP_X > NP_Y > NP_Z > VERB] (* *Jan FFN Sue sent*.)

j. [x CAUSE [y MOVE-TOWARDS z]]
[ARG_X PRED ARG_Y ARG_Z]
[$SUBJ_X$ PRED OBJ_Y OBJ_Z]
[NP_X > NP_Z > NP_Y > VERB] (* *Jan Sue FFN sent*.)

Of these, English selects options in (a–g) as optimal candidates, disallowing those in (h-j). Given that the input in (11) corresponds to multiple optimal outputs (12a-g), if (11) were a complete input, (12a-g) must be free variants. However, we know that the meanings of these candidates are structurally distinct. Hence, they must be conditioned by additional semantic, pragmatic, or discourse specifications in the input.

If we accept this position, we must look for a systematic explanation for when each of these candidates gets chosen as the optimal output in an OT analysis. This naturally involves adding further specifications to the core meaning in (11), in order to narrow down the set of optimal candidates. Take, for instance, the addition of 'TOPIC' and 'FOCUS' to (11), yielding (13a) and (13b), which would then also be part of the output representation:

(**13**)	Input	Illustration for optimal output
a.	x CAUSE [y_{TOP} MOVE-TOWARDS z]	*FFN Jan sent to Sue.*
b.	x CAUSE [y_{FOC} MOVE-TOWARDS z]	*It was FFN that Jan sent to Sue.*

Given (13a), the optimal candidate would be (12d), and given (13b), the optimal candidates would be (12e) and (12f). To distinguish between (12e) and (12f), we need to identify the semantic distinction between clefts and pseudo-clefts. Suppose we use the diacritics FOCUS-C and FOCUS-P to distinguish between the meaning of clefts and that of pseudo-clefts, and distinguish their respective inputs as in (14):

(**14**) a. x CAUSE [$y_{FOC\text{-}C}$ MOVE-TOWARDS z] *It was FFN that Jan sent to Sue.*

b. x CAUSE [$y_{FOC\text{-}P}$ MOVE-TOWARDS z] *What Jan sent to Sue was FFN.*

Assuming that *wh-* questions also involve FOCUS, the input in (14a) does not distinguish between clefted and unclefted *wh*-questions. A possible solution would be to assume the input in (15a) for *wh*-questions (unclefted), and that in (15b) for clefted *wh*-questions. Needless to say, the semantic substance of the diacritic features FOCUS-C, FOCUS-P, and FOCUS-WH would need to be spelt out in a theory of grammatical semantics:

(**15**) a. x CAUSE [y MOVE-TOWARDS z] *What did Jan send to Sue?*
FOC- WH

b. x CAUSE [y MOVE-TOWARDS z] *What was it that Jan sent to Sue?*
FOC- C-WH

If we assume that actives and passives are distinct at the level of sentence or discourse semantics in that, say, the passive has the feature □, more fully specified input representations would be those in (16):

(**16**) a. x CAUSE [y MOVE-TOWARDS z] *FFN was sent to Sue (by Jan).*
□

b. x CAUSE [y MOVE-TOWARDS z] *Sue was sent FFN (by Jan).*
□

If the agent is truly optional in the passive, the meanings of the passive with and without an overt agent would be identical. If the two passives are not free variants, they call for further input specifications. We would need a similar strategy of further input specification to make distinctions such as that between theme-passive and goal-passive, between dative and non-dative, and so on. If the theory does not permit free variation, we would need to find a semantic distinction between datives with and without heavy NP shift as well.

To summarize, the discussion above shows the competing output candidates that must be considered in an OT analysis of a sentence in expressive optimization are the equivalent grammatical constructions provided by universal grammar as alternative options that express the core meaning of the sentence. Given (11) as the core meaning of *Jan sent 'FFN' to Sue*, the competing alternatives would include (12a-j). Adding further specifications to the core meaning of the input narrows down the set of optimal output(s).

6 Representing syntactic input in expressive optimization

We have said that if two competing constructions have distinct meanings, they are not free variants, as they have distinct semantic, discourse, or pragmatic inputs. What would be the nature of inputs in expressive optimization for two competing constructions which are free variants, in a theory that permits free variation?

For the purposes of illustration, let us assume that the dative shift construction does not involve a meaning contrast. If so, the input in (11), repeated as (17), yields as free variants (18a) with a goal-OBJ, and (18b) with a goal-OBL:

(**17**) [x CAUSE [y MOVE-TOWARDS z]]

(**18**) a.
[x CAUSE [y MOVE-TOWARDS z]]
[ARG_X PRED ARG_Y ARG_Z]
[$SUBJ_X$ PRED OBJ_Y OBJ_Z]
Jan sent FFN to Sue.

b.
[x CAUSE [y MOVE-TOWARDS z]]
[ARG_X PRED ARG_Y ARG_Z]
[$SUBJ_X$ PRED OBJ_Y OBL_Z]
Jan sent Sue FFN.

The input in (17) yields (18a, b) as optimal outputs in the mapping from sem-str to f-str. We take it that (18a) and (18b) are now the more articulated inputs in the mapping from f-str to c-str; they determine the choice between (12a) and (12b). This implies a chain of local input-output relations internal to the grammar, as illustrated in (19):

(**19**)

input		output	input		output
sem-structure a-structure	→	sem-structure a-structure f-structure	sem-structure a-structure f-structure	→	sem-structure a-structure f-structure c-structure

Even if the constructions exemplified by *Jan sent Sue FFN*, and *Jan sent FFN to Sue* were free variants in the a-structure to f-structure mapping, they are not free variants in the f-structure to c-structure mapping.

In the examples in (11)-(19), we abstracted away the specifics of the instantiation of grammatical constructions from the specifics of the lexical items. Thus, (12a) is instantiated not only by *Jan sent Sue FFN*, but also by (20a-d).

(**20**) a. *Mary bought Sue a bunch of flowers.*
b. *Mary bought Sue a bunch of roses.*
c. *Ella bought Lee a bunch of pink flowers.*
d. *Ella bought Lee a bunch of purple flowers.*

While it may be possible to develop a universal framework of semantic representations and a set of constraints to choose between competing constructions instantiated by [*x give y to z*], [*x send y to z*], and [*x buy y for z*], trying to develop a theory of semantic representations and constraints to choose between (20c) and (20d) would be an unrealistic goal.

If we think of language as providing a set of options for the expression of meanings, we may distinguish two kinds of options as in (21), namely, lexical options and grammatical options. Among grammatical options, there are those offered by grammatical morphs on the one hand ('morphic' in the table), and by grammatical structures on the other. Structural options could be either paradigmatic or constructional.

(**21**)

<table>
<tr><td rowspan="4">Options provided by a language</td><td colspan="3">lexical</td><td>e.g., pink vs. purple</td></tr>
<tr><td rowspan="3">grammatical</td><td colspan="2">‘morphic’</td><td>e.g., to vs. from</td></tr>
<tr><td rowspan="2">structural</td><td>paradigmatic</td><td>e.g., PAST vs. PRES</td></tr>
<tr><td>constructional</td><td>e.g., cleft vs. non-cleft</td></tr>
</table>

Except for grammatical items (e.g. *to* vs. *for, -ed* vs. *–es*, *may* vs. *can*), a grammar is concerned with types (classes), not tokens (instantiations of the classes). This means that the aspect of semantics relevant for OT syntax is grammatical semantics, not truth conditional semantics. To exemplify, clefts and non-clefts are distinct in grammatical semantics, but not necessarily so in truth-conditional semantics. Conversely, (20c) and (20d) are distinct in truth-conditional semantics, but not in grammatical semantics.

7 Faithfulness, markedness, and cross-dimensional correspondences

Recall that the input-output relation can be viewed either as in (5a), where the input representation is contained in the output representations, or as (5b), where the input and output representations are distinct. As illustrated in (9a, b), constraints may hold either on a single dimension of representation, or on the mapping between two (or more) dimensions. Given the OT-LFG position in (5a), and the multidimensional structure of output candidates sketched in the preceding sections, we are now ready to ask: what is the nature of faithfulness and markedness constraints in OT-LFG?

Faithfulness constraints are conventionally assumed to hold between input and output representations. However, given that input representations are part of the output representations ((5a)), this is not necessary: faithfulness constraints may be viewed as expressing default correspondences between different dimensions of language structure within output representations. The consequence of this result, as also suggested by Vikner (2001), is that the concept of input representations is redundant in the theoretical model: it is only a convenient descriptive term useful for the exigencies of computation.

As for markedness constraints, it is clear that at least some of them hold on a single dimension. The question then is, can markedness constraints also be multidimensional? Standard OT phonology, taking the position in (5b), disallows multidimensional markedness constraints, allowing only faithfulness to constrain the pairing between underlying and phonetic representations. However, versions of OT syntax that subscribe to (5a) do not forbid markedness constraints holding on the correspondence between different structural dimensions. Yet, even in these versions of OT syntax, the problematization of ineffability appears to imply a prohibition against multidimensional markedness constraints.

Interestingly, multidimensional constraints are present in classical LFG. Some of them may be viewed as GEN constraints in OT-LFG, while others will have to be treated as markedness constraints. Take, for instance, consistency and function-argument bi-uniqueness conditions that express the correspondences between a-structure and f-structure. These are generally taken to be inviolable constraints, and hence would be GEN constraints. In contrast, annotation constraints that express the correspondences between f-structure and c-structure, if taken as universal constraints, are necessarily violable in that the f-structure/c-structure pairings obeyed in one language need not hold in another. In classical LFG, annotations are assumed to be part of language-particular phrase structure rules. Since OT-LFG disallows language particular rules, the substance of annotations must be expressed as markedness constraints holding on the relation between f-structure and c-structure.

If both faithfulness and markedness constraints are violable, and markedness constraints may be either unidimensional or multidimensional, faithfulness constraints become a special kind of multidimensional markedness constraints — those that express context-free, default corres-pondences between two dimensions of representation.

8 Ineffability

We are now ready to address the so-called ineffability problem. Ineffability is the phenomenon of a meaning expressible in one language being inexpressible (ineffable) in another. It is a problem in OT because of the assumption that given any input, there must be a winning candidate. To address this problem, it would be useful to begin by clarifying the nature of the problem.

Notice that ineffability is a problem only in the context of an expectation of effability:

(**22**) The meaning expressed by every linguistic sign in one language is expressible by a sign in every language.

That the meaning expressed by a word in a particular language can be expressed in another by using a sentence (with multiple embedding), or that the meaning expressed by a single clause in one language can be expressed in another by a paragraph, is not an interesting claim. The question is: is the claim of effability tenable if formulated as in (23)?

(**23**) The meaning expressed by a linguistic sign in one language is expressible by an **equivalent** sign in every language.

To see if this expectation is tenable, we must clarify the concept of equivalent signs. Let us say that two signs are equivalent if they belong to the same level in the hierarchy of units. Thus, two affixes are equivalent, but not an affix and a poly-morphemic word. Two words are equivalent, but not a word and a sentence, or a phrase and a paragraph. A single clause is not equivalent to a multi-clausal sentence. Going back to the typology of the expressive options outlined in (21), we may break up the substance of (23) as follows:

(**24**) a. Effability of content morphemes: the meaning expressed by a content morpheme in one language is expressible by a content morpheme in every language.

b. Effability of grammatical morphemes: the meaning expressed by a grammatical morpheme in one language is expressible by a grammatical morpheme in every language.

c. Paradigmatic effability: the meaning expressed by a member of a paradigm in one language is expressible by the member of a paradigm in every language.

d. Constructional effability: the meaning expressed by a grammatical construction in one language is expressible by a grammatical construction in every language.

Each of these claims is false. Take the trivial case of the effability of content morphemes. English expresses a lexical contrast between the concepts of red vs. orange, mass vs. weight, and phonology vs. phonetics; Malayalam does not. English has morphemes that express the concepts of quark, monotonic, and gene; Malayalam does not. That this type of ineffability exists is uncontroversial. Clearly then, the claim in (24a) is false. It is also uninteresting.

What about the effability of grammatical morphemes? Malayalam expresses a contrast between two kinds of reflexives. One, *taan* 'self', is non-clause-bounded, and requires the antecedent to be a logophoric center. The other, *swa-* 'self', is clause-bounded (except in the subject position), and has no logophoricity effects. They also express distinct meanings as possessors. This contrast between reflexives is ineffable in English. English has a prefix *re-* (e.g., *rearrange)* that expresses the meaning of an EVENT resulting in a STATE, a distinct token of which (state) existed prior to the event. Malayalam does not have such an affix. Hence, the claim in (24b) is also false.

As for paradigmatic effability, we observe that Malayalam expresses a three-way tense contrast, PAST, PRESENT, and FUTURE, in terms of three distinct verbal affixes, while English distinguishes only between PAST and NON-PAST in terms of verbal affixes, not FUTURE. Such examples show that (24c) is also false.

Finally, take constructional ineffability. The semantic distinction expressed by clefts and pseudo-clefts in English is not available in Malayalam. Conversely, the meaning of *I know the boy who$_i$ Mary was reading a book when —$_i$ came in.* is expressible as a relative clause in Malayalam and Hindi, but not in English. Hence, (24d) is false as well.

The essence of the problem of ineffability in OT is that the expectation of constructional effability does not hold. Is constructional ineffability a design problem that calls for bi-directional optimization, or is it a pseudo-problem, a phenomenon that can be readily captured in terms of multidimensional markedness constraints in expressive optimization? To address this question, let us look at some more examples from the perspective of constructional effability.

As shown by the alternation between *The jar broke,* and *Max broke the jar,* a verb in English can express the meaning: [x CAUS [y GO TO STATE]]:

(**25**)	a.	[y GO TO STATE]	b.	[x CAUS [y GO TO STATE]]	sem-structure
		VERB		VERB	c-structure

However, a verb in English cannot express the meaning: [x CAUSE [y ACT ON z]], unlike verbs in many other languages:

(**26**)	a.	[y GO TO STATE]	b.	[x CAUS [y ACT ON z]]	sem-structure
		VERB		VERB	c-structure

Furthermore, a single verb in English or in Malayalam cannot be associated with a bi-clausal f-structure, unlike in languages like Japanese:

(**27**)	a.	[… PRED …]	b.	[… PRED … [… PRED …]]	f-structure
		VERB		VERB	c-structure

(28) and (29) below give examples from Malayalam and Japanese respectively of verbs in these languages that express the meaning in (26b). A Japanese example instantiating (27b) is given in (29bii) below:

(**28**) a. (i)

ani	*swantam*	*uuññaalil*	*aaTi.*
Ani-N	self's	swing-L	swing-PAST

Ani$_k$ swung in self's$_k$ swing. (self = Ani/*someone else)

(ii)

uma	*aniye*	*swantam*	*uuññaalil*	*aaTTi.*
Uma-N	Ani-A	self's	swing-L	swing-CAUS-PAST

Uma$_j$ swung Ani$_k$ in self's$_{j/*k}$ swing. (self = Uma/*Ani/*someone else)

(iii)

amma	*umayekkoNTə*	*aniye*	*swantam*	*uuññaalil*	*aaTTiccu.*
mother-N	Uma-INST	Ani-A	self's	swing-L	swing-CAUS-CAUS-PAST

Mother$_i$ made Uma$_j$ swing Ani$_k$ in self's$_{i/*j}$ swing.

(self = Mother/*Uma/*Ani/*someone else)

b. (i)

ani	*awaLe*	*nuLLi.*
Ani-N	she-A	pinch-PAST

Ani$_k$ pinched her$^*{}_k$. (her = someone else/*Ani)

(ii)

uma	*aniyekkoNTə*	*awaLe*	*nuLLiccu.*
Uma-N	Ani-INST	she-A	pinch-CAUS-PAST

Uma$_i$ made Ani$_j$ pinch her$_{*i/*j}$. (her = someone else /*Uma/*Ani)

Evidence from disjoint reference, reflexive binding, and control above shows that causatives in Malayalam are mono-clausal in f-structure (K P Mohanan 1983, T Mohanan 1988). Evidence from disjoint reference and reflexive binding below shows that causatives in Japanese are bi-clausal in f-structure (Kuno 1973, Farmer 1980, Dalrymple 1982), while evidence from scrambling and the double *–o* constraint shows that they are mono-clausal in c-structure (i.e., associated with a single S/IP node):

(**29**) a. (i) *John-ga* *zibun-o* *tsuner-ta.*
John-NOM self-ACC pinch- PAST
John$_j$ pinched self$_j$. (self = John/*someone else)

(ii) *Bill-ga* *John-ni* *zibun-o* *tsuner-ase-ta.*
Bill-NOM John-DAT self-ACC pinch-CAUS-PAST
Bill$_i$ made John$_j$ pinch self$_{i/j}$. (self = John/Bill/*someone else)

b. (i) *John-ga* *kare-o* *tsuner-ta.*
John-NOM he/she-ACC pinch- PAST
John$_j$ pinch him$_{*j}$. (him = someone else/*John)

(ii) *Bill-ga* *John-ni* *kare-o* *tsuner-ase-ta.*
Bill-NOM John-DAT he/she-ACC pinch-CAUS-PAST
Bill$_i$ made John$_j$ pinch him$_{*i/*j}$. (him = someone else/*John/*Bill)

In the light of the examples in (28)-(29), we can restate the generalizations about (23)-(25) as (30):

(**30**) a. The meaning of [x CAUSE [y ACT UPON z]] is expressible as a morphological causative construction with a mono-clausal c-structure in Malayalam and Japanese, but not in English.

b. The meaning of [x CAUSE [y ACT UPON z]] is expressible as a morphological causative construction with a bi-clausal f-structure in Japanese, but not in Malayalam or English.

The generalizations in (30) call for the multidimensional constraints in (31): [4]

(**31**) a. Lexical Causative-transitive Constraint: * [x CAUSE [y ACT ON z]] sem-str
|
VERB c-str

b. Lexical Bi-clausality Constraint: * [… PRED …[… PRED …]] f-str
|
VERB c-str

[4] These constraints are similar in spirit to the LCS/c-structure isomorphism and f-structure/c-structure isomorphism constraints in Broadwell (2003).

Constraint (31a) is violated in Malayalam and Japanese, but not in English; constraint (31b) is violated in Japanese, but not in English and Malayalam. These effects would follow from the ranking of these constraints as in (32):

(32)	Constraint ranking:	English:	(39a), (39b) >> Faith-CAUS
		Malayalam:	(39b) >> Faith-CAUS >> (39a)
		Japanese:	Faith-CAUS >> (39a), (39b)

These rankings correctly predict that a verb that expresses the causative of a transitive should be impossible in English, and so should a verb that is associated with a bi-clausal f-structure. The latter should be impossible in Malayalam. Both such verbs are permitted in Japanese.

To summarize, the ineffability effects in (30) follow from the multidimensional markedness constraints in (31), and their ranking in (32). In short, at least some instances of constructional ineffability can be derived without bi-directional optimization, if the theory permits markedness constraints to constrain the pairing between syntactic structure and semantic structure.

9 Concluding remarks

In this paper, we have examined input and output representations, and faithfulness and markedness constraints in OT from the perspective of the multidimensional architecture of LFG, in order to look for a solution to the problem of ineffability. There are at least three alternative assumptions about the representation of global inputs in expressive optimization in OT-LFG:

(**33**) a. underspecified f-structure with an a-structure skeleton (Bresnan 2000, Sells 2001a, b, Kuhn 2003), corresponding to an underspecified d-structure in GB/Minimalism (Grimshaw 1997, Legendre et al 1998);

b. fully specified semantic representation sufficiently detailed to express the semantic contrasts among lexical items (morphemes) (corresponding to deep structure in generative semantics).

c. underspecified semantic representation carrying the semantic information that interacts with syntax and morphology, but not detailed enough to express the semantic contrasts among lexical items, corresponding to the combination of underspecified lexical semantics and LF without the traces in GB/Minimalism, and to Grammatical Semantics (Mohanan and Wee 1999, and the references therein).

We have adopted (33c) in our discussion in this paper. By a way of additional support for (33c), notice that (33a) fails to express the typological variation in the syntactic realization of core meanings. Take the semantic (event structure) information [X CAUS [Y CAUS [Z BECOME OPEN]]] (e.g., *Ann made May open the door*.) In a language like Malayalam, it is realized syntactically as a single f-structure predicate with x, y and z as co-arguments ((26)). The English counterpart has two f-structure predicates, with x as an argument of the matrix predicate, and y and z as arguments of the embedded predicate. Unlike Malayalam, English does not allow a single f-structure predicate associated with two units of CAUSE ((31b)). If input representations in expressive optimization are to encode the meanings that underlie typological distinctions in syntactic realizations, then (33a) is inadequate. (33b) is overambitious. If input information is represented in terms of a universal inventory, a framework of semantic representations rich enough to express the meaning contrasts even in a restricted semantic domain, say, the names of flowers, would be an unrealistic goal.

Accepting (33c) has a number of interesting consequences for OT-LFG. First, consider the following assumption in OT:

(**34**) Given an input, universal constraints and their language particular ranking yield the optimal output.

If we accept (33c), then (34) leads to the conclusion that the output candidates in OT-LFG are not *sentences* with their lexical items, but *constructions* of which sentences are tokens: we cannot deduce the lexical items in a sentence from an abstract grammatical semantic representation that does not carry the semantic contrasts necessary to distinguish one lexical item from another, whether within or across languages.

Second, the output constructions (the candidates) that OT-LFG grammars evaluate are multidimensional structures. The constraints on the output would then contain *wellformedness constraints* internal to a given dimension of representation, and *correspondence constraints* that express the relations between different dimensions of representation in a construction. Given this position, faithfulness constraints may be viewed as a special type of markedness constraints.

Third, (33c) commits OT-LFG to developing a framework of grammatical semantic representations to account for the choice from among competing constructions such as those in (12a-j).

Finally, OT-LFG is committed to providing an account of grammatical ineffability, but not lexical ineffability. If we allow markedness constraints on the correspondence between semantic and syntactic representations, as in (31a, b), grammatical ineffability can be accounted for without appealing to bi-directional optimization that involves structure change of meanings in the course of optimization.

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THE SYNTAX AND SEMANTICS OF TENSED NOMINALS

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Abstract

Sadler and Nordlinger (2001) provides a descriptive overview of the phenomenon of *independent* nominal tense, whereby tense marking on a nominal temporally situates the nominal itself, independent of the tense of the proposition. In this paper we build on this descriptive work by exploring the lines along which an LFG analysis might be developed of the syntax and semantics of different types of nominally-scoped tense marking attested in a range of languages. While the analysis of independent nominal tense is relatively straightforward in LFG, it interacts in interesting ways with the encoding of possession, and with the use of nominals as predicates of verbless clauses, having implications for the f-structure analyses of these aspects of linguistic structure.

1 Introduction

Pretheoretically, we may distinguish two different functional types of nominal tense marking:[1]

(i) *Independent* nominal tense, where a dependent nominal is temporally located independently of the tense of the proposition, and

(ii) *propositional* nominal tense, where the tense marking on the nominal encodes the tense for the whole proposition, and the nominal may be either a dependent of the clause or the clausal predicate in a verbless construction (see Nordlinger and Sadler 2000 and in press for discussion and analysis).

Sadler and Nordlinger (2001) provides a descriptive overview of the phenomenon of *independent* nominal tense. In this paper we build on this descriptive work by exploring the lines along which an LFG analysis might be developed of the syntax and semantics of different types of nominally-scoped tense marking attested in a range of languages. While the analysis of independent nominal tense is relatively straightforward in LFG, it interacts in interesting ways with the encoding of possession, and with the use of nominals as predicates of verbless clauses, having implications for the f-structure analyses of these aspects of linguistic structure.

This paper is structured as follows. In section 2 we briefly recap our analysis of *propositional* nominal tense, since this will inform our account of the *independent* type and our treatment of nominal predicates later in the paper. In 3 we propose an analysis of independent nominal tense which captures the similarites between this and propositional tense marking – both on nouns and verbs. Then in section 4 we discuss the more complex interaction between independent nominal tense and possession. Finally, in section 5 we turn to the interaction between these two types of nominal tense, considering languages which allow ‘tense stacking’, whereby a single nominal can be inflected with both independent and propositional tense simultaneously.

[1] Both of these subtypes can be found on non-nominal elements such as determiners or adjectives but we are not concerned with those cases in the present paper. Our analysis extends to cover them without further modification.

2 Propositional nominal tense

2.1 Nominal predicates

Propositional tense (and aspect or mood) marking on nominal predicates arises in languages that allow nominals to take the same TAM markers as verbs when functioning as clausal predicates. Languages with this type of nominal TAM inflection include Abaza (O'Herin 1995, cited in Baker 2003:51), Mwotlap (François 2003), Tundra Nenets (Salminen 1997), Turkish (Lehmann and Moravcsik 2000:742), Tzutujil (Daley 1985, cited in Baker 2003:51), Bininj Gun-wok (Evans in press), amongst others. We discuss this phenomenon in relation to Bininj Gun-wok.

In Bininj Gun-wok (non-Pama-Nyungan, Australia) predicate nominals (including those in 'adjective' function) are inflected for a subset of the regular verbal TAM markers: the past imperfective (which in this context simply marks past tense) and the irrealis mood marker (Evans in press). Consider the following examples:[2]

(1) *Mayh na-mekke nakka bininj-ni.*
bird MASC-DEM MASC.DEM human-PAST
'Those birds, they were human then,' (Evans in press:680, 13.27b)

(2) *Na-mak-ni.*
MASC-good-PAST
'He was a good man.' (ibid:682, 13.37c)

(3) *Yawkyawk bokenh na-wu bene-berd-djenj-ni yimankek*
young.girl two MASC-REL 3.DU-tail-fish-PAST CTRFAC
kun-dad-niwirrinj.
NEUT-leg-IRR
'There were two young girls who had tails like fish, they didn't have legs.' [lit. 'there were no legs'] (ibid:437, 8.96)

There is limited discussion in the LFG literature of the analysis of verbless sentences such as these (although see Rosén (1996) and the discussion of adjectival predicates in Butt et. al. (1998:113-5)). In LFG terms, one of the primary issues is whether the nominal's f-structure is identified with the clausal f-structure, or whether the predicate nominal has a grammatical function in the f-structure licensed by some 'dummy' clausal PRED (see Rosén (1996)). In Bininj Gun-wok, there is no empirical evidence for a verbal head for these constructions, thus we propose that the nominal in these constructions is the clausal predicate itself. This analysis is supported by the fact that the nominal is inflected with the propositional tense/mood marking which is otherwise found on verbs, but not on nominals which are arguments or adjuncts of other (verbal) heads. Thus, we represent (1) as (4):

[2] CTRFAC = counterfactual, IRR = irrealis, MASC-DEM = masculine demonstrative, MASC-REL = masculine relative pronoun.

(4)
$$\left[\begin{array}{ll} \textsc{pred} & \text{`}\textsc{human}\ \langle\ (\textsc{subj})\rangle\text{'} \\ \textsc{tense} & \textsc{past} \\ \textsc{topic} & [\ ] \\ \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{`}\textsc{bird}\text{'} \\ \textsc{spec} & \textsc{dem} \\ \textsc{gen} & \textsc{masc} \end{array}\right] \end{array}\right]$$

The f-descriptions associated with the tense-inflected nominal are given in (5). We assume that the option for a nominal to behave predicatively and subcategorize for a subject is effected via a lexical rule (or its equivalent).

(5) *bininj-ni*:
$(\uparrow \textsc{pred}) = \text{`}\textsc{human} < (\uparrow \textsc{subj}) >\text{'}$
$(\uparrow \textsc{tense}) = \textsc{past}$

2.2 Dependent nominals

In some languages dependent (argument or adjunct) nominals can also carry propositional tense. We will illustrate this phenomenon here with examples from Sirionó, a Tupí-Guaraní language from Bolivia (Firestone 1965:24-38). Other languages with this type of nominal tense/aspect/mood marking include Chamicuro (Arawak) (Parker 1999), Kayardild (non-Pama-Nyungan) (Evans 1995), Gurnu (Pama-Nyungan) (Wurm and Hercus 1976), Pitta Pitta (Pama-Nyungan) (Blake 1979), Supyire (Niger-Congo) (Carlson 1994). A full LFG analysis of this phenomenon can be found in Nordlinger and Sadler (in press).

In Sirionó, propositional TAM affixes expressing tense and aspect can appear either on the verb, or on a dependent nominal, or be distributed over both. The example (6) shows the tense and aspect markers on the verb; (7 and 8) show tense and aspect (respectively) on a nominal dependent (here the subject); and (9) shows the aspect marker appearing simultaneously on both the verb and a nominal argument.

(6) *Áe ií osó-ke-rv.*
he water go-PAST-PERF
'He went to the water.'

(7) *Ési-ke óso ñá ií-ra.*
woman-PST go near water-to(LOC)
'The woman went near the water.'

(8) *Ęy̨gvtý̨į-rv b̨áe b̨y̨kiacą́ą.*
tapir-PERF thing steal.not
'The tapir did not steal from others.'

(9) *Áe osó-ke-rv ií-rv.*
he go-PAST-PERF water-PERF
'He went to the water.'

These tense/aspect markers are also used with nominal predicates, as in Bininj Gun-wok (but recall that Bininj Gun-wok, unlike Sirionó, limits nominal TAM affixation to predicate nominals):

(10) *Ñéd̡a-he-rae.*
road-REFL-FUT
'It will be a road'

(11) *Kib̡áe-rv.*
man-PERF
'It was a man'

Thus, in Sirionó a TAM-inflected nominal such as *kib̡áe-rv* 'man-PERF' is syntactically systematically ambiguous: it may be the predicate of the clause or be a dependent of a verb-headed clause. In either case the TAM is propositional (referring to the clause as a whole). To account for these different uses, we take it that the lexical descriptions associated with the morphological TAM features are as follows, using constructive morphology (Nordlinger 1998).

(12)
Past: $(((\textsc{gf})\uparrow)\ \textsc{tense}) = \textsc{past}$
Perf: $(((\textsc{gf})\uparrow)\ \textsc{aspect}) = \textsc{perf}$
Fut: $(((\textsc{gf})\uparrow)\ \textsc{tense}) = \textsc{fut}$

When attached to a (nominal or verbal) predicate the morphological feature simply specifies TAM information (e.g. $(\uparrow\ \textsc{tense}) = \textsc{past}$); when attached to a dependent nominal, it also constructs a grammatical function (e.g. $((\textsc{gf}\uparrow)\ \textsc{tense}) = \textsc{past}$). General principles of completeness and coherence will ensure that these are the only grammatical possibilities.

The following simplified f-structures illustrate these two possibilities:

(13) a. *Kib̡áe-rv.*
man-PERF
'It was a man'

b. $$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{man}\ \langle(\textsc{subj})\rangle\text{'} \\ \textsc{aspect} & \textsc{perf} \\ \textsc{subj} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{pro}\text{'} \end{bmatrix} \end{bmatrix}$$

(14) a. *Ési-ke óso ñá ií-ra.*
woman-PST go near water-to(LOC)
'The woman went near the water.'

b. F-structure for *ési-ke* 'woman-PST':
$$\begin{bmatrix} \textsc{tense} & \textsc{past} \\ \textsc{gf} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{woman}\text{'} \end{bmatrix} \end{bmatrix}$$

3 Independent nominal tense

In many languages argument and adjunct nominals may be inflected for tense independently of the tense of the proposition, which is separately expressed. In such languages, it is clear therefore that the domain of tense marking is not always that of the clause. In this section we exemplify this phenomenon using the Arawak language Tariana (Aihkenvald 2003); other languages with this type of nominal tense marking include Halkomelem (Salish) (Galloway 1983), Iate (Macro-Jê) (Lapenda 1968), Kwakw'ala (Northern Wakashan) (Anderson 1985), Nambiquara (Lowe 1999), Potawatomi (Central Algonquian) (Hockett 1958:238), Somali (Cushitic) (Lecarme 1996, 1999).

Consider the following examples from Tariana (taken from Aikhenvald 2003). Examples (15) and (16) exemplify the use of the past tense marker on the nominal stems *eta-* 'eagle' and *panisaru-* 'abandoned village' respectively. Examples (17) and (18) show the nominal stems *unyane-* 'flood' and *kaɾe-* 'wind' inflected with the nominal future tense marker.[3]

(15)	*thepi*	*di-maɾe-pidana*	*eta-miki-ɾi-nuku.*
	to.water	3SG.NF-throw.CAUS=REM.P.REP	eagle-PST-NF-TOP

'He threw the remains of the eagle (lit. the 'ex-eagle', what used to be the eagle) into water.'

(16)	*pi-ɾuku*	*pi-uka*	*hĩ*	*panisaru-miki-ɾi-naku*
	2SG-come.down	2SG-arrive	DEM:ANIM	abandoned.village-PST-NF-TOP
	piɾa	*pi-katha-nha.*		
	2SG.order	2SG-vomit-IMP		

'When you come to an abandoned ex-village, order (him) to vomit.'

(17)	*kayu-maka*	*hĩ*	*waɾipeɾe*	*unyane-pena*	*di-kakwa-pidana.*
	SO-AFF	DEM:ANIM	Walipere	flood-FUT	3SG.NF-plan=REM.P.REP

'Thus Walipere was planning the future flood.'

(18)	*kaɾe-pena-ne*	*hĩ*	*kaɾe*	*di-eku*	*di-a.*
	wind-FUT-FOC	DEM:ANIM	wind	3SG.NF-arrive	3SG.NF go

'The one who was going to become the wind, this wind, arrived.'

In terms of the semantics, we argue that the range of cases of overt nominal tense morphology provides strong support for the position that nominals across all languages must be viewed as being (potentially independently) temporally located and containing a temporal argument in their logical structure (Enç 1986, Hinrichs 1988, Lecarme (1996, 1999), Tonhauser 2002). We therefore take it that nominal lexemes are associated with a temporal variable as shown schematically in (19):

(19) 'flood': flood(x, t_e)

On this view, in a language with independent nominal tense, the tense morphology operates in much the same way as verbal tense morphology does with verbs, to fix the interpretation of the nominal's temporal argument in relation to speech time, as shown schematically in (20).

[3]Non-obvious abbreviations include: DEM:ANIM 'animate demonstrative', FOC 'focused subject', NF 'non-feminine', REM.P.REP 'remote past tense, reported evidentiality', TOP 'topical non-subject'.

(20) 'flood-FUT': flood(x, t_e) & $t_s < t_e$

Note that the presence of overt nominal tense morphology shows that the temporal location of nominals is not always contextually fixed (as is the usual assumption in the literature based on languages like English), but can be specified morphologically as well.

In terms of the syntax, we need first to establish that this tense distinction is an inflection which encodes a morphosyntactic TAM distinction, rather than a derivational lexeme-forming process, as with English 'ex-' ('ex-partner', 'ex-boss', etc.). In the latter case the PRED value of the tense-marked nominal may be 'FUTURE-FLOOD'; in the former case we would expect the tense value to be present in the nominal's f-structure.

There are several reasons for thinking that the role of nominal tense marking is inflectional in these languages, rather than lexeme-creating. Firstly, the process shows a very high level of productivity: in these languages nominal tense morphology can occur on virtually any noun. Derivational affixes like 'ex-' in English, on the other hand, (see also Joseph (1979) on Cree) are much more restricted in the set of nominal stems they occur with (e.g. 'ex-partner',' wife-to-be', but not ?'ex-eagle', ?'ex-pencil', ?'storm-to-be'). Secondly, and perhaps most significantly, independent nominal tense marking in these languages appears to be functionally or semantically equivalent to tense marking on verbs, providing strong motivation for the presence of a nominal TENSE feature at f-structure, on analogy with the standard treatment of verbal tense. In fact, in some languages the same affixes are used to mark independent nominal tense as are used with verbs in regular clausal tense functions (see Jarawara below). Thirdly, in many languages independent nominal tense forms portmanteaux with other inflectional categories such as number, possession and definiteness, which is quite natural if they form part of the inflectional morphology but quite unnatural otherwise. Finally, in some cases, independent nominal tense morphology participates in morphosyntactic agreement (e.g. Somali adjectives agree with nominal heads in gender and tense, see Lecarme (1996:4, 1999:343) for details). In the light of these considerations we conclude that nominal tense marking in the languages which we are concerned with is indeed an inflectional process and should be represented in the f-structure of the nominal.

We therefore propose that in languages with independent nominal tense such as Tariana, *dependent* nominal f-structures also have their own TENSE attribute, distinct from the TENSE attribute of the verbal f-structure. The f-descriptions associated with the tense markers in Tariana are given in (21). That these markers are essentially functionally equivalent to regular tense marking on verbs is captured by the fact that they contribute tense information parallel to regular verbal tense marking.[4]

[4]Note that, according to Aikhenvald's description, *miki-ri* actually encodes non-feminine gender, rather than specifically masculine gender. For ease of exposition however, our representation is simplified in this respect, since a full analysis of the gender system is orthogonal to the interests of this paper.

(21)

Fut (*-pena*):	(↑ TENSE) = FUT
Past+Masc+Sg (*-miki-ɾi*):	(↑ TENSE) = PAST (↑ NUM) = SING, (↑ GEN) = MASC
Past+Fem+Sg (*-miki-ɾu*):	(↑ TENSE) = PAST (↑ NUM) = SING, (↑ GEN) = FEM
Past+Pl (*-miki*):	(↑ TENSE) = PAST (↑ NUM) = PLUR

The (simplified) f-structure for (17) is given in (22):

(22)

$$\begin{bmatrix} \text{PRED} & \text{`PLAN}\ \langle(\text{SUBJ})\ (\text{OBJ})\rangle\text{'} \\ \text{TENSE} & \text{REMPAST} \\ \text{EVID} & \text{REP} \\ \text{OBJ} & \begin{bmatrix} \text{PRED} & \text{`FLOOD'} \\ \text{TENSE} & \text{FUT} \end{bmatrix} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{`WALIPERE'} \\ \text{PER} & 3 \\ \text{GEN} & \text{MASC} \\ \text{NUM} & \text{SING} \end{bmatrix} \end{bmatrix}$$

On the proposal that we have made here, independent nominal tense markers such as those in Tariana are identical (in terms of the f-structure information they contribute) to regular verbal tense, and propositional tense on nominal predicates in languages such as Bininj Gun-wok (section 2.1). If this is so, then we might expect to find a language in which a single set of TAM markers can have all of these functions. This is precisely what we find in Jarawara (Arawá) (Dixon, MS).[5] In the following Jarawara sentences, (23) illustrates the use of the masculine gender tense and evidentiality markers in propositional function on a verb, (24) illustrates the same markers in propositional function on a predicate nominal, and (25) illustrates the use of the feminine gender equivalents[6] to independently temporally locate the nominal itself.

(23) *jama tii ne-mata-mona*
thing(f) cut AUX-FPnm-REPm
'He was said to have cut the things' (Dixon MS:10.58)

(24) *Kimi-mata-mona-ka*
Kimi.-FPnm-REPm-DECm
'It is said to have been Kimi.' (Dixon MS:10.58)

(25) *Mee tabori-mete-mone jokana boto joro ni-kimi-ne-ke*
3nsg home(f)-FPnf-REPf real clearing(f) sit(du) AUX-TWO-CONTf-DECf

[5] Non-obvious abbreviations used in the glosses (retained from the original) are: DEC 'declarative mood', f 'feminine gender', FP 'far past', m 'masculine gender', n 'non-eyewitness', REP 'reported evidentiality'.

[6] We were not able to find equivalent tense/evidentiality examples in the source that used the masculine gender forms. Presumably this is simply as accidental gap.

'The two clearings of their reported past villages are there.' (Dixon MS:10.67)

The multifunctionality of this single set of tense/evidentiality markers follows naturally from the analysis of nominal tense outlined above. Since propositional tense markers on nominal predicates (section 2.1) and independent tense on nominal dependents (see above) are given the same formal analysis as propositional tense on verbs, it is quite natural that the same set of forms may be used in all three functions.

4 Independent nominal tense and possession

Particularly interesting issues concerning the syntax and semantics of independent nominal tense marking arise in languages in which nominal tense interacts with possession within the noun phrase. In the languages which we examine, the possessor (as well as tense marking) is encoded morphologically on the noun. The following examples are from Guaraní, a Tupi-Guaraní language (Gregores & Suárez 1967:127):

(26) *h-óga-kwé*
his-house-PST
'his former house'

(27) *h-emi-.apò-rā̃*
his-work-FUT
'his future work'

Nouns such as these are actually ambiguous between two readings, corresponding to the two semantic predicates with respect to which the tense marker may logically be interpreted. The nominal in (26), for example, can mean either 'my thing which used to be a house (e.g. it has burned down)', in which the property of being a house is located in the past and the tense marker is interpreted with respect to the nominal itself; or it can mean 'the house which used to be mine (but now belongs to somebody else)', in which the possession relation is located in the past, and the tense marker is not interpreted with respect to the nominal 'house' itself. The question therefore arises as to how these two readings are to be captured.

On standard assumptions, and ignoring for the moment the matter of the f-structure representation of nominal tense, (26) would be associated with the single f-structure shown in (28).

(28) 'his-house-PST'

$$\left[\begin{array}{ll} \text{PRED} & \text{`HOUSE}\ \langle(\text{POSS})\rangle\text{'} \\ \text{POSS} & \left[\begin{array}{ll} \text{PRED} & \text{`PRO'} \\ \text{PRES} & 3 \\ \text{GEND} & \text{MASC} \\ \text{NUM} & \text{SG} \end{array}\right] \end{array}\right]$$

The first possibility is that the tense feature occurs in either the f-structure of the nominal or the f-structure of the possessor, that is, that the two f-structures below correspond to the two readings of the Guaraní (26).

(29) 'his-house-PST'

$$
\text{(a)}\ \left[\begin{array}{ll}
\textsc{pred} & \text{`}\textsc{house}\ \langle(\textsc{poss})\rangle\text{'}\\
\textsc{tense} & \textsc{past}\\
\textsc{poss} & \left[\begin{array}{ll}
\textsc{pred} & \text{`}\textsc{pro}\text{'}\\
\textsc{pres} & 3\\
\textsc{gend} & \textsc{masc}\\
\textsc{num} & \textsc{sg}
\end{array}\right]
\end{array}\right]
\qquad
\text{(b)}\ \left[\begin{array}{ll}
\textsc{pred} & \text{`}\textsc{house}\ \langle(\textsc{poss})\rangle\text{'}\\
\textsc{poss} & \left[\begin{array}{ll}
\textsc{pred} & \text{`}\textsc{pro}\text{'}\\
\textsc{tense} & \textsc{past}\\
\textsc{pres} & 3\\
\textsc{gend} & \textsc{masc}\\
\textsc{num} & \textsc{sg}
\end{array}\right]
\end{array}\right]
$$

But this does not appear to be correct. If the TENSE attribute is taken to temporally locate the time of the predication indexed by the PRED value of its f-structure, then (29a) temporally locates the 'house' predication in an appropriate fashion, but (29b) would appear to temporally locate the 'PRO' predication of the possessor. That is, we might expect it to correspond to a reading in which the "he" is deceased. But crucially, this is *not* the second reading which is present in the ambiguous (26) and (27). To clarify, we can distinguish in principle between three separate readings for an NP such as *the boy 3-house*-PAST 'the boy's house', as follows:

(30) (i) the house which was formerly possessed by the boy

(ii) the thing possessed by the boy which was formerly a house

(iii) the canoe possessed by what was formerly a boy

The Guaraní examples, as far as we are aware, exhibit an ambiguity between the first pair of readings only. We have no information on how the third readng would be encoded, but since it is a logically distinct reading, it seems undesirable to adopt the f-structure shown in (29 b) for the different reading in (30 ii).

So, how is the reading in (30 ii) to be captured? The difficulty here occurs because the possessive relation is not conventionally taken to correspond to a predicate at all in f-structure, and hence there is no appropriate predicate for the TENSE feature to temporally locate. We might therefore consider an alternative in which the possessive relation *is* in fact represented by means of a predicate at f-structure. This would amount to positing an abstract possessive PRED for the POSS f-structure: the two readings of (26) would then be (31a,b).

(31) a. 'his-house-PST' temporally locating the nominal

$$
\left[\begin{array}{ll}
\textsc{pred} & \text{`}\textsc{house}\ \langle(\textsc{poss})\rangle\text{'}\\
\textsc{tense} & \textsc{past}\\
\textsc{poss} & \left[\begin{array}{ll}
\textsc{pred} & \text{`}\textsc{poss-reln}\ \langle(\textsc{subj})\rangle\text{'}\\
\textsc{subj} & \left[\begin{array}{ll}
\textsc{num} & \textsc{sg}\\
\textsc{pred} & \text{`}\textsc{pro}\text{'}\\
\textsc{per} & 3\\
\textsc{gen} & \textsc{masc}
\end{array}\right]
\end{array}\right]
\end{array}\right]
$$

b. 'his-house-PST' temporally locating the possession relation

$$\begin{bmatrix} \textsc{pred} & \text{`}\textsc{house}\ \langle(\textsc{poss})\rangle\text{'} \\ \textsc{poss} & \begin{bmatrix} \textsc{pred} & \text{`}\textsc{poss-reln}\ \langle(\textsc{subj})\rangle\text{'} \\ \textsc{tense} & \textsc{past} \\ \textsc{subj} & \begin{bmatrix} \textsc{num} & \textsc{sg} \\ \textsc{pred} & \text{`}\textsc{pro}\text{'} \\ \textsc{per} & 3 \\ \textsc{gen} & \textsc{masc} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

On this view, the nominal tense marker would contribute the following (disjunctive) f-description:

(32) PST:
$(\uparrow (\textsc{poss})\ \textsc{tense}) = \textsc{past}$

While this approach would work formally, it is potentially problematic in that it represents quite a radical departure from standard approaches to the syntax of possession.

However, recent work on the nature of possession (Barker 1997, Laczkó 2000) suggests an alternative way in which the temporal specification of possessed nominals can be accommodated without such a radical departure from standard syntactic assumptions. Building on previous work (outside the LFG framework) by Barker, Laczkó argues that possessive nouns should be analysed as a type of complex predicate, subcategorising a (standard) nominal POSS function, and corresponding to a conjunction of elementary predications in the semantics, as shown schematically in (33), where π denotes the possessive relation.

	surface form:	POSS-house
(33)	*semantics:*	house(x) & π(x, y)
	f-descr:	$(\uparrow \textsc{pred})$ = 'house-π <$(\uparrow \textsc{poss})$ >'

This analysis of possession thus provides two distinct elementary predications in the semantics which are available for temporal location by nominal tense marking. Laczkó's analysis can be straightforwardly combined with the proposal in section 3, that extends the occurrence of temporal arguments beyond the domain of verbal predications. Our proposal is that both of the elementary predications in (33) should be replaced by logical forms which involve additional temporal arguments: house(x,t_e) & π(x, y,t_{e1}). On this view, (34) would be the lexical information associated with the fully inflected 'his-house-PAST'. We do not spell out the process of semantic composition here, but we assume that the past tense marker is free to situate either event variable t_e or t_{e1} with respect to speech time.

	surface form:	'his-house-PAST':		
	semantic form	house(x, t_e) & π(x, y, t_{e1}) & [$t_e < t_s \vee t_{e1} < t_s$]		
(34)	*f-descr:*	$(\uparrow \textsc{pred})$ = house-π <$(\uparrow \textsc{poss})$ >		
		$(\uparrow \textsc{tense}) = \textsc{past}$	$(\uparrow \textsc{poss}) = \downarrow$	$(\downarrow\textsc{pred})$ = '$\textsc{pro}$'
		$(\downarrow\textsc{gen}) = \textsc{masc}$	$(\downarrow\textsc{per}) = 3$	$(\downarrow\textsc{num}) = \textsc{sing}$

In summary, each elementary predication has a temporal event variable. The possessive morphology introduces a possession relation into the semantics. A nominal with possessive morphology has a PRED value which reflects the addition of a possessor argument. The tense morphology situates an event variable: in the case of Guaraní possessed nominals it can situate either the temporal event variable of the nominal, or that of the possession predication.

In terms of f-structure, the tense marking contributes a TENSE attribute to the nominal f-structure, and the possessive marking contributes a POSS attribute. Hence both of the readings of the Guaraní nominal in (26) correspond to the same f-structure (35); the ambiguity is dealt with in the semantics, rather than in the syntax.

(35)
$$\begin{bmatrix} \text{PRED} & \text{`HOUSE-}\pi \ \langle \ (\text{POSS})\rangle\text{'} \\ \text{TENSE} & \text{PAST} \\ \text{POSS} & \begin{bmatrix} \text{PRED} & \text{`PRO'} \\ \text{NUM} & \text{SG} \\ \text{PER} & 3 \\ \text{GEN} & \text{MASC} \end{bmatrix} \end{bmatrix}$$

An interestingly differently situation arises in Hixkaryana (a Carib language of Brazil), in which nominal tense is expressed with a series of portmanteau tense/possession nominal suffixes. In this case, the intepretation possible is that the tense temporally locates the possessive relation itself, rather than the property denoted by the nominal (Derbyshire 1979:99).

(36) *ɾo-kanawa-ɾɨ*
1-canoe-POSSD
'my canoe'

(37) *ɾo-kanawa-tho*
1-canoe-POSSD.PST
'the canoe that used to be mine'

We assume that nominal predications in general will always have a temporal variable, and thus Hixkaryana does not differ from Guaraní in this respect. Rather, the difference lies only in the semantic effect of the tense marking. In Guaraní, the tense marker can situate either the temporal event variable of the nominal or of the possessive relation. In Hixkaryana, on the other hand, it obligatorily situates that of the possessive relation. This is shown in (38), which provides the lexical entry and f-structure for (37). Note that the f-structure is the same as in the corresponding Guaraní; it is only the semantics that differs.

(38) a. Hixkaryana: 1-canoe-POSS.PST:
canoe(x, t_e) & π(x, y, t_{e1}) & $t_{e1} < t_s$
$(\uparrow \text{PRED}) = \text{canoe-}\pi < (\uparrow \text{POSS}) >$
$(\uparrow \text{TENSE}) = \text{PAST}$

b. F-structure of (37):

$$\left[\begin{array}{ll} \text{PRED} & \text{`CANOE-}\pi \ \langle\ (\text{POSS})\rangle\text{'} \\ \text{TENSE} & \text{PAST} \\ \text{POSS} & \left[\begin{array}{ll} \text{PRED} & \text{`PRO'} \\ \text{NUM} & \text{SG} \\ \text{PER} & 1 \end{array}\right] \end{array}\right]$$

One might wonder why there is this difference between Guaraní and Hixkaryana. We have no real answer to this question, although it is possible that it is related to the fact that the expression of tense and possession are portmanteau in Hixkaryana, so that only possessed nominals are tense-bearing. [7]

5 Tense stacking

We have distinguished two different syntactic analyses of nominal tense marking. In one case the tense marker functions identically to tense on verbs, contributing a TENSE attribute to the f-structure of the nominal (39). In the other, the tense marker provides a tense feature for the f-structure *outside* of that of the nominal to which is it attached (40).

(39) Past: $(\uparrow \text{TENSE}) = \text{PAST}$
(e.g. Bininj Gun-wok (sect. 2.1); Tariana, Jarawara (sect. 3); Guaraní, Hixkaryana (sect. 4))

(40) Past: $((\text{GF} \uparrow)\ \text{TENSE}) = \text{PAST}$
(e.g. Sirionó (sect. 2.2), also Kayardild, Lardil, Pitta Pitta, Chamicuro (see Nordlinger and Sadler in press))

A obvious question is whether it is possible to have both types of nominal tense marking in a single language on a single nominal. In fact, this is found in both Tariana (41) and Guaraní (42), both languages which use a different set of affixes for independent nominal tense and propositional tense (on verbs and (predicate) nominals).

(41) *Pi-ya-dapana-miki-ɾi-naka.*
2 SG -POSS-house-PST-NF-PRES.VIS
'This is what used to be your house (I can see it).' (Aihkenvald 2003)

(42) *Che-roga-rã-ta*
1SG-house-FUT$_x$-FUT$_y$
'It will be my future house.' (Dagmar Jung, pc)

[7]Anette Frank points out that our analysis presents a third logical possibility; namely that there could be a language otherwise like Guaraní, but where the nominal tense marking can only situate the *nominal* predication and not the possession relation. That is, languages in which 'POSS-house-PAST' can only mean 'thing belonging to x which was once a house', and not 'house which used to belong to x'. This type of language essentially restricts the two readings of Guaraní in the opposite way that Hixkaryana does. We have as yet found no examples of such a language, but leave this as an open question for future research.

These examples from Tariana and Guaraní are very similar in that each one involves a nominal predicate in a type of ascriptive verbless clause. The presence of the propositional tense marker outside of the independent nominal tense marker in these examples suggests that the nominal predicate in these languages has a grammatical function in the clause, rather than serving as the predicate directly (as in Bininj Gun-wok in section 2.1 above). Otherwise, in the case of a nominal such as (41), we would have a clash of tense features in the f-structure of the nominal. If the propositional tense marker is constructive however, as in Sirionó (40), the tense markers provide information about different f-structures and such a feature clash is avoided. This is shown by the (partial) f-structure for (41) in (43):[8]

(43) a. PST-NF: $(\uparrow \text{TENSE}) = \text{PST}$

b. PRES.VIS: $((\text{GF} \uparrow)\ \text{TENSE}) = \text{PRES}$

c. f-structure:
$$\left[\begin{array}{ll} \text{TENSE} & \text{PRES} \\ \text{GF} & \left[\begin{array}{ll} \text{PRED} & \text{`HOUSE}\langle(\text{POSS})\rangle\text{'} \\ \text{TENSE} & \text{PST} \\ \text{POSS} & \left[\begin{array}{ll} \text{NUM} & \text{SG} \\ \text{PER} & 2 \\ \text{PRED} & \text{`PRO'} \end{array}\right] \end{array}\right] \end{array}\right]$$

Furthermore in Tariana, as in Sirionó, the propositional tense marker can appear on dependent nominals also, thus providing further support for the analysis above in which the propositional tense constructs a GF for the nominal to which it is attached. Aikhenvald (2003) states that the propositional tense/evidentiality marker in Tariana appears on any focused constituent in the clause, including dependent nominals:

(44) *Kayu-maka diha nawiki-nha ñamu na-nite*
SO-AFF he person-PAUS evil.spirit 3 PL .say-TOP.ADV+CL:ANIM
nawiki-miki-ɾi-mha.
person-PST-NF-PRES.NONVIS
'So this man called evil spirit ñamu, they say he is the one who used to be a person (lit. he is an 'ex-person').'

(45) *Naha-se-pidana na-inu di-na iniri-nuku*
they-CONTR-REM.P.REP 3pl-kill 3pl-OBJ traira-TOP
'They killed the traira fish.'

The tense stacking examples in Tariana and Guaraní show that, in these languages, nominals predicates are the value of a GF within the clause, as shown in (43 c). We follow Butt et. al. (1999) in assuming that this GF is the syntactically

[8]For simplicity, we have only represented the tense information in the following f-descriptions, and not additional information such as gender and evidentiality. Such information can be incorporated with no impact on the analysis presented.

closed function labelled PREDLINK.[9] For present purposes we assume that a dummy clausal predicate is contributed by the propositional marker itself in these constructions. Thus, the lexical f-descriptions for the tense markers, and the full f-structure for (41) is shown in (47).[10]

(46)

$$\begin{array}{lll} \textsc{pst-nf}: & (\uparrow \textsc{tense}) = \textsc{pst} & \\ \textsc{pres.vis}: & ((\textsc{gf} \uparrow)\ \textsc{tense}) = \textsc{pres} & \\ & ((\textsc{gf} \uparrow)\ \textsc{pred}) = \text{`be } \langle(\uparrow \textsc{subj}), (\uparrow \textsc{predlink})\rangle\text{'} & \\ & (((\textsc{gf} \uparrow)\ \textsc{subj pred}) = \text{`}\textsc{pro}\text{'} & \end{array}$$

(47)

$$\left[\begin{array}{ll} \textsc{tense} & \textsc{pres} \\ \textsc{pred} & \text{`}\textsc{be}\ \langle(\textsc{subj})(\textsc{obj})\rangle\text{'} \\ \textsc{subj} & \left[\textsc{pred}\ \ \text{`}\textsc{pro}\text{'}\right] \\ \textsc{predlink} & \left[\begin{array}{ll} \textsc{pred} & \text{`}\textsc{house}\langle(\textsc{poss})\rangle\text{'} \\ \textsc{tense} & \textsc{pst} \\ \textsc{poss} & \left[\begin{array}{ll} \textsc{num} & \textsc{sg} \\ \textsc{per} & 2 \\ \textsc{pred} & \text{`}\textsc{pro}\text{'} \end{array}\right] \end{array}\right] \end{array}\right]$$

On this analysis, the fact that the propositional tense marker in Guaraní constructs a clausal predicate when attached to nominals accounts for the absence of this marker on dependent nominals in verb-headed clauses (since there would then be two clausal PRED values). To account for the occurrence of these affixes with dependent nominals in Tariana, we assume that this part of the f-description is optional in this language.

[9] As noted by Rosén (1996), analyses of these clause types in the LFG literature differ as to whether such predicative complements correspond to open or closed functions at f-structure. Andrews (1982), for example, treats them as having the open function NCOMP, while Grimshaw (1982) takes NCOMP to be a closed function. Here we adopt the closed function view of predicative complements, and we adopt the label PREDLINK for this function (following Butt et. al. (1998)), given that NCOMP is often used as an open function label.

[10] Notice that a (potential) disadvantage of the open function (XCOMP) view is that it would involve the f-structure of the predicate nominal containing both a POSS and a SUBJ, as shown in (1).

(1)

$$\left[\begin{array}{ll} \textsc{tense} & \textsc{pres} \\ \textsc{pred} & \text{`}\textsc{be}\langle(\textsc{subj})(\textsc{xcomp})\rangle\text{'} \\ \textsc{subj} & \left[\textsc{pred}\ \ \text{`}\textsc{pro}\text{'}\right] \\ \textsc{xcomp} & \left[\begin{array}{ll} \textsc{pred} & \text{`}\textsc{house}\langle(\textsc{subj}),\ (\textsc{poss})\rangle\text{'} \\ \textsc{tense} & \textsc{pst} \\ \textsc{subj} & [\,] \\ \textsc{poss} & \left[\begin{array}{ll} \textsc{num} & \textsc{sg} \\ \textsc{per} & 2 \\ \textsc{pred} & \text{`}\textsc{pro}\text{'} \end{array}\right] \end{array}\right] \end{array}\right]$$

6 Conclusion

Using a very straightforward syntactic analysis we have shown how a wide range of nominal tense data can be naturally captured in the LFG framework. Moreover, the different types of nominal tense – (i) propositional tense on nominal predicates, (ii) propositional tense on dependent nominals, (iii) independent tense on dependent nominals – are given a *unified* syntactic analysis. The differences between them arise from interactions with the language's tense system as a whole, the semantics of the tense marker itself, and the syntactic function of the nominal to which the tense marker is attached.

A mini-typology of the nominal tense possibilities discussed in this paper, the analysis provided for them and the languages in which they occur is provided in Table 1.

Table 1: Summary of Nominal TAM possibilities

	DEPENDENT NOM.	PREDICATE NOM.
A: (↑ TENSE)	Tariana, Jarawara and Guaraní (sect. 3) Hixkaryana (sect. 4)	Bininj Gun-wok (sect. 2.1), Sirionó (sect. 2.2), Jarawara (sect. 3)
B: ((GF ↑) TENSE)	Sirionó (sect. 2.2) Tariana (sect. 5)	Guaraní, and Tariana (sect. 5)

Notes:

- Bininj Gun-wok and Sirionó don't have A markers on dependents, since in these languages the semantics of tense is necessarily propositional.
- Tariana and Guaraní don't have A markers on predicates since these tense markers in these languages are semantically *not* propositional.
- Guaraní has no B markers on dependent nominals as these necessarily construct a clausal predicate in this language (this is only optional in Tariana).

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Differential Possessor Expression: Are Pair-Wise Comparisons Ever Required?

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Abstract: Accounts of clause-level phenomena such as inversion and obviation (Aissen 1997, 1999) make crucial reference to the relative ranking of two arguments, subject and direct object, on a person/animacy/discourse hierarchy. Are such pair-wise comparisons ever required within the NP? O'Connor (1999a,b) proposed an analysis of NP-internal case-marking of possessors in Northern Pomo that paralleled Aissen's analyses of clause-level phenomena. An OT analysis employing harmonic alignment and local conjunction yielded universal constraints on pairings of possessor and possessum, ranked on a hierarchy of NP form (pronoun, proper, common). This paper proposes an alternative analysis of the Northern Pomo data, one that does not require universal constraints on the NP forms of pairs of possessors and possessa. In this reanalysis, I find evidence of another parallel between the clausal and NP levels of structure: absence of case-marking on possessors of kinship nouns in Northern Pomo is explainable as a result of functional uniqueness: kinship stems display an obligatory pronominal prefix that acts as an incorporated pronoun, fulfilling the possessor argument requirement of the kinship stem and blocking the possibility of a case-marked possessor inside the possessive NP. This parallels clause-level subject pronominal incorporation in Chichewa (Bresnan & Mchombo 1986). Finally, pair-wise comparisons are shown to figure in yet another kind of differential possessor expression: the phenomenon of 'genitive promotion' as described in Nez Perce (Rude 1986b).

1. Introduction

In many languages there are at least two constructions available for the expression of possession and related semantic functions. The contrast between the English Saxon genitive (*the ship's captain)* and the "of" genitive (*the captain of the ship*) is a well-known case in point, but many Indo-European and non-Indo European languages display what I will call "differential possessor expression" (DPE). A survey of the factors determining speakers' choice of construction in languages with DPE leads quickly to an obvious question. Is the choice between constructions a function of some feature of the possessive modifier (*the ship*) or the possessum (*the captain*) or of some relation between the two? In the case of the English alternation, at least some analysts have proposed that the choice is determined by the relative animacy of possessor and possessum (Hawkins 1981, Taylor 1996, Anschutz 1997). In other words, the choice is determined not by simple specification of feature values for one argument, but by a pair-wise comparison of the head (possessum) and modifier (possessor).

This question is of interest beyond explorations of differential possessor expression. Some recent work in clause-level typology formalizes grammatical options that crucially refer to pair-wise comparisons of arguments. For example, in studies of obviation and inversion (Aissen 1997, 1999), an adequate description of the phenomenon in question must make crucial reference to the *relative* status of two arguments with respect to some feature. For example, in Nocte inversion (as described by Delancey (1981)), an inverse marker on the verb is triggered when the direct object argument outranks the subject argument in the person hierarchy 1>2>3. In obviation systems, the argument marked 'proximal' outranks obviative arguments in terms of discourse prominence (a feature that must be further defined within the specific language). In phenomena such as these, morphosyntactic marks (such as verbal inflection, case-marking, or other devices) indicate a departure from the unmarked values for animacy and/or discourse status, as proposed early on by Silverstein (1976). For obviation and inversion, in Aissen's analysis, a pair-wise comparison is necessary: e.g. in Nocte, not all 3rd person subjects trigger inversion marking; only those that appear with 1st or 2nd person objects.

In contrast, there are morphosyntactic alternations that are triggered by the values of animacy or discourse features in only one argument, not a pair. For example, in differential object marking (DOM; Aissen 2001, building upon Bossong 1985), direct objects receive case-marking based not on their status relative to the subject, but on an absolute criterion level of definiteness, animacy, specificity, etc.

Do these same kinds of morphosyntactic alternations, reflecting markedness values, occur within the noun phrase? Structural and semantic parallels between the noun phrase and the clause have been pursued in various ways for decades (Chomsky 1970, Jackendoff 1977, Abney 1987, Bernstein 2001), with many citing an explicit parallel between the clausal subject and the prenominal modifier, the 'subject' of the NP. However, with the exception of Aissen 1997, little work has been done on the parallels between clauses and NPs with respect to the workings of the person/animacy hierarchy and its reflection in morphosyntax.

What would such parallels between the clause and the NP look like? At the clausal level, choice of inverse or direct verbal marking requires us to consider the relative status of subject and direct object. If indeed choice of possessor construction requires that we consider the relative status of possessor and possessum, and if indeed the possessor parallels the subject in outranking other grammatical functions inside its domain, then we might expect to find languages in which a possessor that is lower in animacy than the possessum head would receive morphosyntactically marked expression. We might also expect to find cases in which the relative discourse status of possessor and possessum would play a role in speakers' choice of expression.

On the other hand, clause-level phenomena like DOM require that the status of only one argument be compared to a criterion level on some scale, e.g. animacy or specificity or definiteness. If differential possessor expression is like differential object marking, it may be that the only relevant consideration is the status of the possessor argument on a person or animacy or discourse status scale: morphosyntactic choices would depend only on the features of the possessor.[1]

In any case, the topic holds potential descriptive and theoretical interest. An exploration of morphosyntactic alternations at the NP level may show Aissen's clause-level proposals to be of even greater general interest. On the other hand, if no such pair-wise comparisons are found to be necessary at the NP level, we will potentially have learned something of interest about differences between nominal and clausal structures and functions. Finally, there are implications for theory-internal issues in Optimality Theory, the framework within which Aissen has formalized the clause-level grammatical phenomena mentioned above. The OT constraints that Aissen uses to select among candidates in the cases of inversion and obviation must represent the required pair-wise comparisons. Because constraints proposed in OT analyses have the status of universals, these constitute a claim about typological parameters of variation.

In the remaining sections of this paper I will consider the question posed in the title, presenting data from two Native American languages that appear to require pair-wise comparisons of the head and modifier nominals. The first set of data are from Northern Pomo, an indigenous language of Northern California. In O'Connor 1999a and 1999b I argued that the correct analysis of case-marking data within possessive NPs in Northern Pomo required a set of

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[1] Some semantic features of the possessum (head of the NP) may play a role in choice of expression, most prominently *relationality*, as suggested by Barker (1995). Mirto (1998) considers the broader relation of *meronymy*, which is grounded in the semantics of the head. However, virtually all proposed explanations that focus on *animacy* or *discourse* features consider only the possessor or pair-wise comparisons of possessor and possessum. Initial corpus-based study of approximately 7,000 examples (O'Connor et al. 2004) has shown little evidence that animacy features of the possessum drive the choice of expression.

pair-wise comparisons, comparisons that could be rendered within an OT analysis using harmonic alignment and local conjunction, following Aissen's general approach. Here, I will question whether in fact pair-wise comparisons are really required in this case. I will then present data from Nez Perce (taken from Rude 1986b and presented in O'Connor & Deal 2003) that do seem to require pair-wise comparisons. Tentative implications for noun phrase typology follow in the conclusion.

2. Descriptive preliminaries

The Northern Pomo case-marking system includes a number of complexities (see O'Connor 1992 for details), but for current purposes it is necessary to mention only the following: there are five basic declension classes of nominals, and three case categories. which for convenience will here be called "Nominative," "Accusative" and "Genitive."

Table 0. Case declension classes, Northern Pomo

	1. Pronoun	**2. Proper Noun**	**3. Kinship Noun**	**4. Common N Animate**	**5. Common N Inanimate**
Nominative	-Ø and suppletive	-Ø	-Ø	=ya?	=ya? (agentive only)
Accusative	-al and suppletive	-<u>th</u>uh	-al	-Ø and =yajul	-Ø
Genitive	-a? and suppletive	-wi?	-a?	-Ø and =yaju?	-Ø

In Northern Pomo, prototypical alienable possession (i.e. possession by humans of alienable objects) is expressed by genitive case appearing on the possessor. The possessum head appears to the right and the entire phrase may be case-marked in accord with its role in the clause.[2]

Table 1. Canonical expression of prototypical possession, Northern Pomo

Possessor Nominal Class	**English Gloss**	**Northern Pomo**
Local Pronoun	'my basket'	ke pik'a *1s.Gen basket*
3rd prs. Pronoun	'her basket'	ma:d -a? pik'a *3sf. -Gen basket*
Proper Noun	'Mary's basket'	me:di =wi? pik'a *Mary =Gen basket*
Common Noun	'the woman's basket'	ma:<u>th</u>a-nam=yaju? pik'a *woman-Det=Gen basket*

Notice that although the realization of genitive case morphology varies across nominal class (including suppletive, suffixal, and clitic case-marking), morphosyntactic expression of human possessors and inanimate possessa is uniform across those classes: the genitive case, whatever its specific form, marks the possessor, and the possessum is not inflected. The morphosyntax

[2] Morphosyntactic expression of human body part possession in Northern Pomo may follow the pattern in Table 1 or may call for external possession (sometimes called 'possessor raising'). The semantic and pragmatic factors determining this choice are discussed at length in O'Connor 1996 and will not bear on the current analysis.

associated with prototypical alienable possession is the unmarked or canonical form of possession in Northern Pomo.

Restrictions on inanimate possessors When we look at the entire range of possible possessor-possessum combinations, however, attempting to find all combinations of animacy and expression type, we find a number of combinations that cannot be expressed using this canonical form of possession. In English, inanimate nouns may display canonical possessor marking in many circumstances: part/whole (*the car's windshield*), intrinsic property (*the shirt's color*), etc. Inanimates may grammatically 'possess' animates: *the city's mayor*. Northern Pomo does not allow inanimate possessors, even of other inanimates. That is, genitive case may not appear on inanimate nouns in the target semantic relations, even when the 'possessor' is specific and definite as indicated by the specifier <u>=nam</u> (i.e. it is not in a generic kind modification relation, e.g.: *a pine tree root*). To convey the meaning provided in the English translation in (1), speakers use a non-case-marked form of the possessor.

(1) jom xale =nam yem English translation: 'the grey pine tree's root'
grey.pine tree =Spec. root

Is this restriction morphological or semantic in nature? Careful readers will have noted that the fifth declension class, inanimate nouns, displays no forms for Accusative or Genitive case. This suggests that the constraint is simply an epiphenomenon: gaps in the paradigm. However, speakers have more options than Table 0 suggests. They may cliticize a pronoun to a definite and specific expression of any nominal declension class (2-5 in Table 0). In this way even inanimates may be case-marked. Examples in (2) illustrate this strategy: the inanimate demonstrative pronoun <u>mil</u> heads phrases that are objects of postpositions:

(2a) lamesa =nam =mil diyi
table =Spec =Dem.Gen next.to
'next to the table'

(2b) pik'a =nam =mil dake
basket =Spec =Dem.Gen about
'[talk] about the basket'

However, this strategy is not available for would-be inanimate possessors: NPs denoting specific inanimate referents may not display the pronominal genitive case to mark possessor status (2c), but must instead either appear unmarked, as in (1), or, in some semantic relations, may appear unmarked with a post-position, as in (2d).

(2c) * pik'a =nam =mil ha
basket =Spec =Dem.Gen mouth
'the basket's mouth/rim'

(2d) balo? xay ke ja?-xale?
PotterValley from person-chief
'Potter Valley's chief'

Animate possessors: restrictions by NP form There are numerous restrictions on animate possessors as well. These, however, appear to primarily concern the *NP form* or *expression type* of the nominal. A simple scale of NP forms will be assumed here, in which pronouns outrank proper nouns, and proper nouns outrank common nouns. This skeletal scale can be justified based on work by Prince (1981, 1992), Gundel et al. (1993) and Ariel (1990), among others, who have studied the discourse-pragmatic basis for speaker choice of NP form. The data described in this section will be shown to support the following rough generalization: in order to receive canonical possessor case-marking in Northern Pomo, it appears necessary (if not sufficient) that the possessor must not be outranked by the possessum on an implicational hierarchy of NP forms.

(3) Pronoun > Proper / Kinship N > Common N (animate)

The hierarchy in (3) adds kinship nouns to the class of proper nouns, based on their behavior in the data presented below, but also for independent semantic and discourse-pragmatic reasons. [3]

Silverstein's 1976 paper is often interpreted to mean that NP form class plays a role in markedness hierarchies, but O'Connor (1999a) suggests that it is useful to separate the different dimensions he described. Some of the features discussed by Silverstein, notably animacy and humanness, are features of *entities*, whereas other features, notably proper noun vs. common noun, and pronominal vs. nominal, are more properly described as features of *expression types*. Silverstein himself drew back from positing that the opposition of pronominal/nominal was part of the "true nature of split systems," suggesting instead that any apparent effects might be epiphenomenonal; for example in some languages they could be due to a restriction on pronominals, which in those particular languages only index humans (1976: 160).

Common noun possessors Common nouns with animate referents cannot be expressed as genitive-marked possessors of kinship terms (*that woman's mother*). They must appear without case-marking, as in (4b).

(4a) * maa<u>th</u>a =nam =yaju? bate
woman =Spec =Gen. mother
'the woman's mother'

(4b) maa<u>th</u>a =nam bate
woman =Spec. mother
'the woman's mother'

Can common nouns possess proper nouns? In English it is possible to use a possessive determiner with a proper name, given the right contextual support. If a name does not secure unique identifiability, a possessor may provide it: *Mrs. Chase's Rebecca isn't in school today, but that other woman's Rebecca is here*. In Northern Pomo, such a construction is not possible with a common noun possessor, whether or not it bears the genitive case marker.

(5) * maa<u>th</u>a =nam =yaju? /Ø keli 'that woman's Kelly'
woman =Spec. =Gen. /Ø Kelly

Proper and kinship noun possessors Proper noun and kinship term possessors of kinship term possessa (*Kelly's daughter, your daughter's aunt*) reflect the same prohibition as common noun possessors: if they are to appear with the kinship stem possessum, they cannot bear genitive case, but must appear without case-marking, as in (6b) and (7b).

(6a) * keli =wi? bapane
Kelly = Gen. daughter
'Kelly's daughter'

(6b) keli bapane
Kelly daughter
'Kelly's daughter'

(7a) * mipane-? bashee
your.daughter-Gen mat.aunt
'your daughter's maternal aunt'

(7b) mipane bashee
yr.daughter mat.aunt
'your daughter's maternal aunt'

[3] Pomo speakers traditionally observed a taboo against using proper names in reference or address. Kinship terms fulfilled the functions normally assigned to proper names (S. McLendon, p.c.).

Proper noun possessa are rejected with both proper noun and kinship possessors (*Mary's Kelly, your daughter's Kelly)*, with or without genitive case marking:

(8a)	* meedi =wi? /Ø	keli		(8b)	* mipane	-? /Ø	keli
	Mary =Gen /Ø	*Kelly*			*yr.daughter*	*-Gen /Ø*	*Kelly*
	'Mary's Kelly'				'your daughter's Kelly'		

Pronominal possessors Finally, pronominal expressions can occur as genitive-marked possessors of all NP form categories (except pronouns, which do not occur as possessa). (Pronominally possessed proper noun possessa, *his Kelly*, are somewhat marginal, but apparently are acceptable in Northern Pomo, unlike (5) and (8).)

Table 2. Pronominal possessors in Northern Pomo

Possessor/Possessum Nominal Classes	English Gloss	Northern Pomo
Pronoun/Proper Noun	(?) 'his Kelly'	moow -a? keli *3sm. -Gen Kelly*
Pronoun/Kinship Term	'her daughter'	ma:d -a? bapane *3sf. -Gen daughter*
Pron/Common N (human)	'their doctor'	pow -a? matu *3pl. -Gen doctor*
Pron/Common N (inan.)	'her basket'	ma:da-? pik'a *3sf. -Gen basket*

Summary First, inanimate possessors are disallowed; i.e. the canonical expression of possession, genitive case on a possessive modifier, does not occur with inanimate entities, no matter what their NP form. Restrictions on animate referents, however, suggest the necessity to posit an implicational hierarchy containing features of NP form, as in (3). If a possessum can co-occur with a common-noun possessor displaying genitive case, it can co-occur with a kinship term or proper noun possessor displaying genitive case. If a possessum can co-occur with a kinship term or proper noun possessor displaying genitive case, it can co-occur with a pronominal possessor displaying genitive case. In other words, the possessum must not outrank the possessor on the NP form hierarchy in (3). A stronger claim would be that the possessor must outrank the possessum, but this is too strong: animate common nouns may be canonically marked possessors of other animate common nouns (*the woman's teacher*).

It is not completely surprising that NP form should be relevant here. Even a cursory look at possessives crosslinguistically reveals that pronominal vs. nominal features are involved in differential possessor expression in a number of languages. In Irish, pronominal possessors trigger agreement and precede the possessum, whereas nominal possessors follow and do not trigger agreement. Pronominal possessors are favored in the 'mono-lexemic possessor construction,' found in numerous Slavic, Germanic and Romance languages (Skarabela et al., 2004). Ultan (1978: 36), as part of Greenberg's language universals survey, also finds asymmetries between nominal possessors and pronominal possessors.

Comparable crosslinguistic patterns are not as apparent for the category of kinship terms and proper nouns vs. common nouns. However, there is evidence beyond Northern Pomo for this pattern: Jespersen notes that there is a strong preference for the pre-nominal genitive when "the genitival adjunct is a proper name: *John's stick*, or a pronoun: *his stick* " (1954: 312).

But what is the basis for these NP form preferences (which in English are not categorical, but statistical)? The properties that drive choice of NP form or expression type are generally pragmatic, and concern the *information status* of the entities referred to: the speaker's and (speaker's assessment of) the hearer's consciousness of entities, relations and attributes in the discourse. O'Connor (1999b) proposed that the three relevant expression types, pronouns, proper nouns, and common nouns, can be viewed as differing in their canonical information status when used as referring expressions. As Prince, Gundel and Ariel, among others, have noted in various formulations, pronouns generally have the value [+Discourse-Old]; this is sometimes referred to as their "presuppositional" property: their use requires either a previous mention or support for a (situationally evoked) deictic interpretation (Prince 1992). As they are [+Discourse-Old], they must be [+Hearer-Old]. In contrast, proper nouns are unmarked for Discourse-Old status, but they bear a positive mark for the status [+Hearer-Old]. A speaker uses a proper noun for a new mention when she believes the hearer will be able to uniquely identify the referent. Finally, common nouns are unmarked both for Discourse-Old status and for Hearer-Old status.

If it could be shown that this NP form hierarchy played a role in DPE, there might be implications for the study of parallels between the clause and the noun phrase: parallels might be found in what is now usually called "preferred argument structure." Dubois (1987) provided an early demonstration of this in his study of Sacapultec oral narratives, where he documented the strong statistical tendency for transitive subjects to be Discourse-Old and for transitive objects to be much less likely to be Discourse-Old. Importantly for the current topic, he found that 93% of possessors were discourse-old, on a par with the rates for transitive subjects. His analysis of the preferred argument structure of the clause might legitimately be extended to the NP, particularly to the possessor, the 'subject' of the NP. If the structural role of possessor (within a particular construction in a specific language) does indeed carry with it a preferred information status (as has been shown for subjects and for numerous other construction subparts; see Birner 1994, Fillmore, Kay & O'Connor 1988, Lambrecht 1994), this could explain the preponderance of certain NP form types in this position, whether motivated by categorical rules or statistical tendencies.

There are other possible explanations for the special status of pronominals and proper nouns in possessive constructions, including syntactic and semantic dimensions. Longobardi (1994), in a study of Romance and Germanic DPs, argues that proper names and generics are semantically distinct, and thus their syntax differs from definite descriptions, as well as from articleless nominals like existentials and nonargument nominal phrases. Syntactic and semantic analyses are not necessarily incompatible with discourse pragmatic analyses. A confluence of factors leading to a hierarchy like the one in (3) would not be surprising.

3. Encoding pair-wise constraints in an Optimal typology

Following Aissen's OT analyses of clause-level phenomena (1999) and obviation within NPs (1997), O'Connor (1999a,b) offered an account of the Northern Pomo facts presented above. A first step consists of harmonic alignment (Prince & Smolensky 1993) of two prominence scales. One includes the structural positions GEN (the canonically marked Possessor modifier) and

HEAD (the possessum head) (cf. Aissen 1997). The second is the animacy prominence scale: Animate > Inanimate.

This alignment yields the harmony scales Animate.GEN $>_H$ Inanimate.GEN and Inanimate.HEAD $>_H$ Animate.HEAD. These can be interpreted as meaning that animate possessors are a less marked, more 'harmonic' combination than inanimate possessors, and inanimate possessa are a less marked, more 'harmonic' combination than animate possessa.

These harmony scales in turn give rise to ranked constraints: *Inanimate.GEN >> *Animate.GEN and *Animate.HEAD >> *Inanimate.HEAD. More colloquially, these constraints constitute predictions about the typology of possession. They predict that cross-linguistically, animate possessors will be less marked, or are less likely to be prohibited, than inanimate possessors. Further, they predict that inanimate possessa are less marked, or are less likely to be prohibited, than animate possessa.

In Northern Pomo, as described above, there is evidence of a general constraint against inanimate possessors. What does it mean to say that a language rules out inanimate possessors? It does not mean that this language cannot express the semantic relations between inanimate entities that, say, English expresses using the Saxon genitive, e.g.: inanimate part-whole relations such as *the table's leg*. It means rather that this language does not allow speakers to employ the construction used for canonical possession (*Mary's basket*) when expressing inanimate part-whole relationships. It is a constraint on using certain morphosyntactic resources, notated here as GEN and HEAD, to express certain semantic relations.[4]

If we concern ourselves only with the restriction on inanimate possessors, then Northern Pomo does not appear to require pair-wise comparisons. The prohibition against inanimate possessors is not dependent on any features of the possessum. However, the facts stated in examples (4) through (8), facts requiring reference to the expression type or NP form class of the possessor and the possessum, do seem to call for pair-wise comparisons.

These facts can be derived within an OT analysis that starts out with a harmonic alignment between the three main expression types or NP form classes, and the structural categories GEN and HEAD. (In the analysis below, proper nouns and kinship terms have been lumped into one category, labelled "Proper," as discussed above.) The alignment of the two-member scale GEN > HEAD with the three-member scale Pronominal > Proper/Kin > Common yields two 'harmony scales' (9), one expressing the relative markedness of (canonically genitive case-marked) possessors in the three NP form classes, and the other expressing the relative markedness of possessa in the three NP form classes. Markedness reversals captured by the alignment correspond roughly to observed facts.

(9) Markedness of Possessor by NP Form: GEN.Pronom $>_H$ GEN.Prop.Kin $>_H$ GEN.Common

Markedness of Possessum by NP Form: HEAD.Common $>_H$ HEAD.Prop.Kin $>_H$ HEAD.Pronom.

Next, two constraint subhierarchies may be derived, each of which captures the relative markedness of different NP form classes in the GEN or HEAD structural configuration, but this time in terms of a hierarchy of (presumably universal) constraints (labelled G1, G2, ... for

[4] In the variety of OT assumed by Aissen, and by Bresnan (2001), the inputs are semantic representations, and the candidate sets are morphosyntactic configurations.

convenience of reference below), constraints which direct the grammar to prefer unmarked structures.

(10) ***Constraint hierarchies from (9)***

	G1		G2		G3
Subhierarchy 1:	*GEN.Common	>>	*GEN.Prop.Kin	>>	*GEN.Pronoun

	H1		H2		H3
Subhierarchy 2:	*HEAD.Pronom.	>>	*HEAD.Prop.Kin	>>	*HEAD.Common

These two sets of subhierarchies correspond with the observation that pronominal and proper possessa are less likely to be licensed across languages than common noun possessa (although the reasons for these tendencies may be diverse, as noted elsewhere in this paper). They also correspond with the Northern Pomo facts that pronominal possessors may always receive canonical morphosyntactic expression, whereas in many cases common nouns cannot.

But note that the facts presented in Section 2 concern pair-wise constraints. For example, a common noun possessor is not always ruled out—it is only ruled out in cases where the possessum is expressed in an NP form class that outranks it. In order to capture the seemingly pair-wise nature of the constraints, O'Connor (1999 a,b) resorted to the use of local conjunction (a formal strategy that is not without controversy in OT).

Following Aissen's analysis (1999) and Artstein's proposals (1998) (both following on Smolensky's original proposal (1995)), we first conjoin constraint G1 with each constraint in subhierarchy 2 (H1, H2 and H3). Then constraint G2 is conjoined with each constraint in subhierarchy 2, and then constraint G3 in the same fashion. Then, one by one, each constraint in subhierarchy 2 is locally conjoined with the constraints in subhierarchy 1. (The local conjunctions are commutative: G1&H1 is equivalent to H1&G1.)

(11) ***Local conjunction of constraints in (10)***

*GEN.Common&*HEAD.Pronom.	>>	*GEN.Comm&*HEAD.Prop	>>	*GEN.Comm*HEAD.Comm
G1&H1		G1&H2		G1&H3
*GEN.Prop&*HEAD.Pronom.	>>	*GEN.Prop&*HEAD.Prop	>>	*GEN.Prop*HEAD.Comm
G2&H1		G2&H2		G2&H3
*GEN.Pronom&*HEAD.Pronom.	>>	*GEN.Pronom&*HEAD.Prop	>>	*GEN.Pronom*HEAD.Comm
G3&H1		G3&H2		G3&H3

and so on:

H1&G1 >> H1& G2 >>H1& G3;
H2&G1 >> H2&G2>> H2& G3;
H3&G1 >> H3&G2>> H3& G3

After the entire set of six subhierarchies of locally conjoined constraints is derived, a partial ordering of the constraints emerges, as shown in the lattice below in Table 3. Table 3 can be interpreted as follows. The top constraint pair, G1&H1, outranks all other combinations. This means that crosslinguistically, the combination of a common noun possessor and a pronominal head (*the man's them*) is more likely to be prohibited than any other combination.

Table 3. Partial ordering of NP form constraints on GEN/HEAD pairs

		G1&H1 *GEN.Common &*HEAD.Pronom.		
	G1& H2 *GEN.Comm& *HEAD.Kin/Prop		G2& H1 *GEN.Prop& *HEAD.Pronom.	
G1&H3 *GEN.Comm &*HEAD.Comm		G2& H2 *GEN.Kin/Prop& *HEAD.Kin/Prop		G3& H1 *GEN.Pronom &*HEAD.Pronom
	G2&H3 *GEN.Kin/Prop &*HEAD.Comm		G3&H2 *GEN.Pronom &*HEAD.Kin/Prop	
		G3&H3 *GEN.Pronom &*HEAD.Comm		

The lowest constraint pair, G3&H3, is outranked by all other combinations. This means that the combination of a pronominal possessor and a common noun head (*her dog*) is least likely to be prohibited cross-linguistically (or in terms of the OT constraints, it is the paired constraint most likely to be violated).

To simplify this analysis, I will set aside the constraints involving pronominal heads. For whatever reason, languages that allow pronominal possessa are at least very rare.[5] We can set aside the three cells that include a constraint on pronominal heads and still obtain a partial ordering as below.

Table 4. NP form constraints on GEN/HEAD pairs, excluding Pronoun Heads

Violation of conjoined constraints[A&E] is most highly marked		G1&H2 *GEN.Comm& *HEAD. Prop/Kin	
These pairs, [A&F] and [B&E], are unranked with respect to each other	G1&H3 *GEN.Comm &*HEAD.Comm		G2&H2 *GEN.Prop/Kin & *HEAD. Prop/Kin
These pairs, [B&F] and [C&E], are unranked with respect to each other	G2&H3 *GEN. Prop/Kin &*HEAD.Comm		G3&H2 *GEN.Pronom &*HEAD.Prop/Kin
Violation of conj. constraints[C&F] is least marked		G3&H3 *GEN.Pronom &*HEAD.Comm	

[5] It may be that the rarity of possessed pronominal heads has to do both with the syntactic and semantico-pragmatic nature of pronouns, in combination with the syntax, semantics and pragmatics of possession. In Northern Pomo, it is possible to adjoin an uninflected kinship term or proper noun to a 3rd pl. pronoun in a relation construable as extended kinship, but the genitive case is not allowed: keli=nam=pow *Kelly=Spec.=3pl.Nom*. The translation in colloquial English, "Kelly and them", means only 'Kelly and her family,' as in "Kelly 'n them are coming over again tonight." The extension of the referring expression appears to include the possessor: mite=pow *yr.mother= 3pl.Nom.*: "your mother's people [lived there]" (includes the mother).

In this lattice,[6] G3&H3 the constraint pair that would jointly prohibit *her dog*, is still lowest, that is, most likely to be violated across languages. The pairing most likely to be successfully prohibited across languages is G1&H2: common noun possessors and proper or kinship possessa: *the woman's Kelly* or *the man's mother*. While the latter sounds perfectly felicitous in English, in Northern Pomo neither can be expressed in the construction used for canonical possession.

The above analysis, when considered within the theoretical commitments of OT typology, constitutes several claims. Among these are the prediction that (a) we will find no language in which common nouns are allowed to possess common nouns (*the woman's dog*), but proper or kinship nouns *cannot* possess common nouns (**Kelly's dog*) and that (b) we will find no language in which common nouns can possess proper or kinship nouns (*the woman's daughter*), but in which proper or kinship nouns *cannot* possess proper or kinship nouns (**his aunt's daughter, *Kelly's daughter*).

Because of the apparent pair-wise constraints found in Northern Pomo, this seems to be a desirable result. O'Connor (1999a,b) shows that the ranking of similar conjoined constraints derives the observed choices of candidates. However, I will now argue that this analysis, while compatible with the facts, may not be necessary, and thus may not be desirable. Within the OT framework, to maintain a hope of constraining the space of possible languages, proposed constraints must be considered universal. Therefore, when proposing something as typologically striking as a large set of pair-wise constraints on a particular structural configuration—pair-wise constraints that have not been widely observed in that configuration cross-linguistically—it is advisable to consider whether there might not be a more conservative analysis that could still capture the facts.

4. A skeptical revisiting

First consider the fact that the canonical expression of possession is ruled out for inanimate possessors. As depicted above, this fact folded nicely into the apparent hierarchy effect. Inanimate entities could not possess any entity higher on the animacy scale, nor could they possess any entity on their 'own level' of animacy. But this fact does not truly require a pair-wise comparison. It may simply be stated as a constraint * Inanimate.GEN, as derived above. Given the harmonic alignment of GEN>HEAD with Animate>Inanimate, we retain the plausible and intuitively appealing prediction that no language will allow inanimate possessors that does not also allow animate possessors.

The core of the proposed hierarchy effects between possessors and possessa lies in those examples in which a kinship stem is the possessed head of the phrase. Examples like *Kelly's mother* and *the woman's daughter* cannot be expressed in the canonical configuration of genitive case marking on the possessor. Yet speakers can express these meanings. How do they do so? As mentioned above, all proper, kinship, and common noun possessors of kinship terms do not receive any case marking: they appear uninflected, as shown in Table 5.[7]

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[6] Generally, constraints on the same level of the lattice are unordered, and constraints that are higher in the lattice outrank those lower down. However, these are not completely regular; e.g. the pair G1&H3 is not ordered with respect to the pair G3&H2, but G2&H2 does outrank G2&H3.

[7] More precisely, the morphologically simplest free form is employed. For proper nouns and kinship terms this is the Nominative, and for common nouns it is (the simplest variant of) the Accusative. Northern Pomo displays an ergative split in its nominal class case marking (see Table 0 above and O'Connor 1992 for details).

Table 5. Caseless possessors of kinship stems

Proper noun possessor *Mary's maternal grandmother*	medi baka? Mary maternal grandmother
Kinship noun possessor *His daughter's maternal grandmother*	bapane baka? his daughter maternal grandmother
Common noun possessor *The woman's maternal grandmother*	maatha =nam baka? woman=Spec. maternal grandmother

Observant readers by this time will be suspicious: what is the internal structure of these kinship terms? As an expanded version of *his daughter's maternal grandmother* will show, each kinship stem carries a prefix indicating person features of the possessor, in (12), third person:

(12) ba- pane ba- ka?
3's- daughter 3's- m.grandmother 'His daughter's maternal grandmother'

Kinship stems must either carry a possessor prefix or the vocative suffix. In (13), the range of possessive prefixes is demonstrated with the kinship root ka?, *maternal grandmother*.

(13) ?ami- ka? 'my maternal grandmother'
mi- ka? 'your maternal grandmother'
ba- ka? 'his/her/their maternal grandmother'
ma- ka? 'logophor's maternal grandmother'
ka? -day 'Grandmother!'

How might these pronominal prefixes provide an explanation for the constraint against genitive case-marked possessors described in Sections 2 and 3? The answer requires that we first consider the special semantics of kinship terms.

Kinship terms are a central member of the class of relational nouns: each carries a lexical requirement for a possessor argument. O'Connor (1999a) proposed that these pronominal prefixes were not agreement prefixes, but were in fact incorporated pronouns, satisfying the possessor argument requirement of these kinship stems. Kinship stems with pronominal prefixes can occur without any other explicit expression of the possessor, and the kinship possessor will be understood either deictically or in terms of an accessible discourse referent.

(14) Speaker one: "Who just left?"

Speaker two: ba-pane 'his daughter' (pointing at him, not the daughter)
3's- daughter

In (15), the 3rd person pronominal prefix ba- may be anaphoric to an NP that is explicit but extra-clausal (either 'he' or 'they' in the first clause below) or it may be interpreted as indexing some previously mentioned or otherwise accessible third person entity.

(15) moow pow-al ba?ole nathe **ba**-ka? ?o? duhu-y
3sm.Nom 3pl.-Acc call but 3's-mat.grmo. already leave-Perf.
'He$_j$ called them$_k$ but his$_j$ /their$_k$ /3's$_x$ maternal grandmother had already left.'

These facts are compatible with an account in which the prefixes are agreement markers, or an account such as the one just mentioned, in which the prefixes are acting as incorporated pronouns. Following the analysis of pronominal incorporation at the level of the clause in Chichewa (Bresnan & Mchombo 1987), it is possible to both show that these prefixes are incorporated pronouns, and at the same time derive an explanation for the caseless possessors in Table 5.

Bresnan and Mchombo (1987) use a variety of syntactic, morphological, phonological and semantic tests to show that an optional "Object Marker" in Chichewa is actually an incorporated pronoun: when it appears on the verb, a full NP that appears to be the Direct Object can be shown to actually be a Topic: the Object Marker is an incorporated pronoun that is fulfilling the argument requirements of the verb. Functional Uniqueness, a principle within LFG that ensures that each grammatical function will be uniquely instantiated, is invoked to explain why the presence of the Object Marker allows a Topic NP but not a Direct Object NP. They extend the analysis to other languages, and make the following statement about languages with pronominal incorporation (PI):

> From the principle of functional uniqueness it also follows that, in languages with PI, a verb or other head cannot govern the case of any referential nominals with which its incorporated pronouns agree. If the incorporated pronoun is a referential argument, itself governed by the verb, then by functional uniqueness an external referential NP cannot also serve as that argument. Hence such an external NP cannot be related to that argument position of the verb by government, but only by anaphora with the agreeing incorporated pronoun. However, the categories of agreement in these anaphoric relations are universally the referentially classificatory properties—person, number, and gender (or animacy), but NOT grammatical case.
>
> (Bresnan & Mchombo 1987: p.765).

If the pronominal prefixes on Northern Pomo kinship terms are instances of incorporated pronouns, then it should not be possible for the possessive NP to contain any other instantiation of the grammatical function of possessor. Therefore, the full NP possessors of kinship terms in Northern Pomo shown in Table 5 are caseless because they are adjuncts, not arguments. They provide information about the number, gender, and specific identity of the third person possessor, but they do not fulfill the possessor argument requirement of the relational head noun, the kinship stem, and thus cannot bear the Genitive case. If we accept this analysis, an entire class of problematic examples that appeared to require pair-wise comparisons are accounted for without the need to propose universal constraints that refer to both the possessor and the possessum.[8]

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[8] This analysis also explains why a few kinship terms that do not carry the <u>ba-</u> prefix do not display the same case-marking constraints. For example, <u>kanema?</u> *'relations, kin,'* arguably a kinship term, allows common, proper and kinship nouns displaying the canonical genitive case for possession: maa<u>th</u>a=nam=yaju? kanema? *woman=Spec.=Gen. relations* 'The woman's relatives.' These contrast with (4), (6) and (7).

However, there is still one unexplained fact that appears to favor the pair-wise comparison on the NP form implicational hierarchy. Recall that *pronominal* possessors *must* display Genitive case when the possessum is expressed as a kinship stem, as shown in Table 2 and below:

(16) pow -a? ba-ka? 'their maternal grandmother'
3pl. -Gen. 3's-m.grandmother

This example appears to violate the very principle that explained the *non*-pronominal cases: functional uniqueness. If the pronominal prefix is fulfilling the role of the possessor argument, how can there be a second NP which by its case-marking informs us that it is also a possessor? Bresnan & Mchombo (1987) faced the same question at the clausal level in Chichewa: they were confronted with a "Subject Marker" that sometimes showed the same behavior as the Object Marker—it sometimes functioned as an incorporated pronoun, blocking a full NP subject but allowing a Topic to which it could be linked anaphorically. In other examples it paradoxically seemed to allow a full NP subject, thus potentially violating functional uniqueness. Their solution was to suggest that the variability reflected linguistic change in progress: they claimed that the well-known historical process whereby incorporated pronouns turn into agreement inflections is in progress in Chichewa.

Is it possible to explain examples like (16) in the same way? I have no independent evidence that the prefix is (16) is an agreement inflection while the prefixes in Table 5 are incorporated pronouns. However, this is a possible solution that would obviate any remaining need to consider pair-wise comparisons in generating possessive phrases in Northern Pomo. Nichols (1988) points out that if a language allows head-marking for inalienable possession at all, it will allow it with kinship terms (head-marking in this instance being agreement realized on the possessum). Presumably this typological observation means that the historical process Bresnan and Mchombo impute to the variable 'Subject Marker' at the clause level in Chichewa could reasonably be entertained as taking place inside the possessive NP in Northern Pomo.

There is, moreover, another class of possible explanations. A persistent problem for the LFG principle of functional uniqueness (and its analogue in other frameworks) is posed by clitic doubling at the clause level. If a pronominal clitic is functioning as an incorporated pronoun argument of the verb, what allows its double to appear in argument position as well? One interesting fact about clitic doubling concerns pronouns: if a language allows clitic doubling, it will always allow it with independent pronoun doubles. At the risk of appearing to hand-wave, I will assert that whatever general explanation underlies this fact at the clause level would be able to explain what is apparently a similar pattern at the NP level in Northern Pomo.

My point is simply that the special privileges of these pronominal possessors, in contrast to the behavior of other NPs, is part of a more general phenomenon, exemplified at the clause level in some languages by the transition of incorporated pronouns to agreement, or by observed patterns in clitic-doubling. We do not have to deal with it by proposing a constraint that invokes pair-wise comparisons. It is enough to say that the licensing of genitive case on the pronominal possessor of a kinship NP in Northern Pomo is an instance of a general problem: apparent clause-level and NP-level violations of functional uniqueness, many of which seem to involve pronouns, and which may receive a variety of explanations.

Finally, what of the unacceptability of proper noun possessa, e.g. 'Mary's Kelly' and 'her aunt's Kelly'? Even in English, these are marginal to some speakers except in highly contrastive contexts. Further study will be required to understand the conditions under which these are allowed. Their unacceptability may well be explainable solely in terms of the NP form of the possessum, and the marginally better pronominal possessors do not present strong evidence of a pair-wise constraint. In the absence of the necessity to explain the far more pervasive kinship facts in terms of pair-wise comparisons, these facts alone do not warrant positing such a striking set of universal constraints.

In summary, it appears that a convergence of unrelated factors creates an appearance of pair-wise constraints within the possessive NP in Northern Pomo. I have shown that it is possible to pull apart these factors and undermine my previous claims about the necessity for such an analysis. But does this mean that there are no legitimate cases of the need for pair-wise comparisons in any other language? In the next section I will review data that, although sparse, suggest that such cases may exist.

5. External Possession in Nez Perce

One important variety of DPE has been called variously 'possessor raising', 'genitive promotion' and 'external possession'. External possession constructions (extensively described in Payne & Barshi 1999) generally code the possessor as a core argument of the verb, leaving the possessum in its own (sometimes adjunct-like) constituent. In a sense it treats an n-place predicate as if it were an n+1-place predicate. In Nez Perce, a Sahaptian language extensively described by Rude (1986a, 1986b, 1999 inter alia) and Aoki (1970, 1979, 1994), "genitive promotion" is signalled by an affix on the verb. When a Possessor has been 'promoted' to direct object, a suffix appears in the verb.

(16) **'imés-ne** tu'uynu tálam pe-'énp **-ey'** -se
deer-OBJ *tail-0* *end-0* *3ERG-take* ***–GEN*** *-IMP.SG*
'She took the deer's tail end' (Aoki and Walker 1988: 389, 61)

When a Possessor is 'promoted' to subject of an intransitive verb, a verbal prefix indicates this, as in (17) below.

(17) **há:ma-nm** sík'em **'e-** kú: -ye
man-GEN *horse-0* ***3GEN*** *-go-PERF*
'The man's horse went.' (Rude 1986b: 110, ex. (5))

Rude (1986b) carried out a study of "genitive promotion" to subject, based on texts in Nez Perce, attempting to quantify the degree to which animacy features determined the use of regular possession versus genitive promotion. What he found appears to indicate that a pair-wise comparison is required. Genitive promotion is most strongly favored when the possessor is human and the possessum is inanimate, and is least acceptable when the possessor is inanimate and the possessum is animate. Table 6 summarizes his results. The sample is quite small, but the results are suggestive: it appears that speakers take into account the possessor's animacy and the animacy of the possessum when they choose the manner in which they will express possession.

Table 6. Nez Perce genitive promotion to subject: pair-wise comparison (data aggregated from Rude 1986b, pp. 128-130)

Animacy of GEN (Possessor) and HEAD (Possessum)	Total	Promoted	Unpromoted	%Promoted
Human Gen, Non-hum Head *"the child's bow"*	38	35	3	92%
Human Gen, Human Head *"Coyote's friend"*	18	12	6	67%
Non-human Gen, Non-human Head *"harpoon of horn"* (horn-GEN harpoon)	8	3	5	38%

Finally, genitive promotion of inanimate possessors over animate heads is strongly dispreferred. Examples such as *the leader of this land* or *this land's leader* appear instead in the canonical possession construction (this land-GEN leader), (Rude 1986b, ex. (71), p. 126).

Does this mean that we have revived the necessity for pair-wise comparisons at the NP level? Not necessarily: consider one important difference between the Northern Pomo and the Nez Perce phenomena. In Northern Pomo, all facts to be accounted for were internal to the NP. In Nez Perce, the choice concerns the accessibility of a core argument slot to a non-core event participant: both the clausal arguments and the potential NP-internal participants are involved in a complex set of contingencies. There are several potential analyses of the Nez Perce genitive promotion facts that might allow us to avoid the necessity for pair-wise comparisons, but space does not permit expanding upon them here. It is also possible that the Nez Perce facts may most appropriately be analyzed in terms of verb-level factors not yet studied. In any case, following the logic of the Northern Pomo reanalysis, it would be wise to proceed cautiously.

6. Conclusion[9]

Several tentative conclusions can be drawn. Though none are fully explicated here, I think it is likely that each could be productively pursued in the context of broader study of differential possessor expression. First, despite very strong evidence for the necessity of pair-wise constraints on person and animacy at the clause level, as Aissen has shown, there is no strong support in the Northern Pomo facts presented here for the necessity to posit a similar pair-wise constraint on the expression of possession in the NP. The apparent necessity for such constraints

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in Northern Pomo NPs was shown to be a product of several unrelated factors working in the same direction. While it is clear that some constraint on inanimate possessors is probably necessary in Northern Pomo, these data do not force an analysis in which NP form classes must explicitly be mentioned in pair-wise comparisons of possessor and possessum NPs. (There is evidence, however, that NP form hierarchy effects may play a role in differential possession expression in other languages, see O'Connor et al. 2004, and Skarabela et al. 2004).

On the other hand, a small study of Nez Perce 'genitive promotion' (Rude 1986b), provides evidence that at least some varieties of DPE may depend on animacy constraints applied to pairs of arguments in the possessive NP. Yet genitive promotion is not limited to the possessive NP. It crucially involves clausal relations as well: the promotion of a possessor to subject or direct object (however this 'promotion' is construed). It may be possible to employ constraints that are independently necessary at the clause level here as well, avoiding the need to propose new universal constraints within the NP.

Finally, these data illustrate an interesting and previously unobserved parallel between clausal and nominal structures. Pronominal incorporation phenomena previously observed at the clause level for subjects in Chichewa (Bresnan & Mchombo 1986) appear quite parallel to pronominal incorporation of possessors inside NPs headed by kinship stems in Northern Pomo. Study of this system and others like it (e.g. those identified in Nichols 1988) may further illuminate the similarities and differences between the clause and the NP.

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Focus Clitics and Discourse Information Spreading

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Abstract

In some languages, morphology plays a crucial role to represent a sentence discourse structure. In this paper, Japanese focus clitics and their distribution are examined. Against recent works on information structure, an independent discourse structure is postulated as a part of the grammar of LFG. Andrews and Manning's (1999) information spreading architecture is adopted here, so that flexible sharing of various types of information among phrase structure nodes is allowed. Moreover, Stump's (2001) Paradigm Function Morphology (PFM) functions as a parallel correspondence between phrase structure, functional structure and discourse structure. Finally, some implications to the puzzling behaviours of the similar focus clitics in Hindi are skeched.

1 Introduction

Many of the recent works on discourse function of a language claims that the grammar has an independent component representing the information structure of a sentence (e.g. Lambrecht 1994, Vallduví 1992).[1] Apart from the terminological variations (topic-comment, focus-background etc.), those works show cases where prosodic, morphological and syntactic structures (and sometimes complex of them) reflect the information structure of a sentence such as intonation, morphological discourse markers and cleft sentences. Thus, it is a natural consequence that some attempts have been made to study the relationship between the information structure and previously assumed linguistic structures like phonology and syntactic configurations as well as formalising the information structure itself. For example, Engdahl and Vallduví (1996) try to incorporate Vallduví's (1992) information packaging as a part of the framework of Head-driven Phrase Structure Grammar (HPSG: Pollard and Sag 1994). Role and Reference Grammar (RRG: Van Valin and LaPolla 1997) proposes focus structure based on the works like Lambrecht (1994).

Lexical Functional Grammar (LFG: Kaplan and Bresnan 1982, Bresnan 2001), like RRG, assumes parallel structures of the grammar. However, in the standard assumption of the framework, TOPIC and FOCUS are called discourse functions and placed in f(unctional)-structure alongside grammatical functions such as SUBJect and OBJect. As Bresnan (2001:97) notes, those TOPIC and FOCUS are not a part of discourse in a sense of communicative functions like information packaging, but syntactically represented (grammaticalised) functions. Some works try to pursue how those grammaticalised discourse functions capture configurationally distributed discourse structures. Based on the careful examinations of the configurational representations of topic-focus information in Hindi/Urdu and Russian, King (1997) and Butt and King (to appear) propose an independent structure for discourse functions instead of analysing them in the discourse functions in f-structure. Choi (1999) indicates the possibility of postulating the discourse structure as a part of the LFG grammar.

Following those preceding works, I also assume d(iscourse)-structure as a part of the parallel LFG grammar. Based on this assumption, I focus on the relationship between morphology and d-structure in this paper. Although the interface between morphology and discourse information has been less studied in LFG, Sharma (2003) analyses interesting behaviours of Hindi focus clitics adopting Nordlinger's (1998) constructive morphology. I present an analysis of the similar phenomena in Japanese focus clitics based on a different approach to morphology, namely Stump's (2001) Paradigm Function Morphology (PFM). PFM is one of the realisation models of morphology where a bundle of morphosyntactic features

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receives formal realisations by the morphological component. I place PFM as a part of the LFG architecture following the works such as Luís et al. (2002) and Sadler and Nordlinger (to appear). Under the current proposal, the morphology component is accessible to f-structure and d-structure, takes features of each structure as an input and spells out the output form in c-structure.[2] This proposal shows the striking contrast to the standard LFG assumption of morphology where a lexical items is inserted into syntax as a fully inflected form. That is, morphological operations are pre-syntactic in the standard LFG, while the c-structure configuration, f-structure and d-structure are visible to morphology in the current proposal. I will show that this model explains morphological manifestations of discourse information neatly.

The paper is structured as follows. I briefly overview the information structure summarised in Lambrecht (1994) and recast it in LFG grammar in section 2. In section 3, the general description of the morphological markings of discourse function is introduced, and the previous approaches to the clitics are examined. The morphological analysis of Japanese data and its implications to Hindi data are presented in section 4. I conclude the discussion in section 5.

2 What is discourse structure?

Lambrecht (1994:5) defines the discourse (information) structure as "the component of sentence grammar in which propositions as conceptual representations of state of affairs are paired with lexicogrammatical structures in accordance with the mental states of interlocutors who use and interpret these structures as unit of information in given discourse contexts." The crucial point of this definition is that the discourse structure is tied to lexicogrammatical structure, namely it must be linguistically observable. In other words, the discourse structure is reflected in prosodic and morphosyntactic structures. This leads to the justification of postulating the discourse structure as an independent component of the grammar rather than an extra-linguistic structure. This point is stated as "just as there are no sentences without morphosyntax and phonological structure, there are no sentences without information structure" (Lambrecht 1994:16).

The information structure is constructed by adding or superimposing the assertion on the presupposition. Those two concepts are defined as follows (Lambrecht 1994:52):[3]

(1) a. Pragmatic presupposition: The set of propositions lexicogrammatically evoked in a sentence which the speaker assumes the hearer already knows or is ready to take for granted at the time the sentence is uttered.

b. Pragmatic assertion: The proposition expressed by a sentence which the hearer is expected to know or take for granted as a result of hearing the sentence uttered.

As in (1), the presupposition is one or another formally evoked by the speaker in the sentence, namely lexicogrammatically evoked. So it must receive formal manifestations, such as prosodic prominence, morphological marking and a particular syntactic position.

[2]As discussed in Sadler and Spencer (2001) and Sadler and Nordlinger (to appear), we need a distinction between syntactic (grammatical) features and morphological (formal) features. However, I do not try to formalise the mapping between those two types of features. Rather, I use trivial mapping between them in most of the cases.

[3]As Lambrecht notes, presupposition corresponds to 'old information' and assertion to 'new information'. However, those two concepts are about the proposition as a whole and must not equated with the lexical or phrasal elements out of which propositions are formed. In other words, we cannot say a particular NP or VP is old/new information ([±new]) since the old/new distinction of each element is irrelevant (or at least not directly related) to constructing the information structure. See Lambrecht (1994:45-50) for the detailed discussion on this point.

TOPIC and FOCUS are information structure categories indicating relations between referents and propositions.[4] The TOPIC and FOCUS structure of the proposition where the referent is an argument determines the correlation between the grammatical (prosodic, morphological and syntactic) structure and discourse referents. Thus, I postulate this TOPIC and FOCUS structure as a part of the LFG grammar called d(iscourse)-structure. The definitions of TOPIC, topic expression (topic phrase, topic constituent), FOCUS and focus domain are as follows (Lambrecht 1994:131, 213, 214):

(2) a. TOPIC: A referent is interpreted as the topic of a proposition if in a given situation the proposition is construed as being about this referent, i.e. as expressing information which is relevant to and which increases the addressee's knowledge of this referent.

b. Topic expression: A constituent is a topic expression if the proposition expressed by the clause with which it is associated is pragmatically construed as being about the referent of this constituent.

c. FOCUS: The semantic component of a pragmatically structured proposition whereby the assertion differs from the presupposition.

d. Focus domain: A syntactic domain in a sentence which expresses the focus component of the pragmatically structured proposition.

Under the current study, we are concerned about how d-structure information interacts with other components of grammar. Thus, as for formalisation in LFG, I assume that the d-structure contains the semantic (LCS) information of the topic and focus expressions.[5] Technically, functional schemata $(\downarrow \text{LCS}) \in (\uparrow {}_{\delta}\text{TOPIC})$ and $(\downarrow \text{LCS}) \in (\uparrow {}_{\delta}\text{FOCUS})$ assigned to the topic/focus constituents abstract LCS values of the domain and map them onto the d-structure (cf. King's (1997) PRED FN abstraction).

As simple illustrations, information structures are exemplified in the following three way distinctions:

(3) a. What happened to your car?
My car/It [$_{\text{VP}}$ broke DOWN].

b.

Sentence:	*My car broke DOWN*.
Presupposition:	"speaker's car is a topic of comment x"
Assertion:	"x = broke down"
Focus:	"broke down"
Focus domain:	VP

(4) a. I heard your motorcycle broke down.
My [$_{\text{NP}}$ CAR] broke down.

b.

Sentence:	*My CAR broke down*.
Presupposition:	"speaker's x is broke down"
Assertion:	"x = car"
Focus:	"car"
Focus domain:	NP

[4]The cognitive states of referents themselves are defined by different information structure categories ACTIVATION and IDENTIFIABILITY (Lambrecht 1994:109). It is possible to include those states in d-structure, but I leave this possibility open.

[5]The standard LFG notion TOPIC in f-structure corresponds to Lambrecht's TOP (left-detached topic constituents). Lambrecht also proposes A-TOP ("Antitopic") for right-detached topic constituents. I do not discuss those types of topic expressions in this paper.

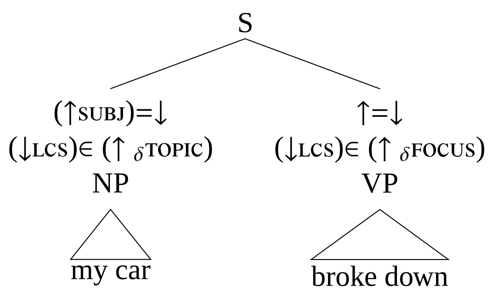
(5) a. What happened?
[$_S$ My CAR broke down].

b.

Sentence:	*My CAR broke down*.
Presupposition:	–
Assertion:	“speaker’s car broke down”
Focus:	“speaker’s car broke down”
Focus domain:	S

Those are called predicate focus (3), argument focus (4) and sentence focus (5) respectively. Let us look at how predicate focus example (3) can be represented in the current proposal.

(6) a. c-structure



b. f-structure

$$\left[\begin{array}{ll} \text{LCS} & [_{\text{Event}}\ \text{BREAK DOWN}\ (X)] \\ \text{TERMS} & \langle X \rangle \\ \text{SUBJ} & \left[\begin{array}{ll}\text{LCS} & [_{\text{Object}}\ \text{MY CAR}] \\ \text{TERMS} & \langle\ \ \rangle\end{array}\right]^{X} \\ \text{TENSE} & \text{PAST}\end{array}\right]$$

c. d-structure

$$\left[\begin{array}{ll}\text{FOCUS} & \left\{\left[\text{LCS}\ \ [_{\text{Event}}\ \text{BREAK DOWN}\ (X)]\right]\right\} \\ \text{TOPIC} & \left\{\left[\text{LCS}\ \ [_{\text{Object}}\ \text{MY CAR}]\right]\right\}\end{array}\right]$$

In the mapping to d-structure, the NP *my car* is annotated as TOPIC, so the LCS value of this constituent is mapped onto TOPIC. Similarly, LCS value of the VP *broke down* is mapped onto FOCUS in the d-structure.

3 Marking the discourse information

In English examples of the previous section, the morphology and syntax of three types of focus structure are identical. Instead, English realises the information structure by intonation in many cases. However, the strategies of information structure manifestation differ among languages. In this section, I briefly look at how languages mark discourse information morphologically. (7) and (8) are Navajo and Turkish examples respectively (Schauber 1978: 148, 152, König 1991: 17):

(7) a. Jáan chid**íísh** yiyííłchǫ
John car.QFOC 3.3.PAST.wreck
*‘Did John wreck the car?’
‘Is it the car that John wrecked?’

b. Jáan chidí yiyííłchǫ'**ísh**
John car 3.3.PAST.wreck.QFOC
'Is it wrecking John did to the car?'

c. Jáan **hanii** chidí yiyííłchǫ'
John NEGFOC car 3.3.PAST.wreck
'It's not John who wrecked the car.'
*'John didn't wreck the car.'

(8) a. oraya ben **de** gittim
there I FOC go.PAST
'I too went there.'

b. ben oraya **da** gittim
I there FOC go.PAST
'I went there too (as well as elsewhere).'

c. ben oraya gittim **de**
I there go.PAST FOC
'I also went there.'

Navajo has question focus marker *ísh* and negative focus marker *hanii*. As seen in (7a, b), *ísh* indicates what element in the sentence is questioned, namely 'car' in (7a) and the wrecking event in (7b). In the same way, *hanii* should follow the element negated as in (7c). Turkish also has focus marker *d-*, which specifies what is focused in the sentence discourse structure as found in (8).

Hindi and Japanese also have morphological ways of realising information structure by attaching particles to a particular constituent. I overview them in the next section.

3.1 The basic description of particles

Hindi and Japanese have a set of markers, which is traditionally called 'particles'. Those particles are attached to the host nominal and represent certain grammatical properties.[6] They are mainly divided into case particles and discourse particles. The basic usage of those particles is found in (9) and (10):

(9) Hindi

a. Mōmbattī=**to** milī, lēkin ab^{h} māchis gum gayē.
the candle.F.NOM-TOP found.PERF.F.SG but now match.NOM lost go-PERF.PL
'The candle was found but now the matches are lost.'

b. Rād^{h}ā=nē=**hī** bacc^{h}õ=kō kahdānī sunāyī.
Radhaa-ERG-EXCL FOC children-ACC story.F make hear.PEF.F.SG
'It was (only) Radha who told the children a story' (Sharma 2003:61, 62)

(10) Japanese

a. Taroo=**wa** Hanako=ni yubiwa=o ageta.
Taroo-TOP Hanako-DAT ring-ACC give.PST
'Taro gave Hanako a ring.'

[6]Some of the particles can appear with other categorical hosts, such as verb, adjectives and even clauses. In this paper, however, I mainly focus on the attachment to nominals.

b. Ken=**mo** titioya=o=**sae** nikunda.
Ken-FOC father-ACC-FOC hate.PST
'Ken too hated even his father.'

Particles are attached to the nominal hosts in each example as indicated by =. The noun with particles carries certain information in the sentence. For instance, *mōmbattī=tō* in (9a) and *Taroo=wa* in (10a) are topic in the information structure of each sentence. *Titioya=o=sae* in (10b) is a direct object and focus at the same time. Similarly, *Rādhā=nē=hī* in (9b) functions as a subject and focus. The following is a part of the basic set of case and discourse particles in those two languages (cf. Sharma 2003, Butt and King in press):

(11)

Hindi	Japanese	
o	*ga*	nominative
nē	–	ergative
kō	*o*	accusative
k-	*no*	genitive
kō	*ni*	dative
se	*de*	instrumental
hī	*dake*	exclusive contrastive focus ('only')
b^hī	*mo*	inclusive contrastive focus ('also', additive/scalar)
tō	*wa*	contrastive topic
tak	*sae*	scalar endpoint marker ('even')
	made	
b^har		entirety ('all')

The phenomena analysed in this paper is focus clitic attachments of each language. I restrict the data to the following two sets of examples in this paper (% indicates that the acceptance of this sentence is subject to dialectal variation.).

(12) a. in tīn laḍkõ=kō=**hī** chōṭ lagī
these three boys=DAT=FOC hurt-F be-applied-to-PERF.F.SG
'(Only) *these three boys* got hurt.'

b. (%) in tīn laḍkõ=**hī**=kō chōṭ lagī
'(Only) these three *boys* got hurt.'

c. in tīn=**hī** laḍkõ=kō chōṭ lagī
'(Only) these *three* boys got hurt.'

d. in**hī̃** tīn laḍkõ=kō chōṭ lagī
'(Only) *these* three boys got hurt.' (Sharma 2003:67)

(13) a. kotira=no san'nin=no syoonen=ni=dake kega-sase-ta
these=GEN three=GEN boy=DAT=FOC hurt-CAUS-PAST
'Only *these three boys* got hurt.'

b. kotira=no san'nin=no syoonen=dake=ni kega-sase-ta
'Only *these three boys* got hurt.'

c. kotira=no san’nin=dake=no syoonen=ni kega-sase-ta
‘Only these *three* boys got hurt.’

d. ?kotira=dake=no san’nin=no syoonen=ni kega-sase-ta
‘Only *these* three boys got hurt.’

According to Sharma, in all the examples in (12), the focused constituent is the whole noun phrase ‘these three boys’ whereas the semantic scope of ‘only’ covers the italicised elements. In other words, there is a mismatch of the focus/semantic scope. Unlike Hindi examples, the order between dative case marker *ni* and focus marker *dake* does not seem to change the scope of ‘only’ in Japanese examples (9a, b), namely ‘only’ takes scope over the whole noun phrase in both examples.[7]

3.2 Phrase structural status

The particles summarised above are attached to the right of the host. There are three possibilities of the phrase structural status of them: X^0-level suffix, postposition and phrasal-level clitic element. Many preceding works suggest that they are clitics (Mohanan 1994, Butt and King in press, Sharma 2003, Ohara 2000), and some works in derivational frameworks assume that semantic particles are postpositions occupying P nodes in the phrase structure (e.g. Miyagawa 1989). The arguments against X^0-level suffix is found in co-ordination.

(14) a. Yasin=nē [kutt-ē or gʰoṛ-ē] =kō/hī hɛ.
Yassin.M.SG-ERG dog-M.SG.OBL and horse-M.SG.OBL ACC/FOC be.PRES.3.SG
‘Yassin saw (only) the dog and the horse.’

b. Nadya [lahor or karacʰi] =se hɛ.
Nadya.F.SG.NOM Lahore and Karachi INST be.PRES.3.SG
‘Nadya is from Lahore and Karachi.’

(15) a. Taroo=wa [inu=to uma] =o mita.
Taroo-TOP dog-and horse ACC see.PST
‘Taro saw the dog and the horse.’

b. Ken=wa [suugaku=to buturi] =de/sae manten=o totta.
Ken-TOP math-and physics INST/FOCUS full mark-ACC get.PST
‘Ken got full marks (even) for math and physics.’

(14) is taken from Butt and King (in press) and Sharma (2003). (14a) suggests that accusative case particle *kō* and focus particle *hī* take the scopes over the co-ordinated NPs, which is impossible for X^0-level suffixes. Similarly, semantic case *se* can have the scope over the co-ordinated NPs as in (14b). Japanese example (15) shows exactly the same behaviour. Another argument against suffix status is accentuation. For example, the lexical stress on each NP in Japanese is not affected by attachment of the particles. This lack of stress interaction is observed in Hindi as well. According to those behaviours of the particles, the possibility of X^0-level suffix is rejected.[8]

[7] The order can affects the interpretation of the sentences with the relation to the predicates (Harada and Noguchi 1992). The detailed semantic analysis of those examples should be treated in semantic structure and are beyond the scope of this paper. So, I simplify the picture here and regard (9a, b) as free variations.

[8] Hindi incorporated focus markers in (12d) are inseparable from the host. I will come back to this point later.

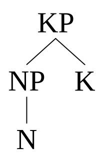
The possibility of independent words, i.e. postposition, is also refuted. Although the particles in Hindi and Japanese have phrasal scope in co-ordinated structure, they cannot stand alone without the hosts, that is they are bound elements. So, for example, scrambling or wh-fronting of a noun phrase leaving the particle behind is impossible. In addition, Hindi has postpositions which may stand themselves. (Butt and King in press).

The conclusion drawn from the preceding observations is that the particles in Hindi and Japanese are clitics. They are bound element, but phrasal attachment is possible (Zwicky 1987, Zwicky and Pullum 1983). The next question to ask is whether clitics occupy syntactic terminals in phrase structure or not, and if so how they project.

3.3 Projection of clitics and constructive morphology

Butt and King (in press) propose that a case clitic is a syntactic object occupying a terminal node K(ase) and becomes a head of KP taking NP complement, i.e. host noun phrase, in Hindi/Urdu as in (16):

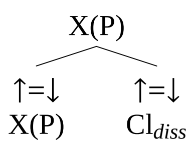
(16)



Butt and King claim that K can contribute complex of features associated with case, including grammatical function and semantically relevant material such as volitionality.

Sharma (2003) follows Butt and King's assumption for case clitics. As for discourse clitics, she proposes the structure like (17).

(17)

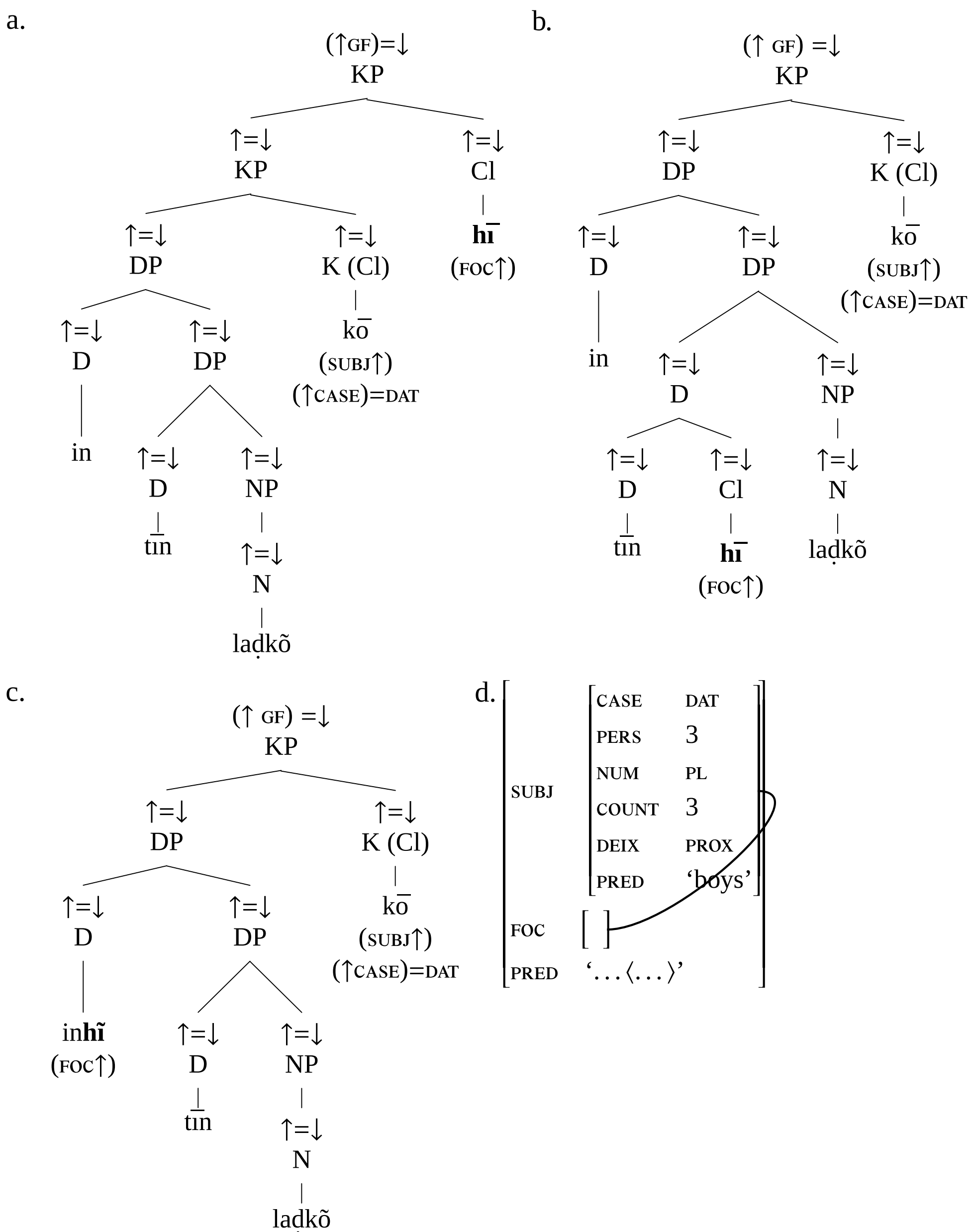


(18) a. *nē* (SUBJ↑)
(↑CASE)=ERG

b. *hī* (FOC↑)

Sharma assumes that Hindi focus clitics can be attached to X^0-level, so that Cl is adjoined to either X or XP. The host and clitic are co-heads, namely LFG notation ↑=↓ is attached to the sister nodes XP and Cl. Further, she expands constructive morphology (Nordlinger 1998) to focus clitics, so (FOC↑) is associated with the lexical entry *hī* as in (18b) in the same way as (SUBJ↑) in the ergative case marker (18a). (18b) states that the f-structure containing *hī* functions as FOCUS in the outer clause. Based on those assumptions, Sharma analyses Hindi focus clitic examples (12) like (19).

(19)



However, there is a difficulty in the KP projection analysis proposed by Butt and King. C-structure in LFG is surface phrase structure – place-holder of words. Therefore, even though the K node is associated with complex feature bundle, it does not justify introducing functional projection like KP. Such an assumption causes a further problem. Since Hindi and Japanese have other types of clitics like discourse and quantification clitics, the functional projection analysis would assume that we could have other types of projection such as FocusP, TopicP, ConjP and QP headed by clitics. This means c-structure contains many functional information, which normally belongs to other structures like f-structure or discourse-structure. Even if we do not assume such functional projections for other types of clitics like Sharma, it is mystery why only case clitics can be a head of KP projection. Or if K covers the other types of clitics, it would be still unclear what the status of K is and why it functions as a head of a functional projection.

Sharma's analysis has other difficulties. Firstly, she assumes that the prenominal modifiers are D and a head of the functional projection DP. It takes either an NP complement or another DP complement and holds a co-head relation. This co-head relation and functional DP projection are crucial for Sharma's analysis to pass (FOC↑) to the top KP node, so that the whole KP is focused. However, as argued in Fukui (1986, 1995), Börjars (1999) and many others, the status of prenominal modifiers are not straightforwardly determined. At least, the difference of the clitic attachment and the incorporation found in (19b, c) indicates the possibility that they constitute distinct classes. Thus, it is skeptical that they are really a head of the functional DP projection.

As Andrews and Manning (1999) point out, the co-headness of the standard LFG is sometimes problematic, and Sharma acknowledges a problem of the mismatch of focus scope and semantic scope. Although we can apply more specific information sharing of Andrews and Manning's (1999) model, a deep problem seems to lie in the morpheme-based assumption of LFG. LFG is based on what Stump (2001) calls 'incremental-lexical' model. Lexical items including morphemes are stored in the lexicon and paired with a particular information. Morphemes are combined with the hosts below X^0 (or X^0-level). The information carried by each item is projected into f-structure by function ϕ. So, for instance, Lee (1999)[9] proposes that Korean case marker is adjoined to the host N and the N and this case marker become co-head:

(20)

```
                  N
          ________|________
         |                 |
        ↑=↓               ↑=↓
         N                Aff
         |                 |
       chayk              -i
  (↑PRED)=‘BOOK’        (SUBJ↑)
                     (↑CASE)=NOM
```

Those types of analyses are equally applicable to the treatment of inflectional morphology in general in the standard LFG. So, for example, Bresnan (2001:57) shows the f-description of the lexical entry *lion*, *live*, plural noun suffix *-s* and verb agreement suffix *-s* as follows:

(21) a. *lion*: N (↑PRED) = 'LION'
-s: $infl_N$ (↑NUM) = PL

b. *live*: V (↑PRED) = 'LIVE ⟨. . .⟩'
-s: $infl_V$ (↑TENSE) = PRES
(↑SUBJ) = ↓
(↓PERS) = 3
(↓NUM) = SG

What (21) suggests is plural marker *-s* carries the information indicating its mother, i.e. N, is plural whereas verbal suffix *-s* carries the information specifying its mother's (V) tense is present, and the person and number values of the mother's subject is 3rd and singular respectively.

The works in realisational model of morphology (Matthews 1972, 1991, Anderson 1992, Aronoff 1994, Beard 1995, Stump 2001) have pointed out the problems found in the assumption of one-one pair

[9]See also Sells (1995), Cho and Sells (1995), Andrews (1996), Nordlinger (1998) and many others for a similar treatment of morphological operations in LFG.

between form and function as in (20, 21) in that it is hard to capture some morphological phenomena such as cumulation, multiple exponence and so on.[10] Contrary to incremental-lexical approaches, the basic assumption behind 'inferential-realisational' model of morphology is that it regards the formatives, such as English *-s* in (21), as formal realisation of morphosyntactic features. In other words, the realisational model rejects the idea of treating morphemes as Saussurean signs where one-one pair between form and function is assumed. Thus, the inflections like (21) are not concatenation of base verb *like* and person/number agreement morpheme *-s*, or base noun *lion* and plural morpheme *-s* by the rule of morphotactics. Rather, lexeme LIKE and LION inflect for the morphosyntactic properties associated with them such as person, number and tense, and the morphology changes the forms of the lexemes to realise those properties, in (21) by suffixation to the root.[11]

Against those realisational model background, the solution to problematic Hindi and Japanese clitics is straightforward, that is they are inflectional suffixes at the phrasal level. We can assume that they do not occupy syntactic terminal such as K, Cl, Prt, rather they are products of suffixation process at phrasal level by morphology.[12] The apparent difference between Hindi and Japanese nominal clitics and English suffixes in (21) is their levels of realisation, i.e. X^0 and XP. The extension of affixasation to phrasal level is favoured in many works in the line of realisational morphology (e.g. Anderson 1992). In fact, the assumption that the morphology accesses to the phrasal level and realises the morphosyntactic properties by adding morphophonological objects like clitics in Hindi and Japanese gives unified account to the data, as we will see in the following sections. I show how to attain those phrasal inflection adopting Stump's (2001) Paradigm Function Morphology (PFM) along the line found in Spencer (2000, 2003b) and Luís and Spencer (to appear).

4 The proposals

4.1 The input to syntax and phrase structure

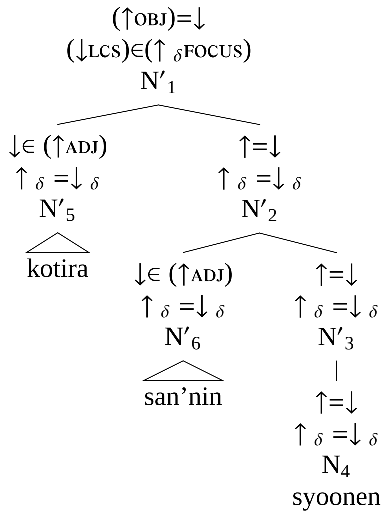
To incorporate PFM as a morphological component of LFG and realise phrasal inflection, a modifications of the frameworks is required. While the input to syntax is thought to be a fully inflected form of the word in the standard LFG (e.g. Bresnan 2001: 44), under the current proposal it is a lexeme. I assume that the lexicon is a storage of lexemes, where each has morphological information (phonological form and permissible morphological features), syntactic information (TERMS list or argument structure, X-bar category etc.) and semantic information (LCS). Thus, morphological operations are carried out on the c-structure according to the values of morphological features, that is they are not pre-syntactic. This process is illustrated in detail in the following sections.

The combinations of lexemes are constrained by phrase structure rules as normally assumed in LFG. For the phrase structure of Japanese nominals, I follow the proposals by Fukui (1986, 1995) which is also adopted by Sells (1995) for Japanese, Cho and Sells (1995) for Korean and Nordlinger (1998) for Wambaya phrase structures. One of the crucial points in Fukui's proposals is that empirical data suggests Japanese lacks D category and accordingly lacks functional projection DP. Lacking functional category D means the projection never reaches to the XP (=X″)-level and lacks Specifier. Thus, Japanese nominal projection is open in the sense that it leaves the projection as N′. Based on this proposal of

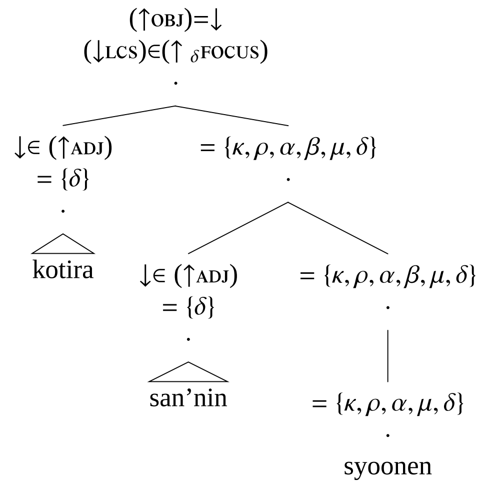
[10] For LFG, Spencer (2003a) points out the difficulties of morpheme-based lexicalism.
[11] Capital letters are used for a index of a lexeme.
[12] We could introduce syntactic terminal by morphology as sketched in Stump (1997). But I do not take this option here.

Japanese phrase structure, the c-structure for (13) is like (22a) – or (22b), the version fully committed to information spreading.[13]

(22) a.

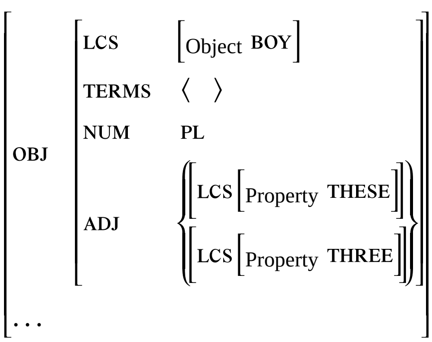


b.

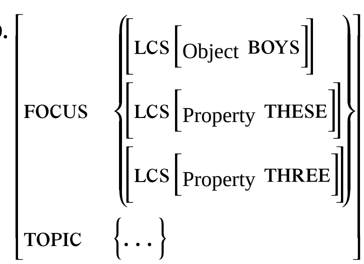


The prenominal modifiers such as KOTIRA ‘this/these’ and SAN’NIN ‘three’ are not D. They are adjoined to N′ of the head noun SYOONEN ‘boy’ and annotated as ADJUNCTIONS. Note that case/focus clitics do not appear in (22) since the terminal elements are not inflected yet. They go into the morphological component and receive particular forms according to the features associated with them as explained in the next section. The corresponding f- and d-structures are as follows:

(23) a.



b.



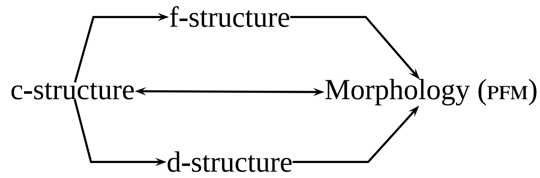
4.2 Incorporating PFM into LFG

One of the roles of morphology is giving a proper form to the stripped-off c-structure introduced in the previous section. Roughly, the general picture of the current proposal is schematised as in (24).[14]

[13]I add δ for discourse information to the natural classes assumed in Andrews and Manning (1999). The other classes are: κ (X-bar categories), ρ (grammatical functions), α (argument structure, TERMS, LCS), β (bar-level), μ (morphosyntactic features).

[14]Only the relevant components appear here. More components such as prosodic structure and semantic structure would come into the picture as well.

(24)



The morphology (PFM) part takes a lexeme (or complex of lexemes) in c-structure and the associated morphosyntactic/ discourse features as an input, then spells out a proper form for that input, which is returned to the c-structure. Note that this operation must not be regarded as derivational process, rather it is a well-formedness condition defined by PFM.

The core assumption of PFM is that function called 'Paradigm Function (PF)' specifies the inflected form for classes of lexeme of the language and places it in the correct cell in the paradigm. In Spencer's (2003b) revised version of PFM, PF is defined by a set of functions such as the rules of exponence, the rules of referral, stem selection and placement. So the basic representation of PF is like (25):[15]

(25) $\mathrm{PF}(\langle £, \sigma\rangle)=_{def}$

i.	stem:	$\mathrm{MOR}(\langle £, \sigma\rangle)$
ii.	exponence:	$\mathrm{R_I}(\sigma)$
iii.	placement:	$\mathrm{align}(\mathrm{R_I}, \mathrm{Right/Left}, \mathrm{Max/Min}, \mathrm{stem}(£, \sigma))$

Here PF is defined by the stem selection function 'MOR', realisation rule 'R' and alignment function 'align' for the input pair $\langle £, \sigma\rangle$ where £ is an index of the lexeme and σ is a complete set of morphosyntactic properties associated with the lexeme.

As for Japanese nominal inflection under the current discussion, the stem selection is straightforward, i.e. a root form. A realisation rule takes a bundle of morphosyntactic features as an argument and gives the output exponent for a particular inflectional class. Some of the realisation rules for Japanese nominals are like (26):

(26)
a. $\mathrm{R_{I,\{[Case:Dat]\},N}}(\sigma) = \mathrm{ni}$
b. $\mathrm{R_{I,\{[Dis:Foc],[Lcs:Only]\},N}}(\sigma) = \mathrm{dake}$
c. $\mathrm{R_{II,\{[Case:Gen]\},N}}(\sigma) = \mathrm{no}$

The realisation rule 'R' is defined by morphosyntactic properties such as [Case], [Number], [Lcs] and [Dis(course)] it formally realises. The subscript indices such as I and II specify the rule blocks which realisation rules belong to. Each rule block contains a number of realisation rules and which rule is applied is determined by Pāṇini's principle, that is for the input feature bundle σ the most narrowly specified rule is applied. Two or more realisation rules can be combined and turn out to be a composed function. For example, if the features associated with the input lexeme are [Case: Gen], [Dis: Foc] and [Lcs: Only], (26b) and (26c) are picked up from the rule blocks I and II respectively, then those two rules become a composed function which gives a morphophonological object *dakeno* as in (27):

(27) $\mathrm{R_I} \circ \mathrm{R_{II}}(\sigma) = \mathrm{dakeno}$

Alignment function specifies where the formatives realisation rules spell-out are placed for the input lexeme. (28) is an example for the Japanese clitic attachment – for the input pair $\langle £, \{[\mathrm{Case: Dat}]\}\rangle$.

[15] I add a hierarchical parameter (Max/Min) to the proposal of Spencer (2003b).

(28) align(R_I, Right, Max, stem(£, {[Case: Dat]}))

Function 'align' consists of 4-tuple. R is a function of the realisation rules, Right is a value of the horizontal parameter (Right/Left) determining to which direction of the host the output form of the realisation rule is attached, Max is a value of the vertical parameter (Max/Min) specifying the projection-level of the host lexeme where the output form is attached, and finally stem(£, σ) is a target stem of the lexeme. Thus, in this case 'align' states that 'place the output form of R_I – *ni* by (26a), to the right of the maximal projection of the stem of the input lexeme £'.

4.3 The analysis

We have looked at the basic mechanism of the morphology component in the previous section. I will show how this mechanism works for the Japanese nominal clitics (13), which is repeated here as (29).

(29) a. kotira=no san'nin=no syoonen=ni=dake kega-sase-ta
these=GEN three=GEN boy=DAT=FOC hurt-CAUS-PAST
'Only *these three boys* got hurt.'

b. kotira=no san'nin=no syoonen=dake=ni kega-sase-ta
'Only *these three boys* got hurt.'

c. kotira=no san'nin=dake=no syoonen=ni kega-sase-ta
'Only these *three* boys got hurt.'

d. ?kotira=dake=no san'nin=no syoonen=ni kega-sase-ta
'Only *these* three boys got hurt.'

The base c-structure for those examples are (22). [Case: Dat] is associated with the projection of the head noun SYOONEN.[16] The projections of the prenominal modifiers KOTIRA and SAN'NIN have [Case: Gen]. Since the focus covers the whole noun phrase, we assume that δ spreads among all the nodes, i.e. [Dis: Foc] is shared among the head noun projection and the prenominal modifier projections. As indicated by the italics in (29), [Lcs: Only] is included in different lexemes in the examples. In (29a, b), SYOONEN and its projection have [Lcs: Only], whereas KOTIRA and SAN'NIN and their projections have this feature in (29c) and (29d) respectively.

Let us look at how each lexeme goes into the morphology and PF puts the input onto the proper cells in the paradigm, i.e. how PF makes it well-formed according to the associated properties. (30) shows the process that PFM specifies the inflected forms of (29a, b).

(30) a. PF(⟨SYOONEN, {[Dat], [Foc], [Only]}⟩)$=_{def}$
- i. stem: MOR(⟨SYOONEN, {[Dat], [Foc]}⟩)
- ii. exponence: ($R_{I,\{[Dat]\},N} \circ R_{I,\{[Foc],[Only]\},N}$)({[Dat], [Foc], [Only]})
- iii. placement: align($R_I \circ R_I$, Right, Max, stem(SYOONEN, {[Dat], [Foc], [Only]}))

b. PF(⟨KOTIRA, {[Gen]}⟩)$=_{def}$
- i. stem: MOR(⟨KOTIRA, {[Gen]}⟩)
- ii. exponence: $R_{II,\{[Gen]\},N}$({[Gen]})
- iii. placement: align(R_{II}, Right, Max, stem(KOTIRA, {[Gen]}))

[16] It is more plausible to say that case is a syntactic/ grammatical feature for the noun phrase rather than the noun. Here, [Case] should be regarded as a morphological/ formal feature associated with a lexeme.

c. PF(⟨SAN'NIN, {[Gen]}⟩)$=_{def}$

i. stem: MOR(⟨SAN'NIN, {[Gen]}⟩)

ii. exponence: $R_{II,\{[Gen]\},N}$({[Gen]})

iii. placement: align(R_{II}, Right, Max, stem(SAN'NIN, {[Gen]}))

In (30aii), the composed function specifies the exponent for the input features like '($R_I \circ R_I$)(σ)=dakeni/nidake' by (26a, b).[17] The alignment function (30aiii) shows where this exponent is placed. Since it says the output form is placed at the right of the maximal projection of the stem of the input lexeme, *dakeni/nidake* is placed at N'_1 in (22a). Similarly, according to '$R_{II,\{[Gen]\},N}(\sigma)$=no' in (26c) and placement of (30b, c), *no* is added to N'_5 and N'_6 of (22a). Thus, the resultant inflected form is [*kotira=no san'nin=no syoonen*]=*ni=dake/dake=ni*.

In the case where 'only' takes its scope over the prenominal modifiers, KOTIRA for instance, the following process gives the correctly inflected forms (29c).

(31) a. PF(⟨SYOONEN, {[Dat]}⟩)$=_{def}$

i. stem: MOR(⟨SYOONEN, {[Dat]}⟩)

ii. exponence: $R_{I,\{[Dat]\},N}$({[Dat]})

iii. placement: align(R_I, Right, Max, stem(SYOONEN, {[Dat]}))

b. PF(⟨KOTIRA, {[Gen], [Foc], [Only]}⟩)$=_{def}$

i. stem: MOR(⟨KOTIRA, {[Gen], [Foc], [Only]}⟩)

ii. exponence: ($R_{I,\{[Foc],[Only]\},N} \circ R_{II,\{[Gen]\},N}$)({[Gen], [Foc], [Only]})

iii. placement: align($R_I \circ R_{II}$, Right, Max, stem(KOTIRA, {[Gen], [Foc], [Only]}))

c. PF(⟨SAN'NIN, {[Gen]}⟩)$=_{def}$

i. stem: MOR(⟨SAN'NIN, {[Gen]}⟩)

ii. exponence: $R_{II,\{[Gen]\},N}$({[Gen]})

iii. placement: align(R_{II}, Right, Max, stem(SAN'NIN, {[Gen]}))

Here, (31a) specifies *ni* is attached to N'_1 and (31b) states that *dakeno* is placed at N'_5. Those morphological operations give correct result (29c). (29d) where 'only' takes its scope over 'three' is inflected in a similar way.

4.4 Implications to Hindi focus clitics

The proposal in the previous section is applicable to Hindi data (12) without a significant modification. However, one of the intriguing aspects of the Hindi focus clitic is incorporation. As found in (12d), if *hī* is attached to the demonstrative *in*, it is incorporated. As a result, it is not separable from the host and receives the phonological effect. In other words, the focus marker is no longer a clitic. Sharma (2003:65) illustrate a set of incorporated forms of personal and demonstrative pronominals, a part of which is shown in (32):

[17] Unlike the standard PFM, I allow realisation rules in one rule block to be applied recursively (cf. Otoguro (2003) for Japanese nominal recursive rule blocks).

(32)

UNFOCUSED FORM	FOCUSED FORM	GLOSS OF FOCUSED FORM
muj^h	*mujhi*	me-FOC (obl.)
tum/tuj^h	*tumhi/tujhi*	you-FOC (obl.)
yah	*yahi*	he/she/it-FOC (prox.)
is	*isi*	he/she/it-FOC (obl., prox.)
ham	*hamhĩ*	I/we-FOC
in	*inhĩ*	they-FOC (obl., prox.)

Although I do not present a detailed analysis of Hindi incorporation, the data present some indication of the continuity between clitic and incorporated form. The fact that the incorporation is restricted to the closed class of hosts, i.e. personal/demonstrative pronominals, suggests that the morphological component (placement function, for example) is sensitive to the inflectional classes and gives formal realisations of morphosyntactic properties differently – in this case, it places *hī* onto pronominals at non-phrasal level, which triggers incorporation. This is exactly the point syntactic analyses miss as shown in the attachment of the clitic to D of (19b) and the incorporated form of (19c). In fact, such a continuity is often found in languages (e.g. Modern Greek clitics and affixes (Condoravdi and Kiparsky 2001)) and I believe that the division between clitics and affixes is not crystal clear, so it can be misleading to regard clitics as syntactic objects. Once we acknowledge that some types of formatives, which are often referred to a kind of 'clitics', are morphological objects rather than syntactic one, we can capture the generalisation and continuity by morphological operations. [18]

5 Conclusions

This paper addresses the problematic cases of a syntactic treatment of discourse clitics and their distribution in Hindi and Japanese. The alternative approach I have presented is a morphological treatment of the phenomenon. Unlike the standard LFG assumption to inflectional morphology ('incremental-lexical'), I adopt one of the 'inferential-realisational' models, Stump's (2001) PFM. Under the current proposal, the morphology is accessible to other components of grammar such as c-structure, f-structure and d-structure, so that Paradigm Function specifies the correct form of the input pair, index of the lexeme and associated features. Further, Andrews and Manning's (1999) information spreading allow flexible information sharing, i.e. semantic, discourse information, among phrase structure nodes. Such an architecture attains phrasal-level inflection and neatly accounts for the distributions of the nominals clitics in Japanese. Further, the framework suggests the possibility of capturing the continuity of the phrasal/lexical attachment of the morphological objects, which is widely observable in languages.

Some attempts of proposing the realisation-based morphological theory within LFG have been made. A different way of presenting the morphology-syntax interface within LFG and PFM is presented by Ackerman and Stump (to appear). Sells (to appear) shows how OT-LFG framework can be combined with the realisation models of morphology. The current proposal is one of the contributions to those attempts.

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[18]Note that I do not claim that every type of so-called clitics should be treated by morphology.

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A Realizational Approach to Case

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Abstract

The German noun phrase generally reflects a straightforward four-way case distinction (nominative, accusative, genitive, dative), but this is most clearly realized on the determiner. Nouns show a depleted case system: genitive is only marked specifically on masculine/neuter nouns in the singular. There are several contexts which require genitive case: possessor NPs and objects of certain verbs and prepositions as well as complements to deverbal nominalizations. However, certain forms of proper names obligatorily fail to realize their genitive case in genitive contexts. Moreover, there are contexts in which even an unambiguously marked genitive singular noun is inadequate on its own and has to be accompanied by an inflected (not indeclinable!) modifier. This complex pattern of behaviour is difficult for current LFG approaches to case to handle because there is a many-many relationship between syntactic case specification and morphological case marking. I propose a realizational analysis, in which it is only NP/DPs in c-structure which are given syntactic CASE attributes. A set of f- to c-structure mapping rules define the distribution of these attributes, effectively capturing statements such as 'transitive SUBJECT is realized by ergative', 'POSSESSOR is realized by genitive' and so on. The syntactic CASE attributes are not part of lexical structure but are mapped onto morphological case-marked forms. Thus, syntactic CASE GEN is by default realized by a noun marked [Case: Gen], but not always, and not all [Case: Gen] marked elements realize CASE GEN (much less POSS).

1. Introduction*

This paper investigates the relationship between the formal marking of case by inflected word forms, and the syntactic functions of case. The empirical starting point is the exponence of genitive case in German. The German noun phrase generally reflects a straightforward four-way case distinction (nominative, accusative, genitive, dative), but it is only on the determiner that all four cases are distinctively realized. Nouns show a depleted case system: genitive is only marked specifically on masculine/neuter nouns in the singular.

There are several contexts which require genitive case: complements to nouns (for instance, possessor NPs) and objects of certain verbs and prepositions. In such contexts, case is canonically marked on the determiner and on the lexical noun: *die Kantaten unser-es Kapellmeister-s* 'the cantatas of our-GEN choir master-GEN'. This is also true of bare proper names (in literary registers): *die Kantaten J S Bach-s* 'the cantatas of J S Bach-GEN' (besides the more colloquial *Bachs Kantaten* or *die Kantaten von Bach*). However, proper names show complex restrictions. When a determiner or adjective modifies a proper name the noun fails to inflect: *die Kantaten unser-es/des weltbekannt-en Bach/*Bachs* 'the cantatas of our-GEN/the-GEN famous-GEN Bach'. Likewise, proper names fail to inflect after genitive-taking prepositions: *statt Bach/*Bachs* 'instead of Bach' (cf. *statt unser-es Kapellmeister-s* 'instead of our choir master'). In other words, when a noun heads a noun phrase in a genitive-case marked context, the grammar of German doesn't always require that noun to reflect

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the case marking morphologically. We see the opposite pattern when a verb selects a genitive complement. When such a complement remains unmodified the expression is ungrammatical: **Er bedarf Zuspruch-es* ‘He needed consolation-GEN’. Such a construction is only grammatical if the noun is modified: *Er bedarf unser-es Zuspruch-es* ‘He needed our-GEN consolation-GEN’. This is despite the fact that the form *Zuspruches* unambiguously signals genitive case (as well as singular number).

These and other mismatches between syntactic case function and morphological form show that we must separate two notions of case: syntactic and morphological case. I argue that the most important of these is the syntactic notion. However, syntactic case has to be regarded as a property of the phrase, not of individual words (or word forms). Word forms reflect (realize, serve as an exponent of) syntactic case in various ways to various extents depending on the language. I code this by proposing a realizational account of syntactic case specification and of the relation between the syntactic case of a noun phrase (determiner phrase) and the morphological case marking on constituents of that noun phrase. A consequence of this for LFG is that syntactic case (the attribute that is represented in f-structure) is not projected from inflected words. This means that there is no need, in German at least, for us to assume that a case-marked word form constructs a grammatical function by means of an inside-out designator (as proposed by Nordlinger, 1998, for Australian case systems). On my account a structural syntactic cases is best conceived of as a signal or exponent of a grammatical relation. For instance, suppose that a c-structure NP node is given the annotation (↑POSS)=↓, specifying that NP as the exponent of a possessor. Then the syntactic case associated with that NP is defined by means of a conditional: (↑POSS)=↓ ⇒ (↓CASE)=GEN. More generally, we need to be able to map parts of complete f-structures to c-structures. For instance, to define an ergative SUBJ we need a statement along the following lines: Where f is a complete, coherent clausal f-structure containing SUBJ and OBJ attributes, then the c-structure correspondent of SUBJ is annotated (↓CASE) = ERG.

In effect, the proposal reverses the ‘direction’ of constructive case. Where a constructive designator acts as an instruction to add a GF description to an f-structure, the realizational equivalent takes a GF in an f-structure and annotates the c-structure correspondent with the case feature that realizes that GF. In principle, the two types of relation should be inverses of each other, but this isn’t entirely the case, because under the present proposal the relationship between case marking of a phrase and morphological case marking is non-standard. I leave it for future research to determine the extent to which the realizational approach is compatible with a constructive case interpretation, and if so, under what terms.

The realizational rules are not yet formulated explicitly in the paper. They are most naturally envisaged as an extension of the Paradigm Function architecture familiar from morphology (Stump 2001), in which the realization rules serve to define the manner in which an f-structure (and perhaps associated semantic features) is realized in c-structure and morphological form. Some of the realization rules select individual function words, for instance:

(1) [SPEC DEF] ⇒ $[_{\mathrm{D}}$ *the*]

Others define constructional idioms (periphrases), for instance,

(2) [ASP PERF] ⇒ HAVE + V[PastPart]

(Specific examples of this kind of construction are discussed in Spencer 2001, 2003).

Case rules define (structural) syntactic case marking, e.g. for structural case in ergative languages, apply the following rules (where either rule can be pre-empted by a more specific rule, e.g. one defining Experiencer SUBJ as DAT, or volitional intransitive SUBJ as ERG):

(3) (i) where ν is the c-structure correspondent of SUBJ in the f-structure

$$f: \begin{bmatrix} \text{PRED} & \text{'Verb} \langle\;\rangle\text{'} \\ \text{SUBJ} & \\ \text{OBJ} & \end{bmatrix}$$

annotate ν with (↓CASE) = ERG

(ii) where ν is the c-structure correspondent of GF in f, annotate ν with (↓CASE) = ABS.

2. Preliminary distinctions

As in earlier work (see Sadler & Spencer, 2001) I will refer to the names of syntactic properties/features (whether in f-structure, c-structure, a-structure or other projections) as "s-features" (without any commitment to a specifically featural analysis of these properties in a formalized grammar). Such labels are to be distinguished from purely morphological (form) properties governing the shapes of words, "m-features". In some instances there will be no morphological correlate to an s-feature (4a), and in other instances there will be no syntactic correlate to an m-feature (4b). In many cases, however, there will be some kind of correspondence, in that certain morphological forms will serve as the realization or exponent of an s-feature (or ensemble of s-features), (4c, d):

(4)	(a)	SUBJ	–	no m-feature equivalent
	(b)	[Declension:3rd]	–	no s-feature equivalent
	(c)	NUM PL	⇔	[Num:Pl] (usually!)
	(d)	CASE ERG	⇔	[Case:Erg] (but not always!)

3. Some LFG approaches to case

In this subsection I briefly outline two of a number of approaches to case in the LFG literature, which are pertinent to my argument.

3.1 Case as a constraint on form

King (1995: 177) provides the entry in (5) for the accusative singular form of the feminine gender noun KNIGA in Russian:

(5) *knigu* (↑GEN) = FEM
(↑NUM) = SNG
(↑CASE) =c ACC

She observes: “*Knigu* itself is not an accusative case noun, rather it is a form that must be assigned accusative case.” In terms of the distinctions introduced in section 2 we can interpret this as follows:

> “*Knigu* itself does not bear the (syntactic) feature CASE ACC, rather it is a form bearing the morphological (form) feature [Case: Acc], which by default will have a c-structure correspondent bearing the attribute CASE ACC.”

3.2 Constructive case

Nordlinger (1998) makes the important point that structural cases enjoy a very specific relationship with grammatical functions. She argues that case markers ‘construct’ grammatical relations, coded by means of inside-out designators, which allow reference to higher portions of f-structure. Thus, an ergative case morpheme might be given the entry shown in (6):

(6) $((\text{SUBJ}\uparrow)\ \text{OBJ})$
$(\uparrow\text{CASE}) = \text{ERG}$

This can be interpreted as saying ‘my f-structure is the value of a SUBJ attribute, which is contained in an f-structure which contains an OBJ attribute’. This device offers an immediate way to capture the morphosyntactic function of structural case marking and therefore represents an significant advance over earlier approaches to similar phenomena.

3.3 Observations

Without investigating the extent to which the older approach exemplified by King (1995) is compatible with the newer Constructive Case model, I shall make brief observations on each of these approaches.

First, the Russian case system provides well-known problems for the kind of entries deployed by King. Russian nominals inflect for a number of cases, including nominative, accusative and genitive. The accusative plural of all animate nouns is identical to the genitive, while the accusative plural of all inanimate nouns is identical to the nominative. Modifiers inflect in the same way as head nouns, so that choice of ending for accusative plural depends on the animacy of that head noun. Feminine gender nouns belong either to the 2nd or 3rd declension. In either case the accusative is distinct from the genitive in the singular (and 2nd declension nouns have the unique form in *–u* illustrated in (5)). Most masculine gender nouns are in the 1st declension. In the singular these show the same syncretism as plural nouns: the accusative singular of animates is identical to the genitive and that of inanimates is identical to the nominative. Modifiers reflect animacy in the accusative in that they take the genitive singular form when agreeing with an animate masculine noun in accusative contexts and they take the nominative singular form with inanimates in the same contexts.

There is an interesting twist, however. Many masculine animates follow the 2nd declension, including many proper name diminutives such as Sasha, Lyosha, Volodya and even the word *mužčina* ‘man’. Being 2nd declension nouns these have the dedicated accusative singular form in *–u*. The behaviour of such nouns is illustrated in the examples in (7), contrasting with 1st declension masculines and 2nd declension feminines:

(7) Ja uvidel
‘I saw

a. vysok-uju ženščin-u
tall-FEM.ACC.SG woman.FEM-ACC.SG
‘a tall woman’

b. vysok-uju rjabin-u
tall-FEM.ACC.SG rowan.fem-ACC.SG
‘a tall rowan tree’

c. vysok-ogo mal’čik-a
tall-MASC.GEN.SG boy.masc-GEN.SG
‘a tall boy’

d. vysok-ij dub
tall-MASC.NOM.SG oak.MASC-NOM.SG
‘a tall oak tree’

e. *vysok-ij mal´čik
tall-MASC.NOM.SG boy.masc-NOM.SG

f. vysok-ogo mužščin-u
tall-MASC.GEN.SG man.MASC-ACC.SG
‘a tall man’

cf:

g. vysok-ogo mužščin-y
tall-MASC.GEN.SG man.MASC-GEN.SG
‘a tall man’

h. *vysok-ij mužščin-a
tall-MASC.NOM.SG man.MASC-NOM.SG
‘a tall man’

The problem presented by these data is to ensure that an accusative DP with a masculine animate lexical head triggers genitive agreements, even when the noun itself has a dedicated accusative form, as in (7f) vs. (7g). Thus, in (7f) we have to ensure that the inflected form *mužčinu* has a lexical entry specifying that it is accusative, but the adjective has to be given a conflicting case value, genitive. The problem for constructive case is to ensure that a genitive case form is able to construct the grammatical function appropriate to accusative case (direct object, complement to certain prepositions) in addition to the genitive case form functions (possessor, complement to certain classes of verbs and prepositions).

There are other interesting problems for the Constructive approach to case. These are summarized in (8):

(8) Issues for Constructive Case

- It requires coherent lexical entries to case markers.
- Case marking has to perform a dual function: CASEs construct GF's (of which they are an attribute) but also have to constrain morphological form of lexical head.
- 'Agreement': how do you force, say, CASE ERG on more than one constituent of a SUBJECT NP (cf Sells, forthcoming)? More particularly, how can one account for:
- 'Excrescent case marking' (Nordlinger 1998 on Warlpiri)

(9) Jalangu-rlu ka-lu-jana puluku turnu-ma-ni
today-ERG PRES-3.PL.S-3.PL.O bullock(ABS) muster-CAUS

yapa-ngku
man-ERG
'The people are mustering cattle today'

In (9) (Nordlinger's example (50)), the adverbial *jalangurlu* 'today' is marked with ergative case because that is the case of the subject. Thus, Nordlinger writes the equation given in (10):

(10) $((GF\uparrow)$ SUBJ CASE$)$ = ERG

This says that the f-structure of whole clause, $(GF\uparrow)$, has a SUBJ attribute whose CASE attribute has the value 'ERG'. However, the ADJUNCT *jalangu-rlu* is not itself marked CASE ERG in f-structure. But in that case, it's not obvious why the f-structure SUBJ attribute has to have a value for a CASE feature, since the CASE has done its job (twice!) of constructing the SUBJ.

4. The German Genitive

In this section I show that the genitive m-case markers of Standard German (Hochdeutsch) cannot be given coherent lexical entries. Morphological genitive case marking on a noun is sometimes excluded in contexts where the syntax demands CASE GEN contexts and in other contexts it is neither necessary nor sufficient.

4.1 Case-marking is not necessary: non-obligatory marking

Masculine gender proper names inflect for genitive. However, in compound names (for instance, given name + surname) only the final element inflects for genitive (11). Some prepositions select genitive case complements, but proper names never inflect for genitive after these prepositions (12). Finally, if a propername is modified by an inflecting determiner or adjective then the head noun cannot inflect for genitive (13):

(11) a. die Kantaten Johann Sebastian Bachs
'the cantatas of J S Bach'

b. die Kantaten Johanns

(12) statt Bach(*s)
'instead of Bach'

(13) die Konzerte des jüngsten Bach(*s)
'the concertos of the youngest Bach'

The last fact crucially refers to the property 'Proper Name'. Some proper names are homophones with common nouns, and this can give rise to minimal pairs such as that shown in (14). Only the inanimate dirigible is allowed to inflect in the genitive (14b), not the founder of the company that made the airships (14a):

(14) a. das Schicksal des weltbekannten Zeppelin
the fate THE.GEN famous Zeppelin
'the fate of the famous (Count) Zeppelin'

b. das Schicksal des weltbekannten Zeppelin-s
the fate THE.GEN famous Zeppelin-GEN
'the fate of the famous Zeppelin (airship)'

4.2 Case-marking not sufficient - obligatory overt marking

It has been observed (Schachtl 1989, Gallmann 1990, 1996, 1997) that there are other constraints on the patterning of case marking on nouns[1]. In the plural nouns lack an unambiguous genitive form. Bare noun complements in genitive case contexts are unacceptable (15a) and require a case marked modifier of some sort (15b):

(15) a. *die Aussagen Zeugen
'the statements of witnesses.PL'

b. OKdie Aussagen dieser Zeugen
'the statements of this.GEN.PL witnesses.PL'
'the statements of these witnesses'

This may seem functionally motivated, but it's of interest that the determiner *dieser* 'this' could be masculine singular nominative or feminine singular genitive/dative. Thus, the form itself only determines the features 'genitive' and 'plural' in conjunction with the head noun. Moreover, no such modification is required in nominative or accusative case contexts.

Of particular interest for the theory of lexical entries and case marking is the fact that even an unambiguously genitive case-marked noun form isn't always sufficient to guarantee acceptability:

(16) a. *Er bedarf Zuspruch-es
'He needs consolation-GEN.SG'

b. OKEr bedarf unser-es Zuspruch-es
'He needs our-GEN.SG consolation-GEN.SG'
'He needs our consolation'

In (16) the form *Zuspruches* is unambiguously genitive and singular but the form can't be used as a genitive complement in isolation. In (16b) the modifier is also unambiguously (masculine/neuter) genitive singular, but that is not true of the modifier in (17b) below:

[1] See also Zlatić & Wechsler (2001) on similar phenomena in Serbo-Croat

(17) a. die Verarbeitung des Holz-es
the preparation THE.MASC.GEN.SG wood-GEN
'the preparation of the wood'

b. die Verarbeitung tropisch-en Holzes
the preparation tropical-en wood-GEN
'the preparation of tropical wood'

The form *tropischen* could appear in almost any cell of the paradigm, depending on whether there is a definite determiner somewhere in the DP, and thus it can't by any stretch of the imagination be said to uniquely determine the (already uniquely determined) head noun. On the other hand, there has to be some modifier and that modifier has to inflect. In (18) we see that an indeclinable modifier, *prima* 'fine', is as bad as no modifier at all:

(18) *die Verarbeitung (prima) Holz-es
the preparation fine.INDECL wood-GEN

To complicate matters somewhat, an indeclinable modifier such as *rosa* 'pink' is acceptable provided it is accompanied by a declinable modifier (19a), but the declinable modifier must precede the indeclinable (19b):

(19) a. Das Tragen gestreift-er, rosa Kravatte-n
the wearing striped-PL.GEN pink tie-PL
'the wearing of striped, pink ties'

b. *Das Tragen rosa gestreift-er Kravatte-n
the wearing pink striped-PL.GEN tie-PL

4.3 Conclusions

The German facts just summarized show us that it is not sufficient to furnish the lexical entry for nouns of the form *Noun–*(*e*)*s* with a constraint equation ($\uparrow$CASE) $=_c$ GEN in the manner of (5). This:

- gives ungrammaticality with (some) Proper Nouns
- is not sufficient on Nouns generally in possessive constructions and complements to nouns

These data also show that a noun form with unambiguous morphological case marking isn't always capable of constructing a grammatical function (such as 'POSS', 'OBJ'). I will therefore propose a different account of case marking which is capable of capturing the full richness of the phenomenon, and which can also answer the questions posed in section 3.3.

5. Realization-based analysis

In this section I present an analysis that relies on the idea of capturing regularities in morphosyntax by reference to mapping principles which take partial f-structures and specify the kinds of c-structures that can realize those f-structures. I have argued for such a 'top-down' approach to auxiliary-participle constructions in Slavic (Spencer 2001, 2003), following the lead of Ackerman & Webelhuth (1998). In this section I develop these ideas in the context of the German genitive. The analysis has also been significantly influenced by the work of Durrell (1979).

5.1 Overview

The basic assumptions of the analysis are presented in (20):

(20) Basic assumptions

- Distinguish specification/distribution of CASE in the syntax from the morphological realization of case (s-CASE vs. m-Case).
- CASE is a grammaticalized property, hence, it must be apparent in grammatical structures (e.g. CASE agreement, CASE selection by specific lexical items etc.). Thus, we aren't committed to saying that the English preposition *with* is a 'Instrumental Case (marker)'.
- CASE is a device for (partially) realizing GFs, specifying semantic aspects of GFs (including adjuncts), specifying semantic aspects of predicators (verb, adposition, ...)
- CASE is a property of NPs (DPs), not of nouns, not even Case-marked nouns.
- CASE is realized (partly) by morphosyntactic marking on the NP/DP: (i) lexical head marking, (ii) phrasal affixation (cliticization) to (some constituent of) NP

The proposal is summarized in (21):

(21) Proposal

- The distribution of s-CASE is determined by f-structure properties (together, possibly, with aspects of semantics, information structure, ...). These define 'CASE contexts'.
- CASE assignment is defined by the f-structure ⇔ c-structure mapping (but it may also appeal to other projections).
- CASE is (partially) realized by morphological Case (m-Case).
- The syntax ⇒ morphology mapping is couched in terms of 'realization rules' governed by default inheritance[2]. This allows us to capture the idea of a default realization or a default mapping.

5.2 Illustration: Syntax ⇒ morphology mapping

5.2.1 Syntactic case contexts (informal statements)

In (22) I define informally the kinds of contexts which demand genitive case marking in German:

(22) a. $(\uparrow\text{POSS}) = \downarrow$ (Possessor NP)

b. $(\uparrow\text{OBJ CASE}) =_c \text{GEN}$ (Gen complements to V, P)

The default mapping principle for the POSS GF is shown in (23):

(23) $(\uparrow \text{POSS}) = \downarrow \Rightarrow (\downarrow \text{CASE}) = \text{GEN}$

a possessor NP is marked GEN (ceteris paribus!)

In addition, we will need parochial lexical annotations for genitive-taking verbs and prepositions: $(\uparrow\text{OBJ CASE}) = \text{GEN}$[3]. A theory of deverbal nominalizations will also

[2] A generation-mode OT analysis may well be a feasible way of implementing this.

[3] I haven't been able to determine how best to state such constraints. It's very important for my approach that a satisfactory way be found of integrating such

be needed so as to express the fact that an argument of the original verb can be expressed as though it were the complement of the (derived) noun.

Simplifying, then, the equation in (23) tells us that, other things being equal, a c-structure constituent which maps to a POSS GF has to have a genitive case value. I shall assume that such case values are freely assigned to maximal nominal projections as part of the phrase structure component. Equations of this sort will link c-structure CASE annotated NP/DPs with the f-structure correspondents[4]. Now we must turn to the mapping between c-structure and morphological form.

5.2.2 Morphosyntactic realization (for German)

The morphological-case system for German in general distinguishes four cases in each of the singular and plural numbers. In addition, the agreement system recognizes three genders. Adjectives inflect in two ways, showing the so-called 'weak inflection' in the domain of definite determiners, and the so-called 'strong inflection' in most other cases (there is also a 'mixed inflection'). I shall not discuss adjectival inflection in this paper. As far as I can tell the 'strong/weak' declension property is essentially orthogonal to the specific claims being advanced here about case assignment.

The full inflectional system is only found with determiners. The situation with lexical nouns is complicated somewhat by the fact nouns come in two declension classes, 'strong' and 'weak'[5]. The 'weak' nouns take the *–(e)n* desinence in all case/number forms except nominative singular. The 'strong' nouns have a richer, but still severely depleted case system., schematized in (24):

(24) a. {nominative, accusative, genitive} plural
b. {accusative, dative} singular
c. dative plural
d. genitive singular
e. nominative singular

The patterns are illustrated in (25):

(25) Noun declension:
a. [Class: Strong]
Form:

Base	*Mann*	*Zeuge*	*Bach*
PluralForm	*Männer*	*Zeugen*	*Bachs*
GenForm	*Mannes*	*Zeuges*	*Bachs*
DatForm	*Männern*	*Zeugen*	*Bachs*

b. [Class: Weak]

Form:

Base	*Student*
EnForm	*Studenten*

exceptional case marking instances into the architecture. See also the remarks below on non-default subject case marking.

[4] If we were to make (23) into a biconditional we would effectively be formalizing a version of Constructive Case.

[5] This distinction is not to be confused with the 'strong/weak' adjective declension classes.

As can be seen a number of distinctions are completely neutralized. The situation as a whole can be summarized as follows:

- No noun distinguishes non-dative case in the plural
- No noun distinguishes accusative/dative case in the singular
- Weak nouns have *–en* as their default form

If we ignore the Weak nouns, we find that a noun's inflectional paradigm includes at most a base form, a genitive singular, a dative plural and a non-dative plural form. This means that we need just the feature set in (26) to account for noun inflection (cf the observations in Gallmann 1998, 2003, Müller 2002):

(26) a. [Class:{Strong, Weak}], [Type:{Proper, Common}]
b. [Form:{Base, PlForm, GenForm, DatForm}]

We must now make explicit various aspects of case marking and the syntax-to-morphology mapping for case.

(27) For Determiners and (strong) adjectives only:

CASE NOM ⇒ Case: Nom
CASE ACC ⇒ Case: Acc
CASE GEN ⇒ Case: Gen
CASE DAT ⇒ Case: Dat

The following syntax ⇒ morphology default mappings apply:

(28) a. CASE is realized on phrase-initial Det/(strong) Adj
b. CASE is realized on lexical head (but not by (27))

In order to account for the complex and somewhat irregular patterning of case marking which we've seen we need a number of stipulative principles:

(29) Stipulations:

- Weak/mixed declension of adjectives is required after strong determiners.
- Proper nouns inflect on the rightmost word only.
- In POSS/OBJ NPs marked CASE GEN, the leftmost c-structure correspondent in the Det/Adj field must be marked [Form:GenForm], hence:
  **die Verarbeitung (prima) Holzes*
  *bedarf *(dieses/unseres) Zuspruches*
- A proper noun is realized by [Form:Base] in the following contexts:
  (i) where Det/Adj field is not empty: *die Konzerte des jüngsten Bach(*s).*
  (ii) after *statt*-class prepositions: *statt Bach(*s)*
- Various other stipulations: *des Barock* 'of the baroque (period)', *in den letzten Tagen des Monats Oktober* 'in the last days of the month of October' vs. *in den ersten Tagen des Oktobers* 'in the first days of October', etc.

As a result the syntax proper is relatively simple, and the idiosyncrasies are limited to the syntax ⇒ morphology mapping and to the enumeration of morphological forms.

6. Some questions for future research

A phenomenon which has been much discussed and which requires some explication in the framework presented here is that of non-default case assignment to grammatical functions, and particularly the assignment of non-default ('quirky') cases to subjects in languages such as Icelandic. Andrews (1982, 1990) has developed a detailed account of this within LFG which relies on the idea of a grammatical function taking case attributes in f-structure. In addition, the grammatical function itself is the value of a case attribute. Clearly, that approach is incompatible with the approach adopted here, in which (syntactic) case features are attributes solely of c-structure maximal projections and are illegitimate as f-structure attributes.

On the present approach, non-default assignment generally is handled by overrides. Thus, the class of verbs which select dative, genitive or accusative subjects would be marked in such a way as to require any subjects with overt c-structure correspondents to bear the appropriate lexical case. This would capture the intuition (expressed explicitly in the approach of Andrews, for instance) that nominative is in some sense the default, unmarked case. In this respect, the existence of quirky case marking offers a certain degree of motivation for the realizational approach, because the default nature of nominative marking follows automatically from the architecture. However, there are several issues in Icelandic morphosyntax which the realizational approach doesn't yet address, such as the case marking of null subjects in complements and other questions. These must be left to future research.

I have assumed (somewhat tacitly) that case annotations are freely assigned to NP/DP nodes and that illicit assignments are excluded because of violation of a constraint equation. However, this doesn't capture the behaviour of structural cases as described by Maling (1993) for Finnish or by Wechsler & Lee (1996) for Korean. In those languages (as in certain Slavic languages) certain (mainly temporal) adverbials a marked with accusative. In contexts such as the passive, such accusative-marked adverbials may assume nominative case, indicating that they are structurally marked. (In Russian an accusative-marked adverbial may receive the genitive-of-negation in negation contexts.) One way of addressing this question would be to examine the extent to which the proposals of this paper are compatible with or can incorporate the notion of a case 'tier' proposed by Yip, Maling and Jackendoff (1987). For instance, it might be possible re-conceptualize their case tier as a positive restriction in the sense of Andrews and Manning (1999). We would then assume, following Yip et al., that there is a fixed sequence of available cases and that the linkage between the case tier and c-structural is defined by the realizational mapping principles introduced earlier. However, other technical responses to this problem spring to mind and so I shall leave this aspect of the problem to future research.

In a variety of languages we find that case marking of a GF depends on semantic factors. Thus, in Hindi-Urdu a subject may be marked with the 'ergative' marker *ne* if it is necessary to stress the agentive properties of the subject (for instance, to distinguish between volitional and involuntary actions, Butt 1995). Likewise, in Finnish choice of genitive/accusative vs. partitive case for the direct object depends on whether the object is affected entirely or only partly (Maling 1993). These and many other related phenomena demonstrate that the case specifying mapping principles sometimes need access to a properly semantic representation, as well as to f-structures.

On occasions a particular grammatical function such as OBJ or POSS can be realized in entirely different ways depending on various factors. One obvious instance of this is found in languages with free noun incorporation, in which a direct object (and sometimes other GFs) can either be expressed as a NP/DP in the syntax or as part of a compound verb stem (with intermediate possibilities). Conversely, we sometimes find an alternation between NP-internal expression of possessors and external marking of possession. My assumption is that in such constructions one of the structures will be the default and the others will be conditioned by discourse, semantic, morphosyntactic or lexical properties. However, there is no obvious problem in principle with such cases. Indeed, they merely illustrate again the fact that the mapping which specifies how a given GF is to be expressed morphosyntactically in the general case needs to take as its input a rich representation, including not only f-structure attributes, but also other aspects of the representation such as semantics.

Finally, a problem which has been largely ignored in this paper is that of multiple case marking. There are two distinct, though possibly related, questions here. The first is how to handle the familiar phenomenon of so-called ‘case agreement’, in which a modifier reflects the case marking of the head that it modifies. It is unclear whether such phenomena belong properly to a theory of syntactic ‘multiple exponence’ or to a theory of agreement. Another problem is that of successive marking of more than one case on a single nominal, as found in many Australian languages (Nordlinger 1998). Languages can exhibit very complex patterning here (for an overview see the papers in Plank 1995). A treatment within the current framework would presuppose a properly worked out theory of case agreement generally, and that will have to await a special study.

7. Conclusions

I present here the principal implications of this paper for the architecture of grammatical theory.

- m-Case is a paradigmatic (inflectional) property of a noun lexeme serving various purposes, including the expression of s-CASE.
- s-CASE is an (abstract) property of maximal constituents (typically the NP/DP).
- s-CASE can be realized as m-Case (and other structures) by means of realization rules which define the mapping s-CASE ⇒ m-Case.
- The relationship between s-CASE and m-Case is in general many-many (as witnessed by mismatches between s-CASE labels and m-Case labels). Hence, the realization of CASE need not be ‘compositional’
- The specification of CASE in c-structure is the result of mapping rules (realization rules) which take partial f-structure as input. They may also take other aspect of the representation into account, such as discourse factors or semantics.
- The specification of s-CASE is achieved by default mappings which can be overridden in specific circumstances.

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The *thuuk* Construction in Thai

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The *thuuk* Construction in Thai

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The *thuuk* construction in Thai has been referred to as passive by many Thai linguists (Chaiyaratana 1961, Warutamasinthop 1975, Warotamasikkhadit 1963, Lekhawattana 1970, Kullavanijava 1974, Wongbaisaj 1979). I argue that the *thuuk* construction is not a true passive, but rather a weak unbounded dependency construction like the "Tough" construction in English. Essentially following Dalrymple and King's (2000) analysis of English "Tough" construction, I propose that the *thuuk* construction results from two grammatical processes: topicalization and functional control. The first grammatical function in the body of the path of the *thuuk* predicated is always SUBJ of the matrix verb, which comes from TOP of SCOMP, and the bottom of the path can be either an embedded object or an embedded subject. The *thuuk* construction in Thai is similar to the so-called 'passive' constructions in Mandarin Chinese and in Japanese, which, according to Huang (1999) and Toyoshima (1996), are also weak unbounded dependencies.

The *thuuk* Construction in Thai *

1. Introduction

The Thai sentence in (1) has been referred to as the *thuuk* construction (Kullavanijava 1974). This sentence has a structure parallel to the sentence in (2).

(1) dææng *thuuk* mææ tii
Dang suffer mother hit
'Dang suffered (from the experience that) mother hit (him).'

(2) mææ tii dææng
mother hit Dang
'Mother hit Dang.'

The object NP dææng 'Dang' in (2) becomes the subject in (1), and *thuuk* is added between this NP and the NP mææ 'mother'.

There is an adversative meaning associated with *thuuk* in (1), that is, its subject suffers from an unpleasant experience. Although the status of *thuuk* is controversial, many Thai linguists (Warotamasikkhadit 1963, Lekhawattana 1970, Kullavanijava 1974, Wongbaisaj 1979) consider this construction a passive.

thuuk has two functions in Thai sentences. First, it is a main verb and subcategorizes for an NP as in (3)[1].

(3) dææng *thuuk* [$_{NP}$ tau mææ].
Dang touch body mother
'Dang touched (his) mother's body.'

Second, it occurs in the *thuuk* construction as in (1). The status of *thuuk* in this construction is still not clear. The structure of (1) is either a complex sentence (if *thuuk* is analyzed as a lexical verb) or a simple sentence (if *thuuk* is analyzed as a passive marker).

There is a difference in the relation change of a sentence (1) compared to the standard passive sentence in which the subject of the active sentence becomes an oblique in the passive sentence. The NP mææ 'mother' in (1) is in the same position in which it occurred in (2); it is still in the subject position of the verb tii 'hit', which means that this subject is not mapped to be an oblique as it would be in the standard passive. This observation raises a question about the analysis of (1) as a passive. I argue that the *thuuk* construction has a structure like (4), in which *thuuk*, as a main verb, requires a clausal complement and the syntactic category of the gapped object and the matrix subject is matched, which is a property of long-distance dependencies. The dependency between the gapped object and the matrix subject involves functional control.

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[1] I will discuss the lexical entry of *thuuk* in 4.1.

(4) dææng *thuuk* [mææ tii __$_i$]
Dang suffer mother hit
'Dang suffered (from the experience that) mother hit (him).'

This construction is similar to the "Tough" construction in English such as (5), in which the subject has the same referential index as the trace.

(5) a. Kim$_i$ would be easy to bribe ___$_i$.
b. Kim$_i$ would be easy to prove Sandy bribed ___$_i$.

I thus propose that the thuuk construction in Thai, like the "Tough" construction in English, is a kind of weak unbounded dependency structure, and its dependency involves a control relation in which the subject and its gapped object are identical.

I continue this paper with an overview of Thai syntax in section 2. In section 3, I give the structure of passive construction in Thai showing that there are two kinds of constructions, which are referred to as passives: *dooy* and *thuuk* constructions. I propose that only the *dooy* construction is a true passive. Then I present previous studies of the *thuuk* construction and argue that it is not a true passive. I show that *thuuk* in this construction is a main verb which subcategorizes for a clausal complement in section 4. In section 5, I propose an alternative analysis of the *thuuk* construction in terms of Lexical Functional Grammar (LFG), showing that this construction has two grammatical processes: topicalization and functional control. I also show that the *thuuk* construction is similar to the "Tough" construction in English and propose to classify this construction as a weak unbounded dependency. Finally I conclude the paper in section 6.

2. Thai Syntax: Overview

This study is based on the dialect of Thai spoken in the central part of Thailand, where Bangkok, the capital of the country, is situated. This dialect is used in the classroom and in conducting national affairs and is officially considered 'Standard Thai' or the national language of Thailand. It is in the Tai family, which is the monosyllabic language family[1]. The Thai language has subject-verb-object (SVO) word order. The phrase structure rule S NP VP generates the following Thai sentences:

(6) nóy nåå[2] n
Noy sleep
'Noy sleeps.'
(7) nóy kin khâaw
Noy eat rice
'Noy eats rice.'
(8) nóy kin khâaw mîo[3] waanníi
Noy eat rice yesterday
'Noy ate rice yesterday.'

In (6), the verb nåån 'sleep' has only one argument, which is nóy 'Noy', while the verb kin 'eat' in (7) has two arguments, which are nóy 'Noy' and khâaw 'rice'. The preverbal

[1] Some linguists such as Paul K. Benedict referred to Tai family as 'Tai Kadai' in order to include many Thai dialects such as Kelao, Lagua and Lati spoken in Vietnam and Mainland China.
[2] å = a back low vowel (I implement this symbol because of the limitation of fonts).
[3] There are three diphthongs in Thai: ia, io, ua.

argument NPs nóy 'Noy' in (6) and (7) are subjects, while the postverbal argument NP khâaw 'rice' in (7) is an object. In this paper, the term 'subject' refers to surface grammatical subject, which is equivalent to Dixon's term 'pivot' *(see Dixon 1994)*.

The most important property of Thai words is that they do not reflect the inflectional change. Neither prefix nor suffix is required when they appear in a sentence. Besides, tense is not marked on verbs, rather it is expressed by an adverb as in (8): the adverb mîowaanníi 'yesterday' shows that this sentence is in the past time (*see the structure of Thai words in Phanupong 1983)*. Verbs, in Thai sentences, are not inflected in any constructions. For example in the passive construction, which I present in the next section, the verb is not changed from the form it takes in the active counterpart.

3. The constructions which are referred to as passives in Thai

3.1 Two types of constructions which are referred to as passives in Thai

Kullavanijava (1974:192-202) proposes that there are two types of constructions, which are called passive in Thai: the *dooy* (by) construction and the *thuuk* construction. According to Kullavanijava, the *dooy* passive sentence (10) is generated from the active sentence (9).

(9) nákkhian mii chö[1] khian röng nán
writer have name write story that
'A famous writer writes that story.'
(10) röng nán khian dooy nákkhian mii chö
story that write by writer have name
'That story is written by a famous writer.'

In the active counterpart (9), the position before the verb khian 'write' is the subject position. The NP röng nán 'that story' is advanced into this position in the passive sentence (10) to be the subject of the sentence, while the NP nákkhian mii chö 'a famous writer' is demoted to be a "by-phrase". There is no change of the form of the verb khian 'write' in (10) since Thai verbs do not inflect as I have already showed in the second section. This construction resembles the English passive except there is no morphological change in the verb form. The *dooy* passive construction is often heard on television or radio programs and is found in written works, which is considered a translation of English passive sentences (Kullavanijava 1974: 196-197). The *dooy* construction is indeed a type of passive.

The second type of construction that has been referred to as passive is the *thuuk* construction as in (12). This sentence is said to be derived from the active sentence (11).

(11) mææ tii dææng
mother hit Dang
'Mother hit Dang.'
(12) dææng *thuuk* mææ tii
Dang suffer mother hit
'Dang suffered (from the experience that) mother hit (him).'

In (12), the object NP dææng 'Dang' occurs in the subject position of the sentence, and there is *thuuk* in between this NP and the NP mææ 'mother'. Note that the NP mææ

[1] ö = a back central vowel (I implement this symbol because of the limitation of fonts).

‘mother’ does not change the position in which it occurs in the active sentence (11), that is, it still precedes the verb tii ‘hit.’ And this NP is optional as in (13).

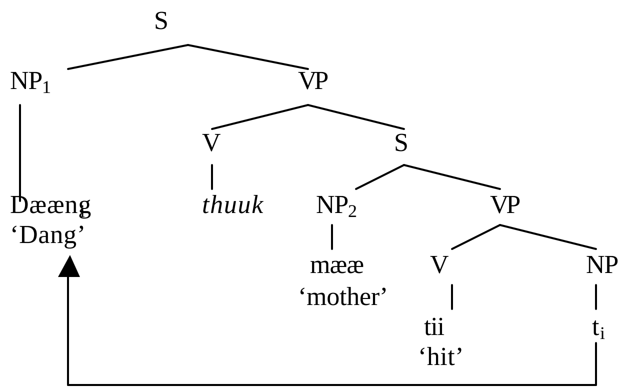
(13) dææng *thuuk* tii
Dang suffer hit
‘Dang suffered (from the experience that) (someone) hit (him).’

3.2 Previous studies of the “thuuk” construction

3.2.1 the three main analyses of thuuk in the thuuk construction

In previous studies, *thuuk* has been analyzed in two ways. The first idea is proposed by Chaloa Chaiyaratana (1961). She analyzes *thuuk* as a passive marker morpheme carrying a syntactic meaning: ‘passive’. In proposing this view, she adopts the Chomskyian ‘standard’ analysis of the English passive, and postulates the base structure (14) for the sentences in (11) and (12).

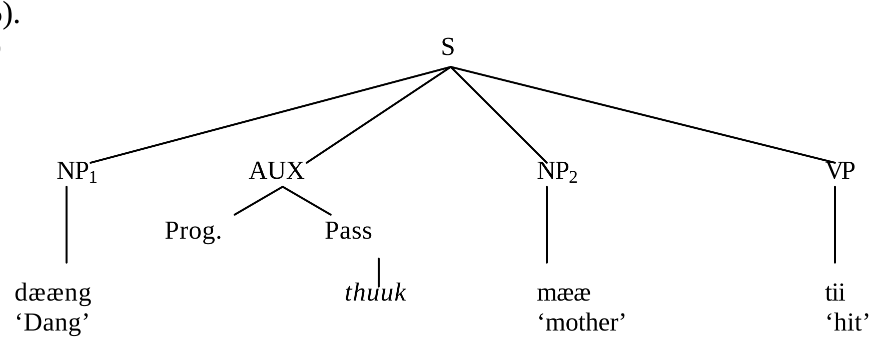
(14)



In this analysis, the active and passive have the same underlying structure, and the passive transformational rule moves the object in an active sentence (11) to the beginning of the sentence and adds *thuuk* after it in a passive sentence (12). Agent deletion can also apply here, which generates the sentence (13).

In the second analysis proposed and accepted by many Thai linguists (Warotamasikkhadit 1963, Lekhawattana 1970, Kullavanijava 1974, Warutamasinthop 1975 and Wongbaisaj 1979), *thuuk* is treated as a verb meaning “undergo an unpleasant experience”. In this verb analysis, Warutamasinthop (1975) treats *thuuk* as an auxiliary verb, while the others treat it as a main verb. Warutamasinthop’s analysis is called the underlying auxiliary analysis. He proposes the underlying structure of the passive as in (15).

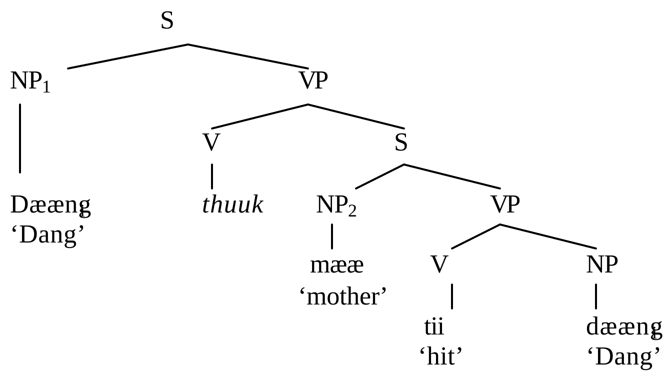
(15)



In this analysis, the passive sentence such as (12) has an underlying structure of its own, with *thuuk* as an auxiliary verb as in (15). Warutamasinthop applies only one rule, the agent deletion rule, to delete NP_2 for generating a sentence like (13). And this rule is optional.

For another verb analysis, here called the embedding analysis, other linguists treat *thuuk* as the main verb in the base structure. They propose the underlying structure as in (16).

(16)



In this analysis, the passive does not have the same base structure as the active, but the relationship between these two constructions still holds. That is, the active sentence mææ tii dææng 'mother hit Dang' is a part of the passive sentence dææng thuuk mææ tii dææng 'Dang suffered (from the experience that) mother hit Dang' in its underlying structure. The main point in this analysis is that *thuuk* is treated as a main verb in the base structure and it is obligatorily followed by a complement, which contains verbs conveying unpleasant meanings. The transformational rule, which is applied here, is the one that requires the NP occurring with *thuuk* to be identical with the object NP in the embedded clause.

In sum, Thai linguists proposed to analyze thuuk in the thuuk construction in three ways. First, it is treated as passive marker. Second, it is treated as an auxiliary verb. And third, it is treated as a main verb. Next, I discuss these three kinds of analysis in the view of Wongbaisaj (1979).

3.2.2 Discussion of the three main analyses

Wongbaisaj (1979) points out that the first analysis is weakly compatible with a native speaker's intuitions in as much as we feel that a passive sentence is related in some way to the active counterpart in having the same propositional content. On the assumption that the deep structure is determined by the meaning, it is more reasonable to posit two separate underlying structures, one for the active and the other for the passive, since the full meaning of the latter is particularly different from the former.

For the underlying auxiliary analysis, Wongbaisaj indicates that it is descriptively inadequate since it gives an inconsistent phrase structure rule for Thai, i.e. S NP AUX NP VP. I agree with Wongbaisaj that there is no other instance of structure with an NP between an AUX and a VP in Thai. The auxiliary in Thai always precedes a main verb, as in (17), in which the progressive auxiliary kamlang precedes the main verb tii 'hit.

(17) mææ kamlang tii dææng
mother PROG hit Dang
'Mother is hitting Dang.'

No NP can appear between the auxiliary and the main verb, as shown in the ungrammatical sentence (18).

(18) * mææ kamlang nóy tii dææng
mother PROG Noy hit Dang

Given the data in (17) and (18), the underlying auxiliary analysis is not right for the *thuuk* construction in Thai.

Wongbaisaj argues that the embedding analysis is the most appropriate one since it requires the fewest unnecessary mechanisms and leaves the fewest facts to be explained. In this analysis, *thuuk* and its embedded verb have a direct semantic interaction such that the patient of the action and the 'sufferer' are the same person. Whatever is done to the object of the embedded verb affects the subject of *thuuk* directly. In other words, the patient of the embedded verb is the same as the agent of *thuuk*, so NP dææng'Dang' in (16), which is an agent of *thuuk*, is the same NP as the patient of the embedded verb tii 'hit'.

Given the embedding analysis, there is no passive rule in Thai. Wongbaisaj (1979) proposes that the deletion rule deletes the NP following *thuuk* when it does not appear, as in (13). She purposes further that the other possible rule or process involved in the *thuuk* construction is pronominalization. In (19), the resumptive pronoun khaw 'him' is left in the object position of the embedded clause.

(19) dææng *thuuk* mææ tii khaw$_i$
Dang suffer mother hit him
'Dang suffered (from the experience that) (his) mother hit him.'

Even though Wongbajsai supports the embedding analysis, which does not include the passive rule in the *thuuk* construction, she still calls this construction "passive". And for her, the *thuuk* construction is base-generated, that is, it is not derived but directly generated in the base structure, and this construction allows the overt embedded object, which co-refers with the subject of the matrix clause, as a pronoun in (19) and a full NP in (20).

(20) dææng *thuuk* mææ tii dææng$_i$
Dang suffer mother hit Dang
'Dang suffered (from the experience that) (his) mother hit Dang.'

One point that I would like to make here about why many Thai linguists refer to the *thuuk* construction as a passive is that this construction seems to have some meanings of passive. Wongbaisaj (1979: 208) indicates that the *thuuk* construction in Thai generally has 'adversative' connotations. The sentence that has no adversative connotations in the *thuuk* construction is pragmatically odd as in (21).

(21) # dææng *thuuk* mææ rák
Dang suffer mother love
'Dang suffered (from the experience that) mother loved (him).'

The adversative connotations of *thuuk* are carried over the sentence to show that the patient suffered from an unpleasant experience. With such a connotation, the *thuuk* construction is controlled by some semantic restrictions allowing only sentences with an unpleasant association in connection with the patient (which in turn is the surface grammatical subject of *thuuk*) to be generated. Consequently, the surface grammatical subject dææng 'Dang' in the *thuuk* construction (12) is the object of both *thuuk* and the embedded verb tii 'hit' in the semantic sense, that is, it is the entity which undergoes the event described by the embedded verb. Therefore, semantically the *thuuk* construction seems to have some meanings of 'passive', which are the logical object has undergone some events, and the NP mææ 'mother' after *thuuk* still has an agent role, which is the person who does the action upon the patient.

The adversative meaning associated with *thuuk* in the *thuuk* construction misleads many Thai linguists into thinking that it is a passive in spite of the fact that the construction does not reflect the complete passivization process. That is, the subject is not mapped to an oblique relation. Also, this subject is not the object of the verb *thuuk* that gets promoted.

In sum, the embedding analysis seems to be the best analysis among the others for showing the structure of the thuuk construction in Wongbaisaj's view. Next, I show that all previous studies still do not give a clear structure of the thuuk construction.

3.2.3 the relationship between thuuk and the following NP

I agree with Wongbaisaj that the *thuuk* construction has the structure as (16) in which *thuuk* is a main verb that requires a clause complement, but I disagree that this construction is a passive since the grammatical relation between *thuuk* and the NP following it is not clearly defined. Although the structure in (16) shows that the verb *thuuk* subcategorizes for a clausal complement, we cannot definitely claim that the NP in the subject position of its embedded clause is not also the object of the verb *thuuk* since we still do not have evidence for it.

Wongbaisaj's analysis does not show the relationship between *thuuk* and the NP following it either. Besides, her passive construction is not different from the other embedded structures in Thai such as the "wâa" construction in (22).

(22) dææng songsay wâa nóy maa haa $\_\_\_\__i$ / $khaw_i$
Dang suspect that Noy come find $\_\_\_\__i$ / him_i
'Dang suspected that Noy came to see (him).'

Given these observations, there are questions about the classification of the *thuuk* construction as a passive. In order to verify the grammatical structure of the *thuuk* construction in Thai, we need to answer the following questions:

1) what is the status of *thuuk* ?, and
2) what is the grammatical relation between *thuuk* and the NP following it?

In the next section, I show that *thuuk* in the *thuuk* construction is a main verb that requires a clausal complement.

4. The status of *thuuk* in the *thuuk* construction

4.1 The lexical entries of thuuk and doon

As shown in the third section, the *thuuk* construction (12) has the sentence counterpart (11). According to the embedding analysis, the verb *thuuk* in the *thuuk* construction seems to require a clause complement. This is an important characteristic of the verb *thuuk* in this construction since its meaning will be changed when it subcategorizes for an NP as in (23).

(23) dææng *thuuk* [$_{NP}$ tau mææ].
Dang touch body mother
'Dang touched (his) mother's body.'

Wongbajsai (1979) and Pingkarawat (1989) claim that the verb *thuuk* in Thai is one lexical item with two sub-entries: *thuuk* in its active usage, and *thuuk* in its passive usage. These two lexical sub-entries share the semantic similarities such as they both mean 'to come in contact with'; both have the unintentional feature inherent in them and both have an adversative implication associated with them.

However, the context is also important in determining the interpretation of the sentence. When the verb *thuuk* subcategorizes for an NP, the context plays a major role in determining whether the verb is interpreted with an inherent unintentional action or has an adversative implication. The examples are in (24) and (25).

(24) dææng congcay *thuuk* [$_{NP}$ möö nit] phrå longrák thø[1] maa tâng naan lææw
Dang intend touch hand Nid because falling in love her come for a long time already
'Dang deliberately touched Nid's hand because (he) had been falling in love with her for a long time.'
(25) nit chååp *thuuk* [$_{NP}$ tau nåång] phrå tau thø nîm
Nid like touch body sister because body her soft
'Nid liked to touch (his) sister's body because her body is soft.'

Given the contexts, neither the meaning of the verb *thuuk* in (24) nor (25) has the unintentional feature or the adversative feature associated with it. *I, therefore, argue that only thuuk that subcategorizes for a clause has a strict adversative feature inherent in it, that is, the patient in such clauses undergoes an unpleasant experience.*

Then, in the lexicon, the verb *thuuk* has two sub-entries: one subcategorizes for an NP, which has no restricted adversative connotation, while the other subcategorizes for a clause and has a restricted adversative connotation. Only the sentence in which the patient suffered from an unpleasant experience can be generated in the *thuuk* construction. The sentence that has no adversative connotations is pragmatically odd as in (21).

In the *thuuk* construction, *doon*, which also means 'suffered from the unpleasant experience' can be used in the position of *thuuk*. This is shown in (26).

(26) dææng *doon* mææ tii
Dang suffer mother hit
'Dang suffered (from the experience that) mother hit (him).'

Wongbiasaj (1979: 207) assumes that both *thuuk* and *doon* have the same meaning and can occur in the same position when they subcategorize for a clause. In both of them the patient of the verbs have an adversative connotation. The sentence (26) also comes from (11). Like the verb *thuuk*, only the sentences in which the patient is understood as suffering from the unpleasant experiences are allowed to appear with *doon* in this type of construction. A sentence like (27) is weird and unacceptable.

[1] ø = a central mid vowel (I implement this symbol because of the limitation of fonts).

(27) ???dææng *doon* kruu chom
Dang suffer teacher admire
'Dang suffered (from the experience that) (his) teacher admired (him).'

The difference between the verb *thuuk* and *doon* is reflected when they subcategorize for an NP. For the verb *thuuk*, its subject is an agent: the person who does the action *(see (23))*, while for the verb *doon*, its subject is the experiencer : the person who experiences the action, as in (28).

(28) dææng *doon* fon pìak tháng tau
Dang experience rain wet all body
'Dang was in the rain (and he) got wet.'

In this paper, I follow Wongbaisaj's assumption that both *thuuk* and *doon* can occur interchangeably in the *thuuk* construction. Throughout this paper, I give examples of *thuuk* only since what applies to *thuuk* applies to *doon*.

4.2 The grammatical relation between thuuk and the NP following it.

In order to clarify the status of the NP <u>mææ</u>'mother' in the *thuuk* construction (12), I use the 'Complex NP Shift' phenomenon to test for the grammatical relations between the NP <u>mææ</u>'mother' and the verb *thuuk* on one hand, and between the NP <u>mææ</u>'mother' and the verb <u>tii</u> 'hit' on the other hand. The complex NP shift is the operation that has the function of moving a 'heavy' (that is, roughly, long and / or clause-containing) NP from its normal position to the right of the end of its immediately containing clause. Postal (1974: 83) offers the generalization of the complex NP shift phenomenon, which I adopt here as in (29).

(29) *Complex NP shift only operates on an object.*

This process applies in the English sentences as in (30), in which a heavy NP in the object position can be extraposed in (30a); while it cannot be shifted rightward when it is in the subject position as the ungrammatical sentence in (30b):

(30) a. Jack bought from Melvin---a book which taught him organic knitting.
b. * Are happy---all of the men who recovered from mononucleosis?

Pollard and Sag (1994: 113) indicate that Postal's generalization in (29) also supports the subject-object Raising (SOR) analysis by virtue of the fact that the NPs whose object status is in question clearly undergoes complex NP shift as (31).

(31) a. Pat believes to be a spy ___ everyone who was working for the Warren Commission.
b. ? Kim expects to be on time ___ every employee who was hired for the Christmas rush.

The phenomenon in (29) also occurs in Thai. The complex NP shift can operate on an object as in (32) - (34), but not on the subject as in (35b) and (36b).

(32) a. dææng söö nãngsöö caak nói
Dang buy book from Noy
'Dang bought a book from Noy'.

b. dææng söö caak nói--- nãngsöö thìi pææng maak
Dang buy from No --- book that expensive very
'Dang bought from Noy ---the book that is very expensive'.

(33) a. khruu sàng nákrien hây pay phop
teacher order student give go see
' A teacher ordered a student to see him.'

b. khruu sàng hây pay phop --- nákrien thìi maa saay mööwaan
teacher order give go see --- student that come late yesterday
'A teacher ordered to see him ---the student who came late yesterday'.

(34) a. nói khít wâa níd khámoy nãngsöö caak dææng
Noy think that Nid steal book from Dang
'Noy thinks that Nid stole the book from Dang.'

b. nói khít wâa níd khámoy caak dææng--- nãngsöö thìi pææng maak
Noy think that Nid steal from Dang--- book that expensive very
'Noy thinks that Nid stole from Dang---the book that is very expensive.'

(35) a. nákrien thìi maa saay mööwaan söö nãngsöö caak nói
student who come late yesterday buy book from Noy
'The student who came late yesterday bought a book from Noy.'

b. * söö nãngsöö caak nói---- nákrien thìi maa saay mööwaan
buy book from No--- student who come late yesterday

(36) a. nói khít wâa níd khon thìi yöön bon wethii khámoy nãngsöö caak dææng
Noy think that Nid who that stand on stage steal book from Dang
'Noy thinks that Nid who stands on the stage stole the book from Dang.'

b. * nói khít wâa khámoy nãngsöö caak dææng--- níd khon thìi yöön bon wethii
Noy think that steal book from Dang--- Nid person that stand on stage

Given this complex NP shift that operates only on the object in Thai, it can also reveal the grammatical relation between the NP mææ 'mother' and the verb *thuuk* in the *thuuk* construction. The NP mææ 'mother' is not an object of a verb *thuuk* since it cannot undergo complex NP shift, as in (37c). But this NP can occur with a relative complement before the verb tii 'hit' as in (37b), suggesting that it is the subject of that verb.

(37) a. dææng *thuuk* mææ tii
Dang suffer mother hit
'Dang suffered (from the experience that) (his) mother hit (Dang).'

b. dææng *thuuk* [mææ thìi khåå khaw maa liang] tii
Dang suffer mother that ask him come raise hit
'Dang suffered (from the experience that) the mother who adopted him hit (him).'

c. * dææng *thuuk* tii --- [mææ thìi khåå khaw maa liang]
Dang suffer hit --- mother that ask him come raise
'Dang suffered (from the experience that) hit ---mother who adopted him.'

One might suspect that the NP mææ 'mother' after the verb *thuuk* in (37a), even though it cannot undergo the complex NP shift as in (37c), may be raised from the subject position of the embedded clause to be the object of the matrix verb. I show next that subject-to object raising is not possible in Thai.

In Thai, subject-to-subject raising is possible as in (38).

(38) a. duu mîan wâa dææng chååp duu nãng
seem that Dang like see movie
'It seems that Dang liked to see movies.'

b. dææng duu mîan wâa chååp duu nãng
Dang seem that like see movie
'Dang seems to like to see movies.'

In (38a), the NP dæængʻDang' occupies the subject position of the embedded clause, while the subject position of the matrix clause is vacant (an expletive 'it" is usually dropped in Thai). In (38b), the NP dæængʻDang' occupies the subject position of the matrix clause, but it is related to the embedded clause, meaning that it is the logical subject of the embedded verb. In this case the embedded subject NP dæængʻDang' is raised to be the matrix subject.

However, subject-to-object raising is not possible in Thai. There is a sentence such as in (39a) called the "wâa" construction in which the verb chööwâa 'believe that' comes in pairs with closely related meanings. Pingkarawat (1985) suggests that the verb chööwâa 'believe that' is a compound verb which subcategorizes for a clausal complement. The NP mæærʻmother' after the verb chööwâa 'believe that' cannot undergo complex NP shift as in (39b), showing that this NP is not its object.

(39) a. nói chöö wâa mææ tii dææng
Noy believe that mother hit Dang
'Noy believed that the mother hit Dang.'
b. * nói chöö wâa tii dææng -- mææ thìi khåå khaw maa iang
Noy believe that hit Dang -- mother that ask him come raise
'Noy believed that hit Dang – the mother who adopted him.'

The *thuuk* construction is also parallel to the "wâa" construction in that the verb *thuuk* subcategorizes for a clausal complement. Since subject-to-object raising is not possible in the "wâa" construction, I assume that in the *thuuk* construction the subject NP of the embedded clause, mææʻmother', does not raise to be the object of the verb *thuuk*. Besides, this NP cannot undergo the complex NP shift as in (37c), so it is not the object of the verb *thuuk*. Instead, it has the function as the subject of the verb tii 'hit' forming a clause as the complement of the verb *thuuk*.

To sum up so far, I have provided evidence to show that thuuk in the thuuk construction is a matrix verb which requires a clausal complement. The NP following the verb thuuk is not its object, but it is the subject of its complement.

5. The *thuuk* construction: topicalization and functional control

5.1 The alternative analysis of the thuuk construction

5.1.1 Long-Distance Dependency: the topicalization of the thuuk construction

5.1.1.1 The *thuuk* construction does not allow the referential object

In the fourth section, I have already showed that the *thuuk* construction is a complex sentence: the matrix verb *thuuk* requires a clausal complement. There is also another interesting point in this construction, which is that there is no overt object in its complement. And if it is true that the *thuuk* construction (41) comes from the sentence (40) as it is assumed by many Thai linguists, it seems that the subject NP dæængʻDang' in (41) co-refers to the missing object of its complement.

(40) mææ tii dææng
mother hit Dang
'Mother hit Dang.'
(41) dææng *thuuk* [mææ tii ___$_i$]
Dang suffer mother hit
'Dang suffered (from the experience that) (his) mother hit (him).'

Kullavanijava (1974) proposes that the co-referential object in the embedded clause is usually required to be absent; only an object that conveys the meaning of inclusion [1] is allowed in the sentence, as in (42):

(42) dææng *thuuk* phåå pøøt cotmay
Dang suffer father open letter
'Dang suffered (from the experience that) (his) father opened (Dang's) letter.'

In (42), an NP <u>cotmay</u> 'letter' is allowed because it is possessed (one sense of inclusion) by <u>dææng</u> 'Dang', the agent of *thuuk*. In this case, the letter must belong to 'Dang'. It is also acceptable if the object belongs to the person who relates to 'Dang' (also a sense of inclusion), but a possessive pronoun <u>khååŋkhaw</u> 'his' is required as in (43). The object does not belong to <u>dææng</u> 'Dang' is not allowed, so the sentence in (44) is ungrammatical.

(43) dææng *thuuk* phåå pøøt cotmay khååŋ fææn khååŋkhaw$_i$
Dang suffer father open letter of girlfriend his
'Dang suffered (from the experience that) (his) father opened his girlfriend's letter.'

(44) * dææng *thuuk* phåå pøøt cotmay khååŋ níd
Dang suffer father open letter of Nid
'Dang suffered (from the experience that) (his) father opened Nid's letter.'

Note also that only an inanimate NP is allowed for the overt object in the embedded clause as in (45a). The sentence turns out to be unacceptable if the overt object is an animate NP as in (45b).

(45) a. dææng$_i$ *thuuk* thahaan phau bâan khååŋkhaw$_i$
Dang suffer solider burn house his
'Dang suffered (from the experience that) the soldier burned his house.'

b. ?? dææng$_i$ *thuuk* thahaan phau phåå khååŋkhaw$_i$
Dang suffer solider burn father his
'Dang suffered (from the experience that) the soldier burned his father.'

Following Kullavanijava (1974), I assume that the referential object in the embedded clause of the *thuuk* construction is usually absent; however, an inanimate object that conveys the meaning of inclusion with the subject can overtly occur.

In my analysis, I will deal only with the thuuk construction where the referential object in the embedded clause is absent.

5.1.1.2 <u>Topicalization in Thai</u>

Warotamasikkhadit (1995) proposes that in Thai a topicalized argument can be extracted to the front, to the end or to the middle of a sentence depending on the function of the argument or the position of the argument as it appears in the sentence *(see more*

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[1] This kind of inclusion also occurs in the passive construction of Chinese and Japanese. Huang (1999) shows the inclusive passives in Mandarin as in (i) and in Japanese as in (ii).

(i) zha san bei Lisi dadan-le yitiao tui.
Zhangsan BEI Lisi hit-break-PERF one leg
'Zhangsan had his leg broken by Lisi.'

(ii) John-ga Mary-ni kodomo-o sikar-are-ta
John-NOM Mary-DAT child-ACC scold-PASS-PAST
'John had his child scolded by Mary.'

discussion in Warotamasikkhadit 1995). In fronting Topicalization, the object NP phûuying khon níi 'this woman' in (46a) can be extracted to the leftmost as the topic of a sentence in (46b).

(46) a. chan chååp phûuying khon níi
I like woman CL this
'I like this woman.'
b.[phûuying khon níi] $_i$ chãan chååp ____$_i$
woman CL this I like
'This woman, I like.'

Topicalization usually has two important properties. One is that it is indeed unbounded, which means that the dependency in question may extend across arbitrarily many clause boundaries, and the other is that, there is a syntactic category matching condition between the filler and the gap.

Topicalization in Thai also has those two properties. First, it is unbounded as in (47b). The NP phûuying khon níi 'this woman' can be extracted from the second complement clause to the topic position.

(47) a. nóy khít wâa chan chååp phûuying khon níi
Noy think that I like woman CL this
'Noy thinks that I like this woman.'
b. [phûuying khon níi] $_i$ nóy khít wâa chãan chååp ____$_i$
woman CL this Noy think that I like
'This woman, Noy thinks that I like.'

Second, the syntactic category of the filler and the gap are matched. Since the verb chååp'like' requires an NP argument, only an NP phûuying khon níi 'this woman' in (47b) can be its argument, a PP kàp phûuying khon níi 'with this woman' in (48) cannot.

(48) * [$_{PP}$ kàp phûuying khon níi] $_i$ nóy khít wâa chan chååp [$_{NP}$ ____$_i$]
with woman CL this Noy think that I like

5.1.1.3 The *thuuk* construction has Topicalization's properties

The *thuuk* construction also has the two properties of Topicalization: unbounded as in (49) and the syntactic category of the gap and the filler are matched as in (50).

(49) a. dæænç *thuuk* mææ tii ____$_i$
Dang suffer mother hit
'Dang suffered (from the experience that) (his) mother hit (him).'
b. dæænç *thuuk* nóy songsay wâa mææ tii _$_i$
Dang suffer Noy suspect that mother hit
'Dang suffered (from the experience that) Noy suspected that (his) mother hit (him).'
(50) a. [dæænç] *thuuk* mææ tii ____$_i$
Dang suffer mother hit
'Dang suffered (from the experience that) (his) mother hit (him).'
b. * [kàp dæænç] *thuuk* mææ tii ____$_i$
with Dang suffer mother hit

In (49a), the NP dææng 'Dang' is extracted from its embedded complement, and in (49b), the NP dææng 'Dang' can be extracted from the second embedded complement to be in the initial position of the sentence. In (50), the verb tii 'hit' requires an NP argument, so only the NP dææng 'Dang' in (50a), not an PP kàp dææng 'with Dang' in (50b), can be its argument.

Besides, the subject of the *thuuk* sentence is really the topic. No other NP can be topicalized in the *thuuk* construction as an ungrammatical sentence (51b).

(51) a. dææng *thuuk* mææ tii ___i
Dang suffer mother hit
'Dang suffered (from the experience that) (his) mother hit (him).'
b. * mææj dææng *thuuk* ___j tii ___i
mother Dang suffer hit
'Mother, Dang suffered (rom the experience that) (his) mother hit (him).'

5.1.1.4 The *thuuk* construction has all properties of long-distance dependency

The *thuuk* construction has the two properties of long-distance dependency, unbounded dependencies as in (52) and obeying island constraints as in (53).

(52) a. dææng *thuuk* mææ tii ___i
Dang suffer mother hit
'Dang suffered (from the experience that) (his) mother hit (him).'
b. dææng *thuuk* nóy songsay wâa mææ tii _i
Dang suffer Noy suspect that mother hit
'Dang suffered (from the experience that) Noy suspected that (his) mother hit (him).'
(53) * dææng *thuuk* mææ [khon thîi khǎǎ ___i maa líang] tii
Dang suffer mother cl. that ask come raise hit
'Dang$_i$ suffered (from the experience that) mother who adopted ___$_i$ hit (him).'

In (52a), the NP dææng 'Dang' is extracted from its embedded complement, and in (52b), the NP dææng 'Dang' can be extracted from the second embedded complement to be in the initial position of the sentence. In (53), the gap cannot appear in a relative clause within an NP.

So, the missing object in the embedded complement of the *thuuk* construction is clearly the result of long-distance dependency.

5.1.2. the property of the verb thuuk: functional control

I proposed in the last section that the *thuuk* construction involves long-distance dependency. The syntactic category of the gapped object NP in the clausal complement of the *thuuk* construction matches the matrix subject; no resumptive pronoun is allowed in the position of the gap. As such, the gap has a referential relation with the matrix subject. The structure in which the gap in the object position of the embedded clause is co-referential with the matrix subject also occurs in the other Thai constructions such as the "hây" construction in (54) and (55), and the "wàa" construction in (56).

(54) dææng hây chan chàuy __i
Dang give I help
'Dang let me help (Dang).'

(55) dææng bååk chan hây pay haa $\underline{\ \ \ }_i$
Dang tell I give go meet
'Dang told me to come to see (Dang).'
(56) dææng khít wàa chan lååk $\underline{\ \ }_i$
Dang think that I deceive
'Dang thinks that I deceive (Dang).'

The gap after an embedded verb is the missing NP that co-refers to the agent of the matrix verb. If the patient of an embedded verb appears in that clause, it has to be a person that does not co-refer to the agent of the matrix verb as in (57), (58), and (59).

(57) dææng hây chan chàuy púk
Dang give I help Pook
'Dang let me help Pook.'
(58) dææng bååk chan hây pay haa púk
Dang tell I give go meet Pook
'Dang told me to come to see Pook.'
(59) dææng khít wàa chan lååk púk
Dang think that I deceive Pook
'Dang thinks that I deceive Pook.'

Note that the co-referential pronoun can also occur in the object position of the embedded clause when it is semantically emphasized that the object has to be the same with the subject of the sentence as in (60) – (62), otherwise this position is absent as in (54) – (56).

(60) dææng hây chan chàuy khaw$_i$
Dang give I help him
'Dang let me help him, not the other.'
(61) dææng bååk chan hây pay haa khaw$_i$
Dang tell I give go meet him
'Dang told me to come to see him, not the other.'
(62) dææng khít wàa chan lååk khaw$_i$
Dang think that I deceive him
'Dang thinks that I deceive him, not the other.'

The missing object in an embedded clause of the *thuuk* construction as in (52) shows that its structure is parallel to the above constructions. The difference between the constructions in (54) – (56) and the *thuuk* construction in (52) is that, in the former, the object can appear when it does not co-refer to the agent of the matrix verb as in (57) - (59). The co-referential pronoun is allowed when it is semantically emphasized that the object has to be the same with the subject of the sentence as in (60) – (62), while in the latter, the object, which does not co-refer to the agent of the matrix verb, does not allow as in (63), and the co-referential pronoun is not allowed as I already discussed in 5.1.1.1.
(63) *dææng *thuuk* mææ tii níd
Dang suffer mother hit Nid
'Dang suffered (from the experience that) (his) mother hit Nid.'

Pingkarawat (1989) proposes that verbs hây 'give', bååk 'tell', and khít wàa 'think that' in the embedded construction, in which the co-referential NP is missing, are control verbs that assign control relation of the embedded subject to their indirect object as in the examples (64), (65) and (66).

(64) nuan hây e_i [$phim_i$ laa?ååk]
Nuan give Phim resign
'Nuan let Phim to resign.'

(65) $nuan_i$ bååk lek_j [$e1_i$ hây $e2_j$ [$e3_j$ wîng thuk wan]]
Nuan tell Lek give run every day
'Nuan told Lek to run every day.'

(66) $nuan_i$ khít wàa [pro_i tåång pay roongrian wanníi]
Nuan think say must go school today
'$Nuan_i$ thought that (she_i) had to go to school today.'

The verb hây 'give' can subcategorize for either a clause as in (64) or for a direct object and an indirect object as in (67).

(67) nuan hây khànóm phim
Nuan give sweet phim
'Nuan gave sweets (to) Phim.'

Pingkarawat (1989: 164-165) proposes that the verb hây 'give', when it subcategorizes for a complement clause as in (64), is the control verb that assigns control of an embedded subject to its indirect object. The empty indirect object and the embedded subject are co-referential. Pingkarawat proposes that the type of the control relation involved here is 'thematic control' since control applies to a lexical NP 'Phim'. hây 'give' is thus a verb that establishes thematic control over its embedded subject.

Pingkarawat (1989: 172) also says that in a sentence like (65), there is co-referentiality between the arguments in the matrix clause and the arguments in the adjunct *hây* – clause. Since the verb hây 'give' is a thematic control verb, the embedded subject e3 is assigned control to e2, the indirect object of hây. e1 and e2 are assigned their antecedents by Pragmatic principle and the Disjoint Reference respectively. *(see Pingkarawat 1989).* I will not discuss the empty NP's antecedent since it is not in the scope of this paper.

For (66), Pingkarawat (1989: 123) states that the verb khít wàa 'think that' is a control verb that assigns control of pro to its subject. And she proposes that this type of control is 'non-rigid control' since a lexical NP can also occur in place of a pro as in (68).

(68) $nuan_i$ khít wàa [$pro_{i\ /*j}$ /$phim_j$ tåång pay roongrian wanníi]
Nuan think say must go school today
'$Nuan_i$ thought that she_i /Phim had to go to school today.'

In sum, Pinkarawat shows that these three verbs: hây 'give', bååk 'tell', and khít wàa 'think that', are control verbs that assign control to either their subject or their object. with either the subject or the object.

As I have already showed at the beginning of this section that the *thuuk* construction is similar to the "hây" construction and the "wàa" construction, I propose that *thuuk* in the *thuuk* construction has the same property with the verb hây 'give' in the "hây" construction and the verb khít wàa 'think that' in the "wàa" construction, which is control function. The dependency between the missing object NP in the embedded clause and the subject of the matrix verb *thuuk* in the *thuuk* construction involves functional control since the subject and gapped object are identical. I therefore hypothesize a functional predication relation of the verb *thuuk*, represented by identifying the SUBJ of the verb *thuuk* with the TOP of its complement, which is a sentential complement (SCOMP), as in (69).

(69) thuuk: (PRED) = ‘suffer <(SUBJ) (SCOMP)>’
(SUBJ) = (SCOMP TOP)

The first grammatical function in the body of its path is always SUBJ of the matrix clause, and this path comes from TOP of SCOMP. Besides, the bottom of the path can be either an embedded object as in (70), or an embedded subject as in (71). However, an adjunct cannot be extracted as in (72).

(70) dææng *thuuk* [$_S$ mææ tii __$_i$]
Dang suffer [mother hit]
‘Dang suffered (from the experience that) (his) mother hit (him).’
(71) dææg$_i$ *thuuk* [nóy songsay [$_S$ wâa ___$_i$ tii níd]
Dang suffer [Noy suspect that hit Nid]
‘Dang suffered (from the experience that) Noy suspected that (he) hit Nid.’
(72) * möököwaanníi$_i$ *thuuk* [$_S$ mææ tii dææng _$_i$]
Yesterday suffer [mother hit Dang]

I therefore hypothesize that the path of the *thuuk* construction is that in (73).

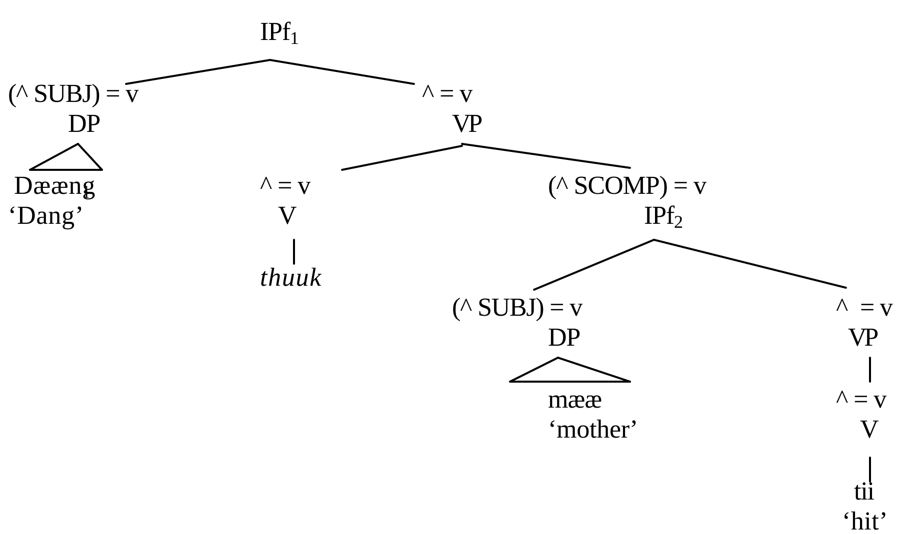
(73) (SUBJ) = (SCOMP TOP)
(SCOMP TOP) = (SCOMP* SUBJ | OBJ)

To sum up so far, I propose that the *thuuk* construction in Thai has two grammatical processes: topicalization and functional control. The full analysis of the *thuuk* construction is given in the next section.

5.1.3 The full analysis of the thuuk construction

As I have showed in 5.1.1 and 5.1.2, the *thuuk* construction involves long-distance dependency (topicalization) with functional control of the complement object by the matrix subject. The constituent structure and functional structure of (70) is shown in (74).

(74) a. constituent-structure:



b. functional structure:

$$f_1 \left[\begin{array}{lll} \text{SUBJ} & & [\text{“Dang”}] \\ \text{PRED} & \multicolumn{2}{l}{\text{‘suffer } \langle\text{(SUBJ) (SCOMP)}\rangle\text{’}} \\ \text{SCOMP} & f_2 & \left[\begin{array}{ll} \text{TOP} & [\quad] \\ \text{SUBJ} & [\text{“mother”}] \\ \text{PRED} & \text{‘hit } \langle\text{(SUBJ) (OBJ)}\rangle\text{’} \\ \text{OBJ} & [\quad] \end{array}\right] \end{array}\right]$$

The functional predication relation of the verb *thuuk* in (69) identifies the SUBJ of the verb *thuuk* with the TOP of its complement.

Now, we come to the last question: If the *thuuk* construction is not a passive, what kind of construction is it? As noted, the *thuuk* construction in Thai involves long distance dependency and the dependency between the gapped object and the subject of the matrix clause involves functional control. This structure is similar to the structure of the "Tough" construction in English, which is a kind of Unbounded Dependencies (UDCs), namely, weak unbounded dependency. I discuss this kind of construction in 5.2.

5.2 the thuuk construction as a weak unbounded dependency

The basic distinction between strong and weak UDCs that Pollard & Sag (1994:157) discuss is that the former have an overt filler in a non-argument position which is strongly associated with a gap as in (75).

(75) a. Kim$_1$, Sandy loves ____$_1$. (topicalization)
b. I wonder [who$_1$ Sandy loves ____$_1$]. (*wh*-question)
c. This is the politician [who$_1$ Sandy loves ____$_1$. (*wh*-relative clause)
d. It's Kim [who$_1$ Sandy loves ____$_1$] (*it*-cleft)
e. [What$_1$ Kim loves ____$_1$] is sandy. (pseudocleft)

The weak UDCs, on the other hand, have a constituent in an argument position that is in some sense co-referential with the gap as in (76).

(76) a. I bought it$_1$ for Sandy to eat ____$_1$. (purpose infinitive)
b. Sandy$_1$ is hard to love ____$_1$. (*tough* 'construction')
c. This is the politician$_1$ [Sandy loves _____$_1$. (relative clause)
d. It's Kim$_1$ [Sandy loves ____$_1$]. (*it*-cleft)

In (76), there is no overt filler in a non-argument position; instead there is a constituent in an argument position that is interpreted as co-referential with the trace.

As for the "Tough" construction as in (76b), Dalrymple and King (2000), propose that it involves long-distance dependency with anaphoric control of the complement object by the matrix subject. They show in their article that the "Tough" construction has all properties of long-distance dependencies: unbounded dependencies as in (77), licensing parasitic gaps as in (78) and obeying island constraints as in (79).

(77) a. This book is too valuable to throw away.
b. This book is too old to get anyone to try to renovate.

(78) This book is too interesting to read without really trying to understand.
(79) a. Kim would be difficult to imagine kissing.
b. * Kim would be difficult to imagine [the likelihood of kissing] *NP*.
c * Kim would be difficult to imagine a person [who likes] *REL – CL*.

Dalrymple and King propose that the dependency in the "Tough" construction involves anaphoric control in which the subject and gapped object are co-referent but syntactically distinct. The "Tough" predicate subcategorizes for the thematic subject and a COMP. The subject anaphorically controls the TOPIC of the COMP, as indicated by the co-indexation, and the TOPIC fills an OBJ role within the subordinate clause via functional control as it is shown in (80).

(80) Moths are tough to kill.

$$\left[\begin{array}{ll} \text{PRED} & \text{'TOUGH < SUBJ,COMP >'} \\ \text{SUBJ} & [\text{PRED 'MOTH'}_{i}] \\ \text{COMP} & \left[\begin{array}{ll} \text{TOPIC} & [\text{PRED 'PRO'}_{i}] \\ \text{PRED} & \text{'KILL < SUBJ,OBJ >'} \\ \text{SUBJ} & [\text{PRED 'PRO}_{arb}\text{'}] \\ \text{OBJ} & [\qquad\qquad] \end{array}\right] \end{array}\right]$$

They also propose the path for the "Tough" predicate, which is the first grammatical function in the body of the path is COMP, and the bottom of the path is OBJ, as in (81).

(81) (COMP TOPIC) = (COMP XCOMP* ({OBL | ADJ}) OBJ)

The *thuuk* construction in Thai is similar to the "Tough" construction in English in that it also has the property of the long-distance dependency: unbounded dependency in (52) and obeying the island constraints in (53). And the dependency between the matrix subject and the gapped object involves control relation. *(see 5.1.2)* So, I propose that the *thuuk* construction in Thai can be counted as a kind of the weak unbounded dependencies like the "Tough" construction in English. In addition, the so-called 'passive' constructions in Mandarin Chinese and in Japanese are similar to the structure of the *thuuk* construction in Thai. According to Huang (1999) and Toyoshima (1996), those constructions are also weak unbounded dependencies.

6 Conclusion

In this paper, I prove that the *thuuk* construction in Thai, which is considered to be the passive by many Thai linguists, is not a true passive since it lacks the most significant characterization of standard passive: the relation change. By using the complex NP shift, I clarify the grammatical function between the verb *thuuk* and the NP following it that this NP is not its object, but the subject of its embedded verb. I propose the alternative analysis in terms of LFG showing that the *thuuk* construction in Thai involves long-distance dependencies, namely topicalization, and the dependency between the gapped object and the matrix subject involves functional control. This kind of construction is similar to the "Tough" construction in English, thus it can be classified as a kind of weak unbounded dependencies.

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1 Introduction

In early Lexical-Functional Grammar (LFG) auxiliaries were treated as raising verbs, i.e., verbs associated with an XCOMPlement and a nonthematic subject. On this analysis it was possible to state the morphosyntactic dependencies between the auxiliary and the nonfinite verb as restrictions on the verbal form features of the XCOMPlement. As discussed in a.o. Butt et al. (1996) this approach is crosslinguistically unsatisfactory in as much as it mirrors the surface syntax and leads to different f-structures in cases where the same morphosyntactic content is expressed by either synthetic or analytic means. Instead, Butt et al. (1996) assign a flat f-structure to verbal complexes with the main verb as the top-level predicate, while the morphosyntactic dependencies are accounted for in a separate morphological projection, projected from the c-structure.

Frank and Zaenen (2002) observe not only that this approach requires functional information to be duplicated in the m(orphological)-structure, it is also confronted with problems in analyzing certain long-distance phenomena involving morphological constraints. To overcome these problems they propose a sequenced architecture where the m-structure is projected from the f-structure. However, Frank and Zaenen's approach, though removing the need for a duplication of functional information in the m-structure, requires all possible morphosyntactic embeddings of the auxiliaries and main verbs to be encoded in the lexicon and leads thus to a massive duplication of morphosyntactic information in the lexicon.

Apart from these rather technical issues, we argue in this paper that both projection approaches are theoretically unsatisfactory, since a morphological projection seems to be called for in exactly those cases where the expression of a given morphosyntactic content is syntactic and not morphological. Instead, we propose to analyze verbal complexes without a morphological projection. We develop an approach based on the restriction operator (Kaplan and Wedekind 1993) where the morphosyntactic dependencies are checked in functional terms as dependencies between a c-structure head and an

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ungoverned DEP function while the verbal complex (and consequently the sentence) is assigned a flat f-structure. This approach overcomes the problems inherent to the raising and m-structure approaches. The approach is illustrated for temporal auxiliaries, passives and modal constructions in Danish.

2 Previous Approaches to Verbal Complexes in LFG

In traditional LFG, auxiliaries have been treated as main verbs which introduce their own predicates (Kaplan and Bresnan 1982, Falk 1984). In particular, they were analyzed as (a special subclass of) raising verbs that are—though marked with the AUX feature—in other respects identical to raising verbs in that their predicates subcategorize for a nonthematic subject and a verbal complement (XCOMPlement). Since the embedding on the f-structure mirrors the embedding of the auxiliaries in the c-structure, the advantage of this analysis is that the morphosyntactic dependencies between the auxiliaries and the nonfinite verb can be encoded straightforwardly by appropriately restricting the verbal form features of the embedded XCOMPlements. For a brief illustration of the relatively straightforward modeling of the morphosyntactic dependencies that the raising approach permits let us consider the simple English sentence in (1)

(1) John will work

and the (oversimplified) entries of *work* and the future tense auxiliary *will* in (2).[1]

(2) a. will V $(\uparrow \text{PRED}) = \text{'FUT}\langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{'}$
$(\uparrow \text{SUBJ}) = (\uparrow \text{XCOMP SUBJ})$
$(\uparrow \text{TENSE}) = \text{FUT}$
$(\uparrow \text{VFORM TYPE AUX}) = \text{TENSE}$
$(\uparrow \text{VFORM FORM}) = \text{FIN}$
$(\uparrow \text{XCOMP VFORM FORM}) =_c \text{INF}$
$(\uparrow \text{XCOMP VFORM TYPE}) = \text{MAIN}$

b. work V $(\uparrow \text{PRED}) = \text{'WORK}\langle(\uparrow \text{SUBJ})\rangle\text{'}$
$(\uparrow \text{VFORM TYPE}) = \text{MAIN}$
$(\uparrow \text{VFORM FORM}) = \text{INF}$

The entry (2a) indicates that *will* is a finite form of the tense auxiliary that contributes the (simple) future tense information, given the verb form of the subcategorized XCOMP is an infinitive form of a main verb, as in case of *work* in (2b). The c- and f-structure that sentence (1) gets assigned under the traditional raising analysis is shown in Figure 1.

It has long been recognized, however, that this f-structure representation mirrors the surface syntax and leads to different f-structures in cases where the same morphosyntactic content is expressed by either synthetic or analytic means.

In the context of parallel grammar development, for example, Butt et al. (1996) observe that a raising analysis would provide for the sentences in (3)

(3) a. The driver will have turned the lever

1 We assume here a slightly different system of morphosyntactic features (than the one used in Kaplan and Bresnan 1982) and abstract from other tenses (future perfect) and modal readings.

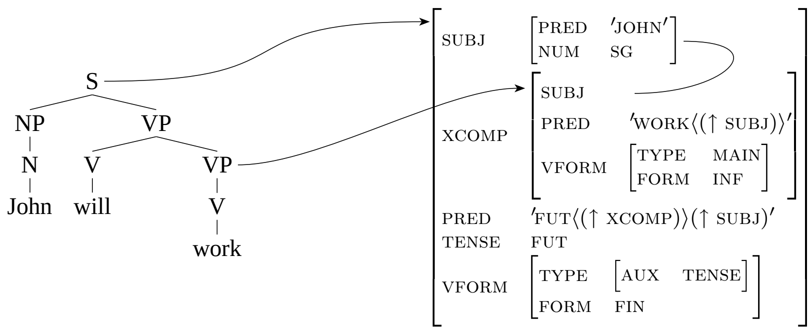

Figure 1
The traditional raising analysis of the sentence *John will work* (together with the relevant structural correspondences).

b. Le conducteur aura tourné le levier

structurally divergent f-structures although the sentences are meaning equivalent and thus expected to obtain equivalent predicate-argument structures. Since future tense is realized in English periphrastically (*will have*), but in French morphologically (*aura*), the f-structure of the French sentence (3b) has one level of embedding less than the structure of the corresponding English sentence (3a). The raising approach thus creates (unnecessary) crosslinguistic problems for parallel grammar development or machine translation, since it provides structurally misaligned analyses for functionally very similar constructions. Similar problems may, of course, also arise language internally, but then affecting language internal descriptive consistency rather than crosslinguistic parallelism. Under a raising analysis, the synthetic and analytic passives in the Scandinavian languages, for example, are associated with different f-structures obscuring the fact that the basic predicate-argument relations are the same.

As a crosslinguistically more adequate alternative, Butt et al. (1996) propose an analysis of the auxiliary complex that provides flat f-structures regardless of whether the tenses are realized morphologically or periphrastically. They analyze auxiliaries as functional categories contributing tense and aspectual information, but no predicate. In order to ensure that the auxiliary complex satisfies the hierarchically organized well-formedness restrictions on the order of the different verb types and forms, they project the multiple XCOMPlement embedding provided by the raising approach simply off of the c-structure into a separate m(orphological)-structure. This requires the original XCOMP to be appropriately renamed, since it is a governable function and thus subject to completeness and coherence tests (which would fail, since auxiliaries are not PRED-bearing anymore).

Morphological structures are related to c-structure nodes by means of the projection μ, just in the same way as c-structure nodes and f-structures are set in correspondence by the projection ϕ. To explicitly identify the structures in the range of multiple projections whose description is being developed by the particular annotations, it is, of course, necessary to explicitly distinguish the projections. This is accomplished by using the symbol $*$ as a variable for the annotated node and the term $\mathcal{M}*$ to denote its mother. With the terms $\mu*$ and $\mu\mathcal{M}*$ it is then possible to refer to the m-structure associated with

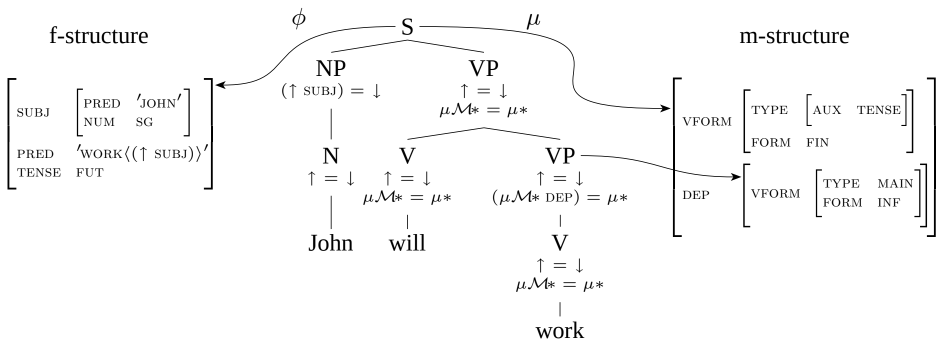

Figure 2
The m-structure analysis of the sentence *John will work* (together with the relevant structural correspondences).

the annotated node and its mother, respectively. Given this more general correspondence architecture (with more than one level of linguistic description involved), the traditional $\downarrow$ and $\uparrow$ metavariables have to be conceived as convenient abbreviations of the more complex expressions $\phi*$ and $\phi\mathcal{M}*$. Continuing with the convenient functional abbreviations, the morphosyntactic dependencies for our example sentence (1) are then encoded in the m-structure approach as follows. As the lexical entries for *will* and *work* in (4) indicate, both the specification of the verbal form features and the constraints on the dependent verb forms are not considered to contribute to the description of the f-structure, but to the one of the m-structure.

(4) a. will V $(\uparrow \text{TENSE}) = \text{FUT}$
$(\mu\mathcal{M}* \text{ VFORM TYPE AUX}) = \text{TENSE}$
$(\mu\mathcal{M}* \text{ VFORM FORM}) = \text{FIN}$
$(\mu\mathcal{M}* \text{ DEP VFORM FORM}) =_c \text{INF}$
$(\mu\mathcal{M}* \text{ DEP VFORM TYPE}) = \text{MAIN}$

b. work V $(\uparrow \text{PRED}) = \text{'WORK}\langle(\uparrow \text{SUBJ})\rangle\text{'}$
$(\mu\mathcal{M}* \text{ VFORM TYPE}) = \text{MAIN}$
$(\mu\mathcal{M}* \text{ VFORM FORM}) = \text{INF}$

The embedding on the m-structure is then, as shown in the c-structure of Figure 2, accomplished by additional μ-annotations of the grammar rules. Here, the recursive VP rule produces the desired flat f-structures because of the trivial equation $\uparrow = \downarrow$, while the equation $(\mu\mathcal{M}* \text{ DEP}) = \mu*$ projects the embedded DEPendent m-structures required to test the hierarchically organized well-formedness restrictions.

Frank and Zaenen (2002), however, show that projecting the morphology from the c-structure leads to a duplication of syntactic information in cases where not only morphological information on the verbs, but also on their arguments is assumed to be represented in the m-structure. Since the different arguments of a verb may introduce conflicting values for the different morphological features, the embedding of the f-structure has to be reproduced in the m-structure by some additional non-governable functions (e.g., EXTernal- and INTernal-ARGuments). This causes the m-structure to structurally assimilate the f-structure and thus to unnecessarily copy structural information on predicate-argument dependencies already contained in the f-structure. Moreover, Frank and Zaenen (2002) observe that a μ-projection from the c-structure might cause problems when morphological agreement and functional uncertainty interact, as, for example, in object relative clauses in French where the perfect participle agrees (in number and gender) with the relative pronoun (and the embedding noun). Here, both the OBJect and the INT-ARGument function are assigned to the relative pronoun by two independent functional uncertainty expressions, one on the f-structure and the other one on the m-structure. To test the agreement with the embedded perfect participle, both functional uncertainty expressions have to be resolved so that the strings that are chosen from the two regular sets are equal in length. But this synchronization is difficult to accomplish, since f-structures but not m-structures are subject to the general principles of completeness and coherence. The differently constrained resolution spaces of the two functional uncertainty expressions might then (at least without any further constraints) permit the functional uncertainty expression on the m-structure to be resolved to strings other than the ones required to ensure the agreement.

To avoid these problems, they propose a sequenced architecture where the morphological dependencies are projected from the f-structure. Since μ is a function, the hierarchical m-structure can here, of course, not any longer be recursively derived by rules that produce flat f-structures by virtue of the trivial equation $\uparrow = \downarrow$. To account for the various constructions, Frank and Zaenen (2002) are thus forced to (non-recursively) enumerate the possible dependencies in the lexicon. But this requires to disjunctively specify for each nonfinite verb form at which level of embedding it may occur and how it constrains from there the form and type of the dependent verb form on the next level. In order to derive, for example, the English sentences in (5), they would have to assume for the lexical entries of the perfect auxiliary *have* and the perfect participle *worked* that at least two alternative levels of embedding are specified.

(5) a. John may have worked

b. John will have worked

In sentence (5a) *have* is directly embedded under an XCOMPlement (subcategorized by the modal) and requires no DEP embedding, whereas in (5b) it is dependent from a tense auxiliary requiring the usual lexical specifications to be pushed down one extra level. Frank and Zaenen (2002) thus have to assume for *have* an entry like (6a). To ensure that the constraints on the dependent verb forms in (6a) take effect, the (usual) morphological features of *worked* have to be embedded under one, respectively two DEP attributes as shown in (6b).

(6) a. have V

$$
\begin{array}{l}
(\uparrow \text{ASPECT}) = \text{PERFECTIVE} \\
\{\ (\mu\!\uparrow \text{VFORM TYPE AUX}) = \text{PERF} \\
\quad (\mu\!\uparrow \text{VFORM FORM}) = \text{INF} \\
\quad (\mu\!\uparrow \text{DEP VFORM FORM}) =_c \text{PERFP} \\
\ |\,(\mu\!\uparrow \text{DEP VFORM TYPE AUX}) = \text{PERF} \\
\quad (\mu\!\uparrow \text{DEP VFORM FORM}) = \text{INF} \\
\quad (\mu\!\uparrow \text{DEP DEP VFORM FORM}) =_c \text{PERFP}\ \}
\end{array}
$$

b. worked V $(\uparrow \text{PRED}) = \text{'WORK}\langle(\uparrow \text{SUBJ})\rangle\text{'}$
$\{ (\mu\!\uparrow \text{DEP VFORM TYPE}) = \text{MAIN}$
$(\mu\!\uparrow \text{DEP VFORM FORM}) = \text{PERFP}$
$|(\mu\!\uparrow \text{DEP DEP VFORM TYPE}) = \text{MAIN}$
$(\mu\!\uparrow \text{DEP DEP VFORM FORM}) = \text{PERFP} \}$

Although Frank and Zaenen (2002) obviously avoid some of the problems of the original projection approach, their solution is nevertheless not really satisfactory. In order to simulate the effects of a simple recursive rule, they have to specify all possible DEP embeddings of the auxiliaries and (nonfinite) main verbs in the lexicon. In case of a full-form lexicon, this solution thus increases the size of the overall grammar far more drastically than any possible solution that is based on a simple recursive rule.[2] It is in this connection also not really helpful to encode, as they do, the possible embeddings for the numerically predominant and most deeply embeddable main verbs by virtue of functional uncertainty expressions instead of finite disjunctions. This certainly reduces the size of the lexicon, but it increases at the same time the disjunctive solution space much more than actually required, since strictly local dependencies are treated as if they were unbounded.

Only their explicit assumption that a morphological analyzer is employed in the system architecture permits it to circumvent these problems to a certain extent. For the nonfinite main verb forms then the encoding of the possible embeddings can be moved to the appropriate morphological tags (e.g., the one for perfect participle morphemes) provided by the morphological analyzer. Since this does not work for alternative architectures based on full-form lexicons (like our's), their approach can hardly be considered as a theoretically satisfying general solution.

As an alternative to the projection approaches that avoids the problems already mentioned as yet we propose here an analysis that provides flat f-structures for auxiliary constructions without leaving the usual functional level of linguistic description. We are thus not compelled to stipulate an additional morphological projection to establish the desired crosslinguistic parallelism. Our approach that we will illustrate by providing an analysis of the Danish verbal complex, including complex tenses, passives and modals, exploits instead of a projection the restriction operator introduced by Kaplan and Wedekind (1993) and Wedekind and Kaplan (1993).

The restriction operator is a formal device that permits it to ignore information from an f-structure if this information is assumed to be irrelevant for the predicate-argument structure and thus for the semantic interpretation of a sentence. Informally, the restriction of a given f-structure f with respect to an attribute F (notated by f/F) is the f-structure that results from removing F and its value from f. The restriction of the f-structure f in (7a) by SUBJ, for example, is the f-structure in (7b).

2 Moreover, since they generate the embeddings not there where they are actually required, namely in the verb complex, the alternative embeddings encoded in the entries of the nonfinite main verb forms also have to be evaluated when constructions without dependent verb forms are processed, like, for example, infinitival complements as in the sentence *John tries to work* (vs. *John will work*).

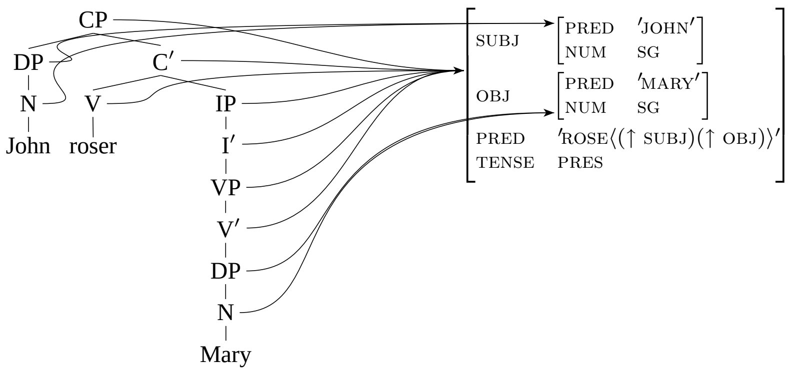

Figure 3
The c- and f-structure of the sentence *John roser Mary* (John praises Mary) and their structural correspondence.

(7) a.
$$f = \begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'JOHN'} \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{PRED} & \text{'ARBEJDE}\langle(\uparrow \text{SUBJ})\rangle\text{'} \\ \text{TENSE} & \text{PRES} \end{bmatrix}$$

b.
$$f/\text{SUBJ} = \begin{bmatrix} \text{PRED} & \text{'ARBEJDE}\langle(\uparrow \text{SUBJ})\rangle\text{'} \\ \text{TENSE} & \text{PRES} \end{bmatrix}$$

In particular, restriction allows it to express that two f-structures only partially agree. The statement $f/\text{F} = g/\text{F}$, for example, asserts that f and g agree with respect to all attributes and values other than F (and its values). Note furthermore that $(f/\text{F})/\text{F} = f/\text{F}$ and $(f/\text{F})/\text{G} = (f/\text{G})/\text{F}$ and that f/F always subsumes f.

For the illustration of our approach, then, we assume for Danish a rather traditional endocentric, X-bar oriented phrasal structure. The basic structure is illustrated by the example depicted in Figure 3. Since Danish is a V2 language, sentences are assumed to be a projection of the functional category C (complementizer). In main clauses the finite verb appears in C position and initial (topicalized) constituents fill the specifier position of CP. If there is no inversion the subject is initial and appears in CP's specifier position. In case of inversion or in subordinate clauses the subject appears in specifier position of IP. Sentence adverbials, like, for example, negation, are dominated by I′. Since unstressed pronominal objects in main clauses appear in front of sentence adverbials, I′ permits them to appear in front of the adverbials.[3] If there is no object-shift, all possible verbal arguments and subsequent adjuncts are derived by the V′ rule.

3 The sentences (a–c) illustrate that object-shift is obligatory if the pronominal object is unstressed.

a. Jeg ser ikke bussen
I see not the-bus

b. Jeg ser den ikke
I see it not

c. *Jeg ser ikke den
I see not it

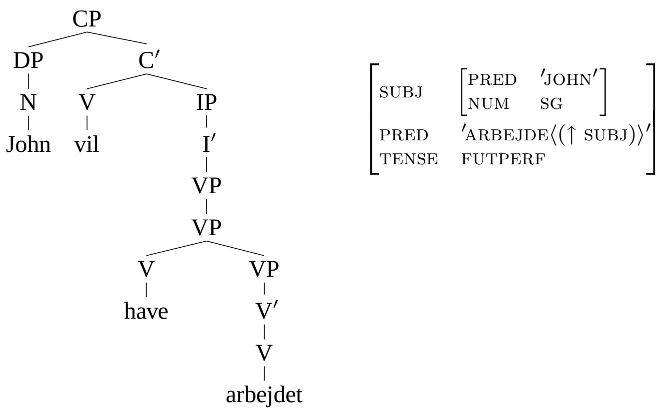

Figure 4
The c- and f-structure of sentence (8).

3 Temporal Auxiliaries

The analysis that we assume here for the complex tenses in Danish is in line with the unified analysis of (tense) auxiliaries in English, French and German proposed by Butt et al. (1996, 1999). They produce flat f-structures by treating auxiliaries as functional, and thus non-PRED-bearing categories and provide complex tense values, like, for example, FUTPERF, based on a system of constraints on the combinations of auxiliaries and main verbs instead of just collecting the morphological features of the auxiliaries and verbs of a complex (analytical) tense form (as, for example, Nordlinger and Bresnan (1996)). For the sentence (8)

(8) John vil have arbejdet
John will have worked

we thus get the c-structure and f-structure in Figure 4.

The Danish (tense) auxiliary system is quite similar to the English one, but it additionally exhibits auxiliary selection for the perfective auxiliary: verbs select either *have* (*have*) or *være* (*be*). Altogether we have to distinguish two synthetic and six analytic tense forms.

(9) (a) Present tense: synthetic
John arbejder
John works

(b) Past tense: synthetic
John arbejdede
John worked

(c) Present Perfect: perfect auxiliary in present tense followed by perfect participle form
John har arbejdet
John has worked

(d) Past Perfect: perfect auxiliary in past tense followed by perfect participle form
John havde arbejdet
John had worked

(e) Future: present tense of *ville* followed by infinitive form (but not of a perfect auxiliary)
John vil arbejde
John will work

(f) Future Perfect: present tense of *ville* followed by infinitive form of perfect auxiliary followed by perfect participle form
John vil have arbejdet
John will have worked

(g) Conditional: past tense of *ville* followed by infinitive form (but not of a perfect auxiliary)
John ville arbejde
John would work

(h) Conditional Perfect: past tense of *ville* followed by infinitive form of perfect auxiliary followed by perfect participle form
John ville have arbejdet
John would have worked

Since Danish does not allow scrambling of the auxiliaries and permits at least in complex forms only nexus adverbials to appear between the finite form and the nonfinite forms, we can—similar to English—derive the nonfinite forms with the recursive VP rule in (10). The finite form is—as the c-structure of Figure 4 illustrates—the head of C′ and the adverbial phrase is considered to be adjoined to I′.

(10) VP → V VP

In order to ensure that each auxiliary and modal can only be followed by a verb of the right type and form we use—similar to almost all other approaches—a system of morphosyntactic features whose relevant parts are given in (11).

(11)
$$\text{VFORM} \left[\begin{array}{ll} \text{TYPE} & \left\{\begin{array}{l} \text{MAIN} \\ \text{AUX} \left\{\begin{array}{l}\text{TENSE}\\ \text{PERF}\\ \text{PASS}\end{array}\right. \\ \text{MOD} \left\{\begin{array}{l}\text{ROOT}\\ \text{EPIST}\end{array}\right. \end{array}\right. \\ \text{FORM} & \left\{\begin{array}{l}\text{FIN}\\ \text{INF}\\ \text{PERFP}\\ \text{PASSP}\end{array}\right. \\ \text{AUX-SEL} & \left\{\begin{array}{l}\text{HAVE}\\ \text{BE}\end{array}\right. \\ \text{PASSIVIZE} & \left\{\begin{array}{l}\text{YES}\\ \text{NO}\end{array}\right. \end{array}\right.$$

This (rather informal) feature declaration indicates that each verb has a VFORM feature whose value specifies the verb type, its form, which auxiliary it selects and whether it passivizes. We distinguish here tense, perfect and passive auxiliaries and root and epistemic modals. Since our present purposes do not require a further subclassification of the main verbs, we consider MAIN as an atomic value. We further distinguish (here) four different forms, namely finite forms, infinitives, perfect participles and passive participles.

Using restriction we can then state the hierarchically organized morphosyntactic well-formedness restrictions on the order of the different verb types and forms similarly easy as in the raising approach. The only difference is that tense and perfect (as well as passive) auxiliaries do not introduce predicates and that the structural hierarchy is established by the non-governable DEP function instead of XCOMP. We thus state the hierarchical DEPendencies and the constraints on them as ordinary functional specifications instead of projecting them off of the c-structure as morphological specifications. For present perfect, for example, this is illustrated by the lexical entries in (12). In order to introduce the tense value PRESPERF, the tense auxiliary *har* is constrained to combine with a DEPendent perfect participle verb form that selects HAVE, as, for example, *arbejdet*.

(12) a. har V $(\uparrow \text{TENSE}) = \text{PRESPERF}$
$(\uparrow \text{VFORM TYPE AUX}) = \text{TENSE}$
$(\uparrow \text{VFORM FORM}) = \text{FIN}$
$(\uparrow \text{DEP VFORM FORM}) =_c \text{PERFP}$
$(\uparrow \text{DEP VFORM AUX–SEL}) = \text{HAVE}$

b. arbejdet V $(\uparrow \text{PRED}) = \text{'ARBEJDE}\langle(\uparrow \text{SUBJ})\rangle\text{'}$
$(\uparrow \text{VFORM TYPE}) = \text{MAIN}$
$(\uparrow \text{VFORM FORM}) = \text{PERFP}$
$(\uparrow \text{VFORM AUX–SEL}) = \text{HAVE}$

The flat f-structure analysis of the complex tense forms is then obtained by simply restricting off the information on the morphological dependencies. This requires to slightly refine the CP and the VP rule as in (13).

(13) a. $$\text{CP} \rightarrow \begin{array}{c} (\text{DP}) \\ (\uparrow \text{SUBJ}) = \downarrow \end{array} \quad \begin{array}{c} \text{C}' \\ \uparrow = \downarrow/\text{DEP}/\text{VFORM} \\ (\uparrow \text{TENSE}) \end{array}$$

b. $$\text{VP} \rightarrow \begin{array}{c} (\text{V}) \\ \uparrow = \downarrow \\ (\downarrow \text{VFORM FORM}) \neq \text{FIN} \end{array} \quad \begin{array}{c} \text{VP} \\ (\uparrow \text{DEP}) = \downarrow \\ (\uparrow \text{VFORM}) \\ \uparrow/\text{DEP}/\text{VFORM} = \downarrow/\text{DEP}/\text{VFORM} \end{array}$$

The VP rule can only be applied if there is already a verb form (enforced by the constraint $(\uparrow \text{VFORM})$). Since we are at the moment only concerned with tense and perfect auxiliaries, the first application of the VP rule requires the finite verb (dominated by C′) to be a tense auxiliary. This results from the rule (14)

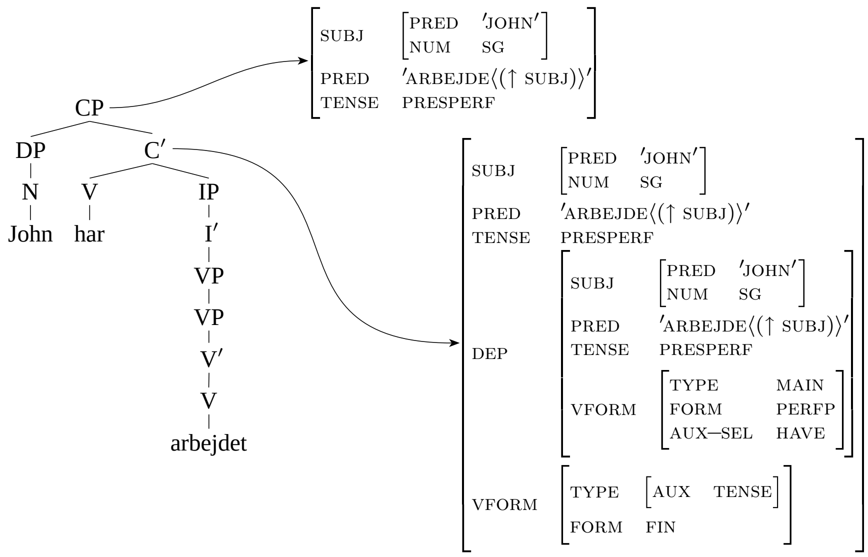

Figure 5
The c-structure of the sentence *John har arbejdet* and the f-structures related to the CP and the C′ node.

(14) $$\text{VP} \rightarrow \begin{array}{c} \text{V}' \\ \uparrow = \downarrow \\ (\uparrow \text{VFORM TYPE}) =_c \text{MAIN} \end{array}$$

that is used to leave the recursively constructed auxiliary complex. Rule (14) requires the f-structure associated with V′ to contain a predicate of a main verb. So, if there were already a finite main verb and rule (13b) is applied at least once, then—under a flat analysis—the semantic form of the DEPendent main verb required by rule (14) would cause a unification failure. Hence, the finite form must be an auxiliary when rule (13b) is applied. Moreover, the first application of the VP rule (13b) can only derive the dependent VP, since the verb is constrained to be nonfinite. Further applications of the rule (13b) then require the verb position to be filled by a nonfinite verb form, preventing the grammar from recursively generating non-branching VP chains. The annotation $\uparrow/\text{DEP}/\text{VFORM} = \downarrow/\text{DEP}/\text{VFORM}$ then expresses that the f-structure associated with the mother agrees with the one of the dependent daughter except for the information on the dependent structures and the particular verbal forms. This causes the information that is relevant for the f-structure of the sentence (assigned to the c-structure root) to be percolated upwards. The C′ annotation of the CP rule finally restricts the information on the dependent verbal forms off of the f-structure that is assigned to C′ and thus to the c-structure root CP. The example in Figure 5 illustrates the effects of the restriction annotations by showing not only the f-structure that is assigned to the root, but also the structure from which it is obtained by restriction, namely the one that is assigned to C′.

Since present and past perfect and future and conditional tenses differ only with respect to the tense form of the auxiliary, we can complete the description of our analysis of the complex Danish tense forms by considering the lexical entries of the auxiliaries that are involved in the future tense forms. For perfect participles which select HAVE these are the ones in (15). Entry (15a) also applies to participles which select *være*.

(15) a. vil V

$$\begin{array}{l}
(\uparrow \textsc{vform type aux}) = \textsc{tense} \\
(\uparrow \textsc{vform form}) = \textsc{fin} \\
(\uparrow \textsc{dep vform form}) =_c \textsc{inf} \\
\{\ (\uparrow \textsc{tense}) = \textsc{fut} \\
\quad (\uparrow \textsc{dep vform type aux}) \neq \textsc{perf} \\
\ |(\uparrow \textsc{tense}) = \textsc{futperf} \\
\quad (\uparrow \textsc{dep vform type aux}) = \textsc{perf}\ \}
\end{array}$$

b. have V

$$\begin{array}{l}
(\uparrow \textsc{aspect}) = \textsc{perfective} \\
(\uparrow \textsc{vform type aux}) = \textsc{perf} \\
(\uparrow \textsc{vform form}) = \textsc{inf} \\
(\uparrow \textsc{dep vform form}) =_c \textsc{perfp} \\
(\uparrow \textsc{dep vform aux–sel}) = \textsc{have}
\end{array}$$

The complex future tense forms are constructed with the present tense form of *ville*. The finite form *vil* requires a DEPendent infinitive verb form. Depending on whether the infinitive form of this DEPendent form is a perfect auxiliary or not, the tense is either future perfect or future. If this form is a perfect auxiliary, like, for example, *have*, it requires, as any other form of the perfective auxiliaries, a DEPendent perfect participle form, for example *arbejdet* that selects HAVE (cf. (12b)). The infinitive forms of the perfect auxiliaries also introduce aspectual information. This is required for nonfinite clauses, but not for finite clauses because of the perfective tense values. For finite clauses we then eliminate this redundancy by restricting aspectual information off at the IP daughter of the rule (16).

(16)
$$\mathrm{C}' \rightarrow \begin{array}{c} \mathrm{V} \\ \uparrow = \downarrow \end{array} \quad \begin{array}{c} (\mathrm{IP}) \\ \uparrow = \downarrow / \textsc{aspect} \end{array}$$

4 Passive Verbal Structures

Like Norwegian and Swedish, Danish has two passive forms: a morphological passive that is formed by adding *s* to the verb and a periphrastic passive that involves—similar to English—a finite or nonfinite form of the passive auxiliary *blive* (*be*) and a passive participle. Examples of both forms are given in (17).

(17) a. John roses af Mary
John is-praised by Mary

b. John bliver rost af Mary
John is praised by Mary

Although there are semantic, contextual and lexical restrictions on the use of these two passive forms (see, for example, Engdahl 1999), these differences do not justify a raising analysis of the passive auxiliary. Such an analysis would not capture the functional similarity between the two passive forms. We therefore prefer an analysis similar to the tense auxiliaries where the main verb contributes the top-level PREDicate value.

Apart from very few past tense forms, the *s*-passive is mainly used in present tense and the infinitive in Danish. An example is the verb *roses* whose lexical entry is shown in (18).

(18) roses V $\begin{array}{l} \{\ (\uparrow \textsc{pred}) = {}'\textsc{rose}\langle(\uparrow \textsc{subj})(\uparrow \textsc{obl–agt})\rangle' \\ \ |(\uparrow \textsc{pred}) = {}'\textsc{rose}\langle(\uparrow \textsc{subj})\rangle'\ \} \\ (\uparrow \textsc{pass}) = \textsc{morph} \\ (\uparrow \textsc{vform type}) = \textsc{main} \\ \{\ (\uparrow \textsc{tense}) = \textsc{pres} \\ \quad (\uparrow \textsc{vform form}) = \textsc{fin} \\ \ |(\uparrow \textsc{vform form}) = \textsc{inf}\ \} \end{array}$

If we assume that the lexicon contains only inflected forms, then the *s*-passive requires no further attention from a syntactic point of view. Sentence (17a) thus is associated with the f-structure in (19).

(19) $$\begin{bmatrix} \textsc{subj} & \begin{bmatrix} \textsc{pred} & '\textsc{john}' \\ \textsc{num} & \textsc{sg} \end{bmatrix} \\ \textsc{obl–agt} & \begin{bmatrix} \textsc{pred} & '\textsc{mary}' \\ \textsc{num} & \textsc{sg} \\ \textsc{pcase} & \textsc{af} \end{bmatrix} \\ \textsc{pred} & '\textsc{rose}\langle(\uparrow \textsc{subj})(\uparrow \textsc{obl–agt})\rangle' \\ \textsc{tense} & \textsc{pres} \\ \textsc{pass} & \textsc{morph} \end{bmatrix}$$

Periphrastic passive forms consist of a finite, infinitive or perfect participle form of the passive auxiliary *blive* and a dependent passive participle form. On the basis of the rules that we already presented we thus easily obtain a flat analysis of the analytic passive by assuming for the different forms of the passive auxiliary lexical entries which are similar to the ones for the tense auxiliaries. The entry for the present tense form of *blive*, for example, is given in (20).

(20) bliver V $\begin{array}{l} (\uparrow \textsc{pass}) = \textsc{periph} \\ (\uparrow \textsc{tense}) = \textsc{pres} \\ (\uparrow \textsc{vform type aux}) = \textsc{pass} \\ (\uparrow \textsc{vform form}) = \textsc{fin} \\ (\uparrow \textsc{dep vform form}) =_c \textsc{passp} \end{array}$

Under the usual assumption that passive participle verb forms are contained in the lexicon we could already stop here and complete this section with a sample f-structure of a sentence containing an analytic passive form. However, in our grammar we followed a suggestion by John Maxwell and encoded passivization syntactically. Passive participle forms are thus not contained in the lexicon. The reason for adopting this strategy was rather practical. Our Danish grammar currently contains a full-form lexicon that was automatically extracted from a lexical database. Here, the use of syntactic passivization rules turned out to be very useful, since we could not only simplify the extraction process, but also reduce the size of the lexicon by the number of passive participle alternatives.

Traditional LFG accomplishes passivization by lexical rules that produce passive form alternatives if they are applied to the functional specifications of verbs that are able to passivize. For English transitive verbs, for example, this is the rule in (21).

(21) $\textsc{pass(schemata)} \quad = \quad \begin{array}{l} \textsc{schemata} \\ (\uparrow \textsc{vform form}) = \textsc{passp} \\ (\uparrow \textsc{obj}) \rightarrow (\uparrow \textsc{subj}) \\ \{\ (\uparrow \textsc{subj}) \rightarrow (\uparrow \textsc{obl–agt}) \\ \ |(\uparrow \textsc{subj}) \rightarrow \textsc{null}\ \} \end{array}$

Syntactic passivization, on the other hand, is performed in the rule component, namely at that position where passive participles can occur. This is the verbal head position of the V′ rule. The V′ rule is usually used to derive the main verb of a (complex) verbal complex, the arguments of the main verb and the subsequent adjuncts. A simplified version that is sufficient for our present purposes is the rule depicted in (22) that allows us to illustrate passivization for transitive verbs.

(22) $\mathrm{V}' \rightarrow \begin{array}{lcc} \multicolumn{1}{c}{(\mathrm{V})} & (\mathrm{DP}) & (\mathrm{PP}) \\ \{\ (\downarrow \textsc{vform type}) =_c \textsc{main} & (\uparrow \textsc{obj}) = \downarrow & \{\ (\uparrow \textsc{obl}) = \downarrow \\ \quad \uparrow = \downarrow & & \ |(\uparrow \textsc{obl–agt}) = \downarrow \\ \ |(\downarrow \textsc{vform passivize}) =_c \textsc{yes} & & (\downarrow \textsc{pcase}) =_c \textsc{af}\ \} \\ \quad \downarrow/\textsc{subj}/\textsc{obj}/\textsc{vform} = \uparrow/\textsc{subj}/\textsc{obl–agt}/\textsc{vform} & & \\ \quad (\downarrow \textsc{obj}) = (\uparrow \textsc{subj}) & & \\ \quad (\downarrow \textsc{subj}) = (\uparrow \textsc{obl–agt}) & & \\ \quad \{(\uparrow \textsc{obl–agt}) = \textsc{null}\} & & \\ \quad (\uparrow \textsc{vform type}) = \textsc{main} & & \\ \quad (\uparrow \textsc{vform form}) = \textsc{passp}\ \} & & \end{array}$

Passivization is then accomplished by this rule as follows. First, it is required that the verbal head position is filled by a (perfect participle form of a transitive) verb that passivizes. The restriction annotation then states that the f-structure associated with the verb agrees with the one assigned to V′ except for the subject, object and the verb form features. Similar to lexical passivization, the subject of the V′ f-structure is identified with the original object and the OBL–AGT with the original subject. For agent-less passives this new OBL–AGT can optionally become NULL. Finally, the f-structure assigned to V′ gets the VFORM features of a passive participle verb form.

For sentence (17b) then we get the c- and f-structure depicted in Figure 6. To illustrate the effects of the passivization annotation we depicted also the f-structures associated with the V and V′ node. As the f-structures of the sentences (17a) and (17b) illustrate, our grammar provides similar f-structures for analytic and synthetic passive forms. We do, however, keep the passive feature as a trigger for the slightly different interpretation of the two forms.[4]

5 Modals

Modals are treated as verbs that introduce a PREDicate subcategorizing for an XCOMPlement that is functionally controlled by the subject. The Danish modal verb system includes as the main representatives *ville*, *kunne*, *måtte* and *skulle*. Since the Danish system is almost identical to the Norwegian system, we observe the same systematic ambiguity between a one-place epistemic reading and a two-place root reading that Dyvik (1999)

4 Passivization can, of course, also be performed syntactically if a morphological analyzer is used. This simply requires to extend the sublexical verb rule such that it alternatively permits passivization as in our V′ rule if a morphological passive feature (-*s* or passive participle form) is present.

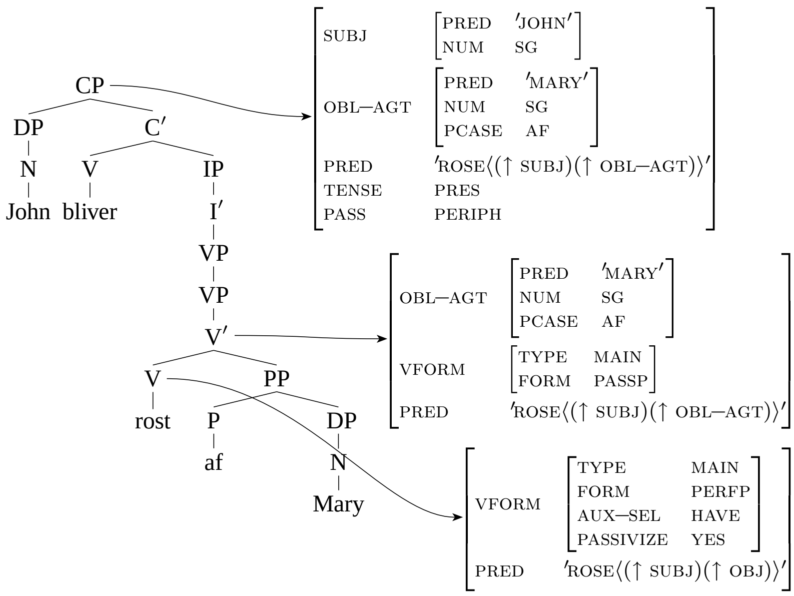

Figure 6
The c- and f-structure of sentence (17b) with the f-structures assigned to the V and the V′ node.

stated for Norwegian. The corresponding examples are given in (23).

(23) a. John kan dreje håndtaget
John may/is able to$_{\text{pres}}$ *turn*$_{\text{inf}}$ *the-lever*

b. John må dreje håndtaget
John must/is obliged to$_{\text{pres}}$ *turn*$_{\text{inf}}$ *the-lever*

c. John skal dreje håndtaget
John is said to/has to$_{\text{pres}}$ *turn*$_{\text{inf}}$ *the-lever*

d. John vil dreje håndtaget
John will/wants to$_{\text{pres}}$ *turn*$_{\text{inf}}$ *the-lever*

As indicated above, we follow Dyvik in making a main distinction between the epistemic and the root reading of the modals. However, in case of the modal verb *kunne* it turns out that Danish grammaticalizes a three-way modal distinction between an epistemic reading, a deontic reading and a dynamic reading. The distinction can be exemplified by (24) below which allows for the three readings in (25). Generally the root reading is vague as to the difference between a deontic and a dynamic reading, but in case of *kunne* the readings are syntactically distinguished in combination with passive complements.

(24) John kan operere
John can operate

(25) a. John kan (være ved at) operere (epistemic)
John may (*be busy*) *operating*

b. John kan (godt) operere (dynamic)
John is (*very well*) *able to operate*

c. John kan operere (i stedet for) (deontic)
John can operate (*instead*)

We will return to a more thorough discussion of these readings below.

For *kunne* the root reading corresponds to ‘be able to’, while under the epistemic reading it translates as ‘may’, ‘have the possibility to’ or ‘be likely to’. The root interpretation of *skulle* is in English expressed by ‘must’ or ‘have to’, while the epistemic reading corresponds to ‘be said to’. For *måtte* the root reading corresponds to ‘be allowed to’ or ‘be obliged to’; the epistemic reading to ‘be bound to’. Only *ville* is an exception. It has a volitional root reading ‘have the will to’ or ‘want’, but no proper epistemic reading. This reading is in some sense blocked, since its finite forms are used for the future tenses (i.e., they are already part of the tense system). Under the epistemic interpretation of the modals the subject is a nonthematic argument, whereas the predicates of the root readings subcategorize for a thematic subject.

Modals require a dependent infinitive verb form. Ignoring for the moment the distinction between epistemic and root modals, we observe that there are no further syntactic type restrictions; they can combine not only with active main verbs as in (23), but also with modals (26a), perfect (26b) and passive (26c) auxiliaries and *s*-passive forms (26d). (Tense auxiliaries occur only in finite form.)

(26) a. John skal kunne komme
John must$_{\mathrm{pres}}$ *be able to*$_{\mathrm{inf}}$ *come*$_{\mathrm{inf}}$

b. John må have set det
John must$_{\mathrm{pres}}$ *have*$_{\mathrm{inf}}$ *seen*$_{\mathrm{perfp}}$ *it*

c. John kan blive valgt
John may$_{\mathrm{pres}}$ *be*$_{\mathrm{inf}}$ *elected*$_{\mathrm{passp}}$

d. John kan vælges
John may$_{\mathrm{pres}}$ *be-elected*$_{\mathrm{inf}}$

Since modals have infinitive forms, it is (in principle) syntactically possible to embed arbitrarily many modals under each other, although, in practice, the number of the embedded modals is certainly bounded by human performance limitations. A more complex example is given in (27).

(27) John må skulle kunne gøre det
John may$_{\mathrm{pres}}$ *have to*$_{\mathrm{inf}}$ *be able to*$_{\mathrm{inf}}$ *do*$_{\mathrm{inf}}$ *it*

Since Danish modals have perfect participle forms too, also tense (28a) and perfect (28b) auxiliaries can combine with them.

(28) a. John har skullet vaske bilen
John has$_{\mathrm{presperf}}$ *had to*$_{\mathrm{perfp}}$ *wash*$_{\mathrm{inf}}$ *the-car*

b. John må have villet gøre det
John must$_{\text{pres}}$ *have*$_{\text{inf}}$ *wanted to*$_{\text{perfp}}$ *do*$_{\text{inf}}$ *it*

Because of the relatively unconstrained position and the in principle unbounded number of modals in the VP, we will incorporate modals in our analysis by allowing the VP rule to derive auxiliaries and modals in any order. This simply requires the VP daughter of rule (13b) to alternatively introduce an XCOMP as in (29).

(29)
$$\text{VP} \rightarrow \begin{array}{c} (\text{V}) \\ \uparrow = \downarrow \\ (\downarrow \text{VFORM FORM}) \neq \text{FIN} \end{array} \quad \begin{array}{c} \text{VP} \\ (\uparrow \text{DEP}) = \downarrow \\ (\uparrow \text{VFORM}) \\ \{\ \uparrow/\text{DEP}/\text{VFORM} = \downarrow/\text{DEP}/\text{VFORM} \\ \mid (\uparrow \text{XCOMP}) = \downarrow/\text{DEP}/\text{VFORM} \\ (\downarrow \text{VFORM FORM}) =_c \text{INF}\ \} \end{array}$$

Unlike auxiliaries where the form of the dependent verb varies depending on the type and the form of the auxiliary, modals always require an infinitive verb form regardless of their form and their type. Since we thus do not have to access the form/type information, we can encode this constraint directly at the XCOMP daughter of the VP rule instead of attaching it to the lexical entries of the modals.[5]

Since we postponed the subtype distinction of the modals when we considered the possible combinations of the modals, it finally remains to be investigated whether and how the type of both the embedding and the embedded verb constrains the interpretation of the modals. First, we work along the principles in (30) that Dyvik (1999) observed for Norwegian before we deal with the influence of passive forms that is not treated by Dyvik (1999).

(30) (i) A modal following a root modal is always given a root interpretation.

(ii) A modal following an epistemic modal always has the root reading unless the embedded modal takes a perfective complement.

(iii) Whenever a modal is the dependent verb of a perfect or perfective tense auxiliary, only the root reading of the modal verb is accepted.

(iv) A modal is always epistemic when it takes a perfective complement.

As the examples in (31) illustrate, principle (30i) seems to hold for Danish as well. Under the root interpretation of the first modal only the root reading of the embedded modal is possible.

(31) a. John skal kunne komme
John has to$_{\text{pres}}$ *be able to*$_{\text{inf}}$ *come*$_{\text{inf}}$

b. John skal måtte komme
John has to$_{\text{pres}}$ *be allowed to*$_{\text{inf}}$ *come*$_{\text{inf}}$

5 For languages which differ from Danish in that they also posses main verbs subcategorizing for infinitival complements without infinitive marker, the additional annotation $(\uparrow$ VFORM TYPE MOD$)$ at the XCOMP daughter is required to constrain the verbal head of the matrix to be a modal.

If two (distinct) modals are combined then the epistemic interpretation of the first modal permits only the root interpretation of the embedded one (32).

(32) a. John må skulle ordne det
John may$_{\text{pres}}$ *have to*$_{\text{inf}}$ *take care of*$_{\text{inf}}$ *it*

b. Man skulle kunne dø af det
One might$_{\text{past}}$ *possibly*$_{\text{inf}}$ *die*$_{\text{inf}}$ *from it*

c. Man måtte kunne dø af det
One might$_{\text{past}}$ *possibly*$_{\text{inf}}$ *die*$_{\text{inf}}$ *from it*

Even though the examples in (32b,c) may also be translated as ‘one may possibly die from it’, we analyze it as an instance of a root modality, for example, with a dispositional reading: one has the disposition that one can die from it. These examples differ from the more obvious readings of the root modality in that the subject argument in (32b) and (32c) is an experiencer rather than an agent. We will return to this issue in the discussion of the passives below.

In accordance with principle (30iii) a modal occurring in a complex tense form has only the root reading (33). For *kunne*, we observe here the same ambiguity between a dynamic and a deontic reading as in (32b,c).

(33) a. John har kunnet gøre det
John has$_{\text{presperf}}$ *been able to*$_{\text{perfp}}$ *do*$_{\text{inf}}$ *it*

b. John vil skulle gøre det
John will$_{\text{fut}}$ *have to*$_{\text{inf}}$ *do*$_{\text{inf}}$ *it*

c. John vil kunne gøre det
John will$_{\text{fut}}$ *be able to*$_{\text{inf}}$ *do*$_{\text{inf}}$ *it*

d. John ville have kunnet gøre det
John could$_{\text{condperf}}$ *have*$_{\text{inf}}$ *possibly*$_{\text{perfp}}$ *do*$_{\text{inf}}$ *it*

Dyvik’s last principle (30iv) does not seem to hold for Danish. If a modal takes a perfective complement we still observe the systematic ambiguity of the modals as illustrated in (34).

(34) a. Eleverne skal have læst stoffet før eksamen
The-pupils may$_{\text{pres}}$ *have*$_{\text{inf}}$ *read*$_{\text{perfp}}$ *the-material before the-exam*
The-pupils must$_{\text{pres}}$ *have*$_{\text{inf}}$ *read*$_{\text{perfp}}$ *the-material before the-exam*

b. Eleverne må gerne have læst stoffet (root)
The-pupils are allowed to$_{\text{pres}}$ *preferably*$_{\text{adv}}$ *have*$_{\text{inf}}$ *read*$_{\text{perfp}}$ *the-material*

Eleverne må vel have læst stoffet (epistemic)
The-pupils may$_{\text{pres}}$ *possibly*$_{\text{adv}}$ *have*$_{\text{inf}}$ *read*$_{\text{perfp}}$ *the-material*

For the effect of the passive forms on the interpretation we can rely on several investigations, among them Engdahl (1999). They all agree on the following systematic interaction: whenever a modal takes a passive complement then the *blive*-passive permits only the epistemic reading of the modal and the *s*-passive only the root reading. Some examples of modals with passive complements are given in (35).

(35) a. Kagen kan blive spist
The-cake may$_{\mathrm{pres}}$ *be*$_{\mathrm{inf}}$ *eaten*$_{\mathrm{passp}}$

b. Kagen kan spises
The-cake can$_{\mathrm{pres}}$ *be-eaten*$_{\mathrm{inf}}$
'The cake is edible'

c. Kagen skal blive spist
The-cake will$_{\mathrm{pres}}$ *be*$_{\mathrm{inf}}$ *eaten*$_{\mathrm{passp}}$

d. Kagen skal spises
The-cake has to$_{\mathrm{pres}}$ *be-eaten*$_{\mathrm{inf}}$

e. Kagen vil blive spist
The-cake will$_{\mathrm{fut}}$ *be*$_{\mathrm{inf}}$ *eaten*$_{\mathrm{passp}}$

f. Kagen vil spises (forces a non-sensical reading)
The-cake wants to$_{\mathrm{pres}}$ *be-eaten*$_{\mathrm{inf}}$

g. Kagen må blive spist
The-cake may$_{\mathrm{pres}}$ *be*$_{\mathrm{inf}}$ *eaten*$_{\mathrm{passp}}$

h. Kagen må spises
The-cake can$_{\mathrm{pres}}$ *be-eaten*$_{\mathrm{inf}}$

However, the picture turns out to be somewhat more complicated. Note that the generalization about the passive form and the interpretation of the modals interacts with Dyvik's principle (30iii). According to principle (30iii), a perfect participle of a modal only permits the root reading, so we would predict that a perfect participle of a modal verb does not allow a complement with a *blive*-passive, since a *blive*-passive forces an epistemic reading. Corpus searches show that this prediction is borne out for the verbs *skulle* and *måtte*, but not for the verb *kunne*. Actually there are several instances of *kunne* combining with a *blive*-passive:[6]

(36) a. Adskillige patienter har kunnet blive opereret
Several patients have could become operated
'It has been possible to operate several patients'

6 We have used the following corpora: korpus2000 (WWW.DSL.DK) and Danish web-pages searched through GOOGLE.

b. ... der ikke har kunnet blive omskolet
... who not have had the possibility to be retrained
'... whom it has not been possible to retrain'

c. Alle har kunnet blive ansat
Everyone has had the possibility to be employed
'It has been possible to employ everyone'

Interestingly, the examples cannot be interpreted as epistemic modality. The combination with a *blive*-passive rather seems to favour a deontic interpretation, while the combination with an *s*-passive a dynamic interpretation, cf. (37).

(37) Patienten har kunnet opereres
The-patient has been able to be-operated
'The patient could be cured by means of operation'

The question is, however, whether this *deontic* reading of the modal *kunne* is indeed associated with a thematic subject. In some respects the deontic reading seems to pattern with the epistemic reading, in others it seems to pattern with the root reading. Dyvik's analysis is motivated by the fact that epistemic modals allow for expletive subjects:

(38) Der kan komme nogen
There can come somebody
'Somebody may come'

This argument is, however, weakened by the fact that deontic interpretations are also available in contexts with expletive subjects, cf. example (39) below and the possible readings in (40).

(39) Der skal komme nogen
There shall come somebody

(40) a. Somebody is said to come (epistemic)

b. Somebody has to come (deontic)

Thus, the possibility of expletive subjects seems not to be restricted to epistemic contexts.

An argument in favour of treating the deontic reading as a reading involving a two-place predicate is that the deontic reading allows for paraphrases containing a *for*-PP. For (41) below, which is ambiguous between a deontic and a dynamic reading

(41) John kan tale tysk
John can speak German

the possible paraphrases are shown in (42).

(42) a. John is able to speak German (dynamic)

b. John is allowed to speak German (deontic)

It is allowed for John to speak German

These paraphrases suggest that the deontic reading patterns with the dynamic reading and provide an argument in favour of treating both as instances of the *root* modality. However, the different readings only have to be resolved when *kunne* combines with passive complements (cf. (36) and (37)).

These considerations boil down to a number of morphosyntactic constraints on the interpretation of modals. Only finite forms, i.e., present and past tense forms, exhibit the systematic ambiguity between an epistemic and a root interpretation, while nonfinite forms, i.e., infinitives and perfect participles, always have solely the root reading (comprising both the dynamic and the deontic reading). Moreover, if we ignore *kunne* for the moment then *blive*-passive complements exclude the root interpretation and *s*-passive complements the epistemic reading. These facts can easily be taken into account by simply assuming for the finite and the nonfinite forms different lexical specifications, like, for example, the ones for the present tense and perfect participle forms of *måtte* in (43a,b).

(43) a. må V $(\uparrow \text{TENSE}) = \text{PRES}$
$(\uparrow \text{VFORM FORM}) = \text{FIN}$
$\{ (\uparrow \text{PRED}) = \text{'MÅTTE}\langle(\uparrow \text{XCOMP})\rangle(\uparrow \text{SUBJ})\text{'}$
$(\uparrow \text{SUBJ}) = (\uparrow \text{XCOMP SUBJ})$
$(\uparrow \text{VFORM TYPE MOD}) = \text{EPIST}$
$(\uparrow \text{XCOMP PASS}) \neq \text{MORPH}$
$|(\uparrow \text{PRED}) = \text{'MÅTTE}\langle(\uparrow \text{SUBJ})(\uparrow \text{XCOMP})\rangle\text{'}$
$(\uparrow \text{SUBJ}) = (\uparrow \text{XCOMP SUBJ})$
$(\uparrow \text{VFORM TYPE MOD}) = \text{ROOT}$
$(\uparrow \text{XCOMP PASS}) \neq \text{PERIPH} \}$

b. måttet V $(\uparrow \text{PRED}) = \text{'MÅTTE}\langle(\uparrow \text{SUBJ})(\uparrow \text{XCOMP})\rangle\text{'}$
$(\uparrow \text{SUBJ}) = (\uparrow \text{XCOMP SUBJ})$
$(\uparrow \text{VFORM TYPE MOD}) = \text{ROOT}$
$(\uparrow \text{VFORM FORM}) = \text{PERFP}$
$(\uparrow \text{VFORM AUX–SEL}) = \text{HAVE}$
$(\uparrow \text{XCOMP PASS}) \neq \text{PERIPH}$

We thus follow Dyvik (1999) in assuming that the predicates of the epistemic readings subcategorize for a nonthematic subject, while the root readings have a thematic one. For constraining the interaction between the interpretation of modals and the possible passive forms we use simple inequalities.

For the root readings of the modal verb *kunne*, we observed that *blive*-passive complements force the deontic interpretation and *s*-passive complements the dynamic reading. We thus arrive at the following lexical encoding for the modal verb *kunne*. We consider first the entries for the finite forms illustrated by the present tense form *kan* in (44).

(44) kan V (↑ TENSE) = PRES
(↑ VFORM FORM) = FIN
{ (↑ PRED) = ′KUNNE⟨(↑ XCOMP)⟩(↑ SUBJ)′
(↑ SUBJ) = (↑ XCOMP SUBJ)
(↑ VFORM TYPE MOD) = EPIST
(↑ XCOMP PASS) ≠ MORPH
|(↑ PRED) = ′KUNNE⟨(↑ SUBJ)(↑ XCOMP)⟩′
(↑ SUBJ) = (↑ XCOMP SUBJ)
(↑ VFORM TYPE MOD) = ROOT
{ (↑ MODVALUE) = DYNAMIC
(↑ XCOMP PASS) ≠ PERIPH
|(↑ MODVALUE) = DEONTIC
(↑ XCOMP PASS) ≠ MORPH } }

The lexical entry shows that the finite form *kan* allows for both an epistemic reading and a root reading where the root reading is ambiguous between a deontic and a dynamic interpretation. If the complement contains a periphrastic passive we get an ambiguity between an epistemic and a deontic reading, and if the complement is a synthetic passive we get a dynamic reading.

The lexical entry for the perfect participle in (45) is similar but lacks the epistemic reading in accordance with Dyvik's principles.

(45) kunnet V (↑ VFORM FORM) = PERFP
(↑ VFORM AUX–SEL) = HAVE
(↑ PRED) = ′KUNNE⟨(↑ SUBJ)(↑ XCOMP)⟩′
(↑ SUBJ) = (↑ XCOMP SUBJ)
(↑ VFORM TYPE MOD) = ROOT
{ (↑ MODVALUE) = DYNAMIC
(↑ XCOMP PASS) ≠ PERIPH
|(↑ MODVALUE) = DEONTIC
(↑ XCOMP PASS) ≠ MORPH }

Compared to Dyvik's analysis, we thus explicitly assume a deontic and a dynamic reading of the root modal *kunne*, since these readings are systematically distinguished when *kunne* combines with a passive complement.

Finally, we have to consider the epistemic readings of the finite forms of *ville*. Since they have degenerated to tense markers, their entries are slightly different. In (46) we show the one for *vil* where the future tense markers substitute the epistemic reading of the entire modals.

(46) vil V { (↑ VFORM TYPE AUX) = TENSE
(↑ VFORM FORM) = FIN
(↑ DEP VFORM FORM) $=_c$ INF
(↑ PASS) ≠ MORPH
{ (↑ TENSE) = FUT
(↑ DEP VFORM TYPE AUX) ≠ PERF
|(↑ TENSE) = FUTPERF
(↑ DEP VFORM TYPE AUX) = PERF }
|(↑ PRED) = ′VILLE⟨(↑ SUBJ)(↑ XCOMP)⟩′
(↑ TENSE) = PRES
(↑ SUBJ) = (↑ XCOMP SUBJ)
(↑ VFORM TYPE MOD) = ROOT
(↑ VFORM FORM) = FIN
(↑ XCOMP PASS) ≠ PERIPH }

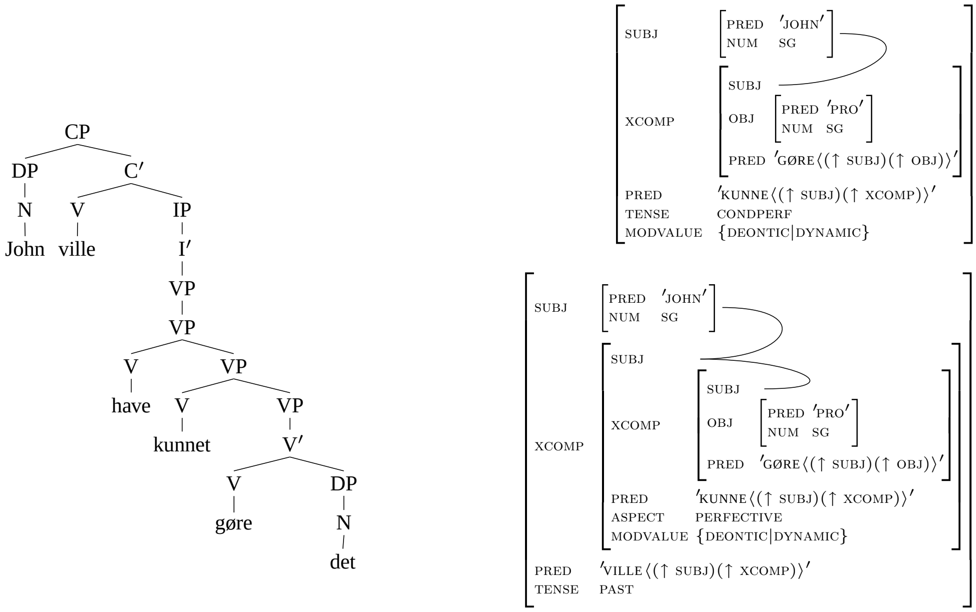

Figure 7
The c- and f-structures of sentence (47).

According to our analysis we then get, for example, for the sentence (33d), repeated here in (47),

(47)	John ville	have	kunnet	gøre	det
	John could$_{\mathrm{condperf}}$	*have*$_{\mathrm{inf}}$	*possibly*$_{\mathrm{perfp}}$	*do*$_{\mathrm{inf}}$	*it*
	John could$_{\mathrm{condperf}}$	*have*$_{\mathrm{inf}}$	*been able to*$_{\mathrm{perfp}}$	*do*$_{\mathrm{inf}}$	*it*
	John wanted to$_{\mathrm{past}}$	*have*$_{\mathrm{inf}}$	*the possibility to*$_{\mathrm{perfp}}$	*do*$_{\mathrm{inf}}$	*it*
	John wanted to$_{\mathrm{past}}$	*have*$_{\mathrm{inf}}$	*been able to*$_{\mathrm{perfp}}$	*do*$_{\mathrm{inf}}$	*it*

altogether four readings. The c-structure and the corresponding f-structures are depicted in Figure 7.

6 Conclusion

We have presented an analysis of the Danish verb complex that provides the desired flat f-structures for auxiliary constructions. Since our restriction-based approach permits us to state and derive the hierarchically organized morphosyntactic well-formedness conditions similarly easy as in the formally quite elegant raising approach, it avoids the space-consuming lexical simulation of the sequenced projection architecture proposed by Frank and Zaenen (2002). Moreover, since our approach operates only on the functional level of representation, the intermodular problems of the parallel projection architecture detected by Frank and Zaenen (2002) cannot occur.

But, apart from these rather technical issues, both projection approaches seem also to be confronted with a more serious conceptual problem resulting from LFG's fundamental assumptions on the modular architecture of the different kinds of linguistic information.

LFG assigns to a sentence a c-structure representing the ordered arrangement of words and phrases in the sentence and an f-structure representing its underlying predicate-argument structure. F-structures that are related to the c-structures by ϕ-correspondences abstract from the superficial arrangement of words and phrases and are thus assumed to be nearly invariant across languages. Since strings are regarded to be (syntactically) well-formed, if they have valid c-structures that get assigned (well-formed) f-structures, grammaticality is entirely determined on the phrasal and functional level of representation. Structures on other (typically more abstract) levels of representation (e.g., semantic and thematic structures) are then related to the c- or f-structure by multiple correspondences.

According to this rough sketch of LFG's modular specifications of different kinds of linguistic information, one would expect the m-structure to differ from the f-structure in at least two respects. For the sequenced architecture one would expect the m-structure to be somewhat more abstract than the f-structure, since it is projected from the f-structure and thus assumed to abstract from some aspects of the underlying predicate-argument relationships while illuminating other linguistically interesting aspects closer to the meaning representation. With the m-structure located on roughly the same rather than a higher level of abstraction this applies slightly weakened also to the parallel architecture. Moreover, since grammaticality is supposed to be determined solely on the phrasal and functional level of representation, the m-description is expected to be a (syntactically) conservative extension of the f-description. In other than syntactic respects, the extension might, of course, be creative, as, for example, an additional semantic projection that might filter out some of the syntactically well-formed strings for purely semantic reasons.

Already the arguments of the authors, then, suffice to see that for both projection approaches exactly the opposite seems to hold. (This fortunately protects our argumentation from entering a complicated and difficult discussion on the explication of the linguistic notion of abstractness.) The f-structure is in both cases more abstract than the m-structure, since it abstracts—as intended by the authors—from the hierarchically organized morphological dependencies encoded in the m-structure. The extensions are in both cases also not syntactically conservative. The whole purpose of the μ-projection is to test the hierarchically organized morphosyntactic well-formedness conditions and to filter out those strings as syntactically ill-formed which violate them. Other than syntactic reasons to mark strings as ill-formed have to be ruled out, since strings that get assigned valid c-structures are morphologically well-formed.

Within LFG's multiple projection architecture, both μ-projections can thus not seriously be considered as representing linguistically motivated, independent and hence legitimate levels of representation. The projections are rather misused to carry out some simple computations which are necessary to determine grammaticality, but not worth or desired to appear in the f-structure.

The restriction approach on the other hand gets along without stipulating these note sheets to represent linguistically interesting and illuminating structures. And it makes it possible to carry out those computations when the f-structure of the entire sentence is computed from the f-structures of its constituents. Hence, it computes the morphological dependencies before the sentence gets assigned its f-structure. The restriction approach thus retains morphosyntactic dependencies—as usually assumed—on a less abstract level of representation and permits grammaticality—as in usual LFG—to be determined on the phrasal and functional level of representation.

A final note about the basic formal properties of the approaches. For traditional LFG grammars (satisfying the Nonbranching Dominance Condition) the parsing problem is decidable, since a grammar can assign to a string only a finite number of valid derivations which guarantees the composition of the (decidable) context-free parsing and the (decidable) constraint satisfaction problem to be finitely bounded by the sentence length. Because of the decidability of the satisfiability problem for descriptions containing projection and/or restriction constraints, decidability of the parsing problem follows for all these extensions too.

With respect to generation, however, the matter is different. We have seen that the restriction operator permits it to remove information when this information is assumed to be irrelevant for the f-structures finally assigned to the sentences. Thereby, it produces floating structures that are not considered to be part of the actual f-structures. Since the inputs to the generator do not include the floating structures produced by restriction, generation is here affected by the same problems as they arise in projection architectures. These assume only the f-structures, but not the complete f- and m-structure configurations derived by the grammar to be given to the generator and depend thus also on the assumption that the inputs to the generator are underspecified.

Unfortunately, the problem of whether or not there are any strings associated with an underspecified input structure had been shown to be undecidable in general (see, for example, Wedekind 1999). Since there is in general no structural relation between the (underspecified) inputs and the fully specified structures, it is in principle possible to restrict/project off structures whose size is not bounded by the size of the actual input f-structures. And this permits the computation of some in general undecidable problems to be encoded in the structures restricted/projected off the f-structures.

However, for auxiliary constructions we have seen that the depth of the required DEP embeddings is always finitely bounded (up to three or four, depending on the language), so that at least for grammars analyzing those particular constructions by restriction or projection decidability of the generation problem can still be established.

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