Formal Devices for Linguistic Generalizations: West Germanic Word Order in LFG

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1 Introduction

In LFG the phrase structure representation of a sentence is used to divide linguistic strings into a hierarchy of ordered phrasal constituents. It is well known that this kind of representation does not capture all the syntactically significant dependencies that exist in sentences. In this paper we look at some dependencies that cannot be captured in this superficial representation but seem nevertheless to be affected by the order of elements of the string. These dependencies are illustrated by word order constraints in Germanic infinitivals. German infinitivals exhibit a syntactic dependency that is not local in the sense that elements that are syntactically closely dependent on each other are in string positions separated by 'extraneous' material. This case is different from that of the wh-constructions discussed in Kaplan and Zaenen (1989) in that there are no clearly fixed positions for the separated elements of the infinitivals. We show that existing mechanisms, specifically functional uncertainty and functional precedence, that were developed to account for other phenomena can be exploited to model the new data in an insightful way.

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2 A case study: Dutch cross serial dependencies

2.1 Basic facts.

Since Evers (1975) several syntactic models have been proposed to account for sentences of the type illustrated in the Dutch example in (1):

(1) ...dat Jan zijn zoon geneeskunde wil laten studeren.
    ...that John his son medicine wants let study.

What is interesting about this sentence pattern is that the verbs and the nominal or prepositional elements that they govern are not adjacent in the surface string or in the phrase structure representation. In Dutch all the dependent elements have to precede all the verbs, but there is no requirement that the verb and its dependents be adjacent either in the string or in the surface tree representation one would naturally assign to such a sentence. In other variants of West-Germanic the verbs and their dependents can be interleaved, as we discuss in Section 4. As an illustration we show in (2) the surface structure proposed in Evers (1975) with the f-structure showing the dependencies that hold in the sentence, assuming some plausible lexical entries consistent with this f-structure. They are given in (3).
Of course, if we allowed crossing branches in the c-structure, we could express the dependencies in the c-structure itself, but the c-structures in LFG are assumed to be of the traditional noncrossing type. Given that they are supposed to have a rather direct relation to the phonological representation, it seems reasonable to keep this constraint.

Our problem then is to find a grammar that expresses the correspondences illustrated in (2).
2.2 An early LFG approach

LFG has no movement rules, but discontinuous government dependencies present no problem because of the way the mapping from c-structure to f-structure is defined. As some of the notions we want to use later crucially depend on particular characteristics of this mapping, we summarize here its relevant properties. LFG assumes there is a correspondence function \( \phi \) from c-structure nodes to f-structure units, but this correspondence is not assumed to be one-to-one nor is it required to be onto (Kaplan and Bresnan 1982; Kaplan 1987). Both of these properties are illustrated by the following example of an English gerund construction:

The functional annotations on the English phrase-structure rules would make all the nodes in a circled collection map to the same f-structure unit, demonstrating the many-to-one property of \( \phi \). There is no node in the c-structure that maps to the pronoun subject of the predicate see, so that \( \phi \) is not onto. In English, nodes that map onto the same f-structure tend to stand in simple mother-daughter relations, but this is not the only possible configuration for many-to-one mappings. Bresnan et al. (1982) account for the Dutch discontinuous constituents by mapping two noncontiguous c-structure components into one f-structure. This is specified by the following two simple rules:
(5) a. \[ VP \rightarrow \left( \left( \text{NP} \underbrace{\text{[\dag OBJ]}}_{=1} \right) \left( \left( \text{VP} \underbrace{\text{[\dag XCOMP]}}_{=1} \right) \left( \text{V'} \right) \right) \right) \]

b. \[ V' \rightarrow V \left( \underbrace{\text{[\dag XCOMP]}}_{=1} \right) \]

and the (simplified) verbal lexical entries given in (3). These rules make use of the standard LFG convention that unannotated categories are assumed to carry the \( \dag = 1 \) head-marking schema.

The annotation on the VP preceding the V' in (5a) and the annotation on the V' expanding the V' in (5b) are the same, and hence they both provide information about the shared corresponding f-structure. The main constraint on dependencies of this kind in Dutch is that all the arguments of a higher verb precede those of a lower verb; the arguments of each verb are ordered as in simple clauses. The c-structure rules in (5) insure this ordering because the VP expands to an (optional) NP object followed by an open complement VP (XCOMP). The phrase structure rules thus impose the right ordering: less embedded OBJs always precede more embedded ones. The different parts of the more and more embedded XCOMPS link up in the right way because the XCOMPS are associated with successive expansions on both the VP and V' spines of the tree, as illustrated in (6):
In this approach the context free part of the phrase structure rules encodes the surface linear order and the assumed surface hierarchical order but not the government relations. These are encoded in the functional annotations added to this context free skeleton.

2.3 Inadequacies of this solution

This system gives a correct description of the data considered in Bresnan et al. (1982) and can be extended in a straightforward way to cover further
infinitival constructions as shown in Johnson (1986, 1988). However, three
drawbacks of this approach have been pointed out, one theoretical, one
technical, and one linguistic.

We will not discuss the theoretical problem in great detail. Schuurman
(1987) points out that, according to X-bar theory, the VP node should
dominate a verb. But, even if one thinks that X-bar principles have some
value, it is not clear how they should be adapted to a nontransformational
functionally oriented framework like LFG. X-bar theory was mainly
developed to allow for the notion head in a representation in which this
notion was not native (Lyons 1968). In transformation-based theories the
head relation is expressed in deep or underlying tree structures by means
of the X-bar schemata (of course, in the surface structure these schemata
are only respected by virtue of abstract linking devices such as traces).
The head notion itself is functional in nature, however, and LFG pro-
vides more explicit and flexible ways of expressing functional relations.
For example, LFG identifies the head of a constituent by means of the
\[ \phi \rightarrow \text{XP} \] annotation, and it marks the non-head dependents with annotations
of the form \( (\phi \rightarrow \text{GF}) \rightarrow \text{XP} \), where GF stands for any governable grammatical
function. Still, it may be worthwhile to establish some invariant connec-
tions between functions and the phrase structures they correspond to, and
Bresnan (1982) offers one proposal along these lines. As a more natural
alternative to X-bar theory for characterizing the relation between lexi-
cal heads and phrasal categories, we suggest the principle in (7a). This
characterizes configurations of the sort illustrated in (7b) in addition to
the usual endocentric arrangement in (7c).

(7) a. A maximal (non lexical) category is of type XP if it corre-
sponds to an f-structure that also corresponds to a lexical
category of type X.

\[
\begin{array}{c}
\text{XP} \\
\phi \\
\rightarrow [] \\
\end{array}
\]

b.

\[
\begin{array}{c}
\text{XP} \\
\phi \\
\rightarrow [] \\
\end{array}
\]

c.

In formal terms, a maximal node \( n \) is of category XP if the set of nodes
$\phi^{-1}(\phi(a))$ contains a node of category X. This principle for determining category labels justifies the VP label in (6) even though the VP does not dominate the V.

The technical problem was pointed out in Johnson (1986) and in Netter (1988). They observed that the obvious extensions to the Bresnan et al. solution needed to account for a new class of data lead to phrase structure trees that violate the LFG constraint against nonbranching dominance chains (Kaplan and Bresnan 1982). According to this condition on valid c-structures, derivations of the form $A \rightarrow^* A$, which permit an indefinite number of $A$ nodes dominating another node of the same category, are prohibited. This restriction against nonbranching dominance chains disallows c-structure nodes that provide no information and insures that the parsing problem for LFG grammars is decidable. An example adapted from Johnson (1986) that violates this constraint is given in (8):

(8) 
...dat Jan een liedje heeft willen zingen.
...that John a song has wanted to sing.

```
S'
  \-------------------------\n  dat                      S
  \-------------------------\n     \---------------------\n     NP                   VP
     \---------------------\n       \-------------\       \-------------\n       Jan          VP     V'  \      \    \
       \----\------\   \    \________\  \    \    \ \n       VP          V    V'  \      \    \    \ \n       \----\------\   \    \________\  \    \    \ \n       NP          heeft V   V' \      \    \    \ \n       \----\------\   \    \________\  \    \    \ \n       een        liedje  willen   V\      \    \    \ \n       \----\------\   \    \________\  \    \    \ \n       een        liedje     willen  zingen
```

_Een liedje_ is the direct object of the most embedded verb _zigen_ and the intermediate VPs are needed to provide the right number of _XCOMP_
levels. In the absence of further difficulties with this approach, we might be tempted to reconsider the value of this formal restriction. But relaxing this condition would not be enough to protect the Bresnan et al. solution from empirical inadequacies.

The linguistic problem is that this analysis does not account for sentences like (9), which are considered perfectly grammatical by most speakers (M. Moortgat, p.c.):

(9) ...dat Jan een liedje schreef en trachtte te verkopen.
...that John a song wrote and tried to sell.

Here een liedje 'a song' is the OBJ of schreef 'wrote' and of verkopen 'sell', but these verbs are at different levels of embedding. To be interpreted as the argument of schreef, een liedje has to be the object, but to be interpreted as an argument of verkopen, it has to be the object of the XCOMP. According to the LFG theory of coordination, a coordinate structure is represented formally as a set in f-structure, with the elements of the set being the f-structures corresponding to the individual conjuncts. LFG's function-application primitive is extended in a natural way to apply to sets of f-structures: a set is treated as if it were a function with the properties that are common to all its f-structure elements (see Kaplan and Maxwell 1988b for formal details). As Bresnan, Kaplan, and Peterson (1985) show, this simple extension is sufficient to provide elegant accounts for the wide variety of facts that coordinate reduction rules and across-the-board conventions attempt to handle. Given the rules in (5) and this theory of coordination, een liedje will not be properly distributed across the two conjuncts in (9), since it has to have a different function in each. The problem is illustrated by the disjunctive function assignments in diagram (10):
3 A Functional Approach

We now propose a revision that takes care of these problems and then examine some of its other consequences. Some of the elements of this new account can also be found in Johnson (1986) and, for a different set of data, in Netter (1988).

To solve the nonbranching dominance problem, Johnson (1986) proposes to replace the phrase-structure rule (5a) by the one given in (11) (see also Netter 1988):

\[ (11) \quad VP \rightarrow \left( \begin{array}{c} NP \\ \left(\uparrow \text{OBJ}=\downarrow\right) \end{array} \right) \left( \begin{array}{c} VP \\ \left(\uparrow \text{XCOMP}^+=\downarrow\right) \end{array} \right) \left( V' \right) \]

The only difference is in the schema attached to the optional VP. This schema now uses the device of functional uncertainty that was introduced in Kaplan and Zaenen (1989) and developed further in Kaplan and Maxwell (1988a). The f-structure associated with this VP is not asserted to be the XCOMP of the V′ at the corresponding level of c-structure embedding. Rather, it is asserted only that it is the value at the end of a chain of one or more XCOMPs, as denoted by the regular expression XCOMP+. This possibility obviates the need for VP expansions in which a VP exhaustively dominates another VP. Predicates and arguments will still be
linked up properly because of the completeness and coherence conditions that are independently imposed on f-structure. The right word order is also maintained because the material contained in the VP following an OBJ NP is always at least one level further embedded than the OBJ itself: the annotation is XCOMP⁺, not XCOMP*. The revised rule associates the correct f-structure for sentence (8) with the more compact tree in (8'):

\[
(8')
\]

\[
S' \rightarrow dat S
\]

\[
S \rightarrow NP VP
\]

\[
NP \rightarrow Jan NP V'
\]

\[
V' \rightarrow een liedje V V'
\]

\[
V \rightarrow heeft V V'
\]

\[
V' \rightarrow willen V
\]

\[
zingen
\]

Notice, however, that the rule in (11) does not account for example (9). If the NP is generated as the OBJ of the highest VP under S, then its only function is OBJ, and it cannot be distributed into the second conjunct as an XCOMP OBJ. On the other hand, if it is generated under an embedded VP so that it has the proper function for the second conjunct, it cannot be a simple OBJ for the first conjunct. If we change the annotation on the VP from XCOMP⁺ to XCOMP*, so that the NP is properly distributed to both conjuncts, then we lose all possibility of imposing the cross-serial ordering constraints by phrase-structure encoding. There are more complicated functional annotations for these rules that will give the desired result in Dutch, but in what follows we explore a different type of solution. This solution exploits functional uncertainty together with func-
tional precedence to assign simpler phrase-structure trees. It accounts for all the data that we have discussed above, including example (9), and has the additional advantage of generalizing in a straightforward way to account for word-order facts in other languages, as is shown in Section 4.

Functional uncertainty was originally developed to characterize wh-movement constructions and to insure their proper interaction with coordination. A second formal device that was introduced into LFG theory after Bresnan et al. (1982) was published is functional precedence. This was applied to anaphoric dependencies by Bresnan (1984) and formally defined in Kaplan (1987). Precedence is a defining relation among the constituents in a c-structure, in the sense that trees with different node-orderings are interpreted as formally different trees. There is no native precedence relation among the parts of an f-structure, but the image of c-structure precedence under the $\phi$ mapping from c-structure to f-structure naturally induces a relation on f-structure, which we have called f-precedence:

(12) For two f-structure elements $f_1$ and $f_2$, $f_1$ f-precedes $f_2$ if and only if all the nodes that map onto $f_1$ c-precede all the nodes that map onto $f_2$:

$$f_1 <_f f_2 \iff \text{for all } n_1 \in \phi^{-1}(f_1) \text{ and for all } n_2 \in \phi^{-1}(f_2), n_1 <_c n_2$$

Even though this relation is defined in terms of conventional c-structure precedence, it has some surprising properties because, as we noted, the mapping from c-structure to f-structure may be neither one-to-one nor onto. For example, if the mapping is many-to-one and $f_1$ and $f_2$ correspond to interleaved sets of c-structure nodes, then neither $f_1$ f-precedes $f_2$ nor $f_2$ f-precedes $f_1$. If the mapping is not onto so that $f_1$ corresponds to no node at all, then vacuously both $f_1$ f-precedes $f_2$ and $f_2$ f-precedes $f_1$ for all $f_2$. This characteristic is exploited in the analysis of null anaphors by Bresnan (1984) and Kameyama (1989) (summarized in Kaplan and Zaenen 1989). Because of this characteristic, f-precedence is neither transitive nor anti-symmetric and hence is technically not a true ordering relation. Its name is meant to indicate only that it is a functional image of c-precedence, not that it is a precedence relation on f-structure. F-precedence also differs from c-precedence in its linguistic implications: while c-precedence restrictions can only directly order sister constituents, f-precedence constraints can implicitly restrict ordering relations among non-sister nodes by virtue of the common f-structure units they correspond to.

We use the f-precedence relation to provide alternatives to the rules in (5) and (11). We dispense with the VP-dominated subtree altogether and assume a simple succession of NP nodes each of which assigns an OBJ at
some indefinite level of \( \text{xcomp} \) embedding. Then we add the requirement that the predicate's \( \text{xcomp}^+ \text{obj} \) does not precede its immediate \text{obj}. The revised rules are given in (13):

\[
\begin{align*}
\text{(13)} & \quad \text{VP} \quad \rightarrow \quad \text{NP}^+ \quad \text{V'} \\
& \quad (\uparrow \text{comp}^+ \text{obj}) = \downarrow \\
\text{V'} & \quad \rightarrow \quad \text{V} \\
& \quad (\uparrow \text{comp}) = \downarrow \\
& \quad (\uparrow \text{comp}^+ \text{obj}) \not\subseteq (\uparrow \text{obj})
\end{align*}
\]

The \( f \)-precedence condition is stated negatively because the existential interpretation of a positive relation over uncertainty (namely, that there be \emph{some} string in the uncertainty language for which the relation holds) does not provide the desired effect that the relation must hold for \emph{all} strings chosen from the uncertainty language. The negative statement implicitly transforms the existential into a universal. Moreover, we also assume a non-constructive interpretation of functional uncertainty in which the uncertainty strings range only over paths that are independently instantiated in the \( f \)-structure. Under these conventions, the rules above can be easily generalized, for example, by replacing \text{obj} by a disjunction of \text{obj} and \text{obj2}. In this way, the \( f \)-precedence constraint on order allows us to propose maximally simple \( c \)-structure expansions for Dutch infinitival constructions while still accounting for the ordering dependencies and functional assignments.

A similar flat structure was rejected in Bresnan et al. (1982) for two reasons, one based on word order constraints and the other on the low acceptability of certain coordination constructions. It was thought that the \text{vp} node was necessary to account for the fact that the oblique \text{pp} arguments of an \text{comp} cannot precede an \text{obj} on a higher level of embedding whereas in a simple clause a \text{pp} can precede its \text{obj}. This argument depends on the assumption that the word order condition can only be stated in \( c \)-precedence terms, an assumption which we now reject in favor of the \( f \)-precedence relation. The observed pattern of acceptability easily follows when we extend the flat \( c \)-structure rules in (13) to include \text{pps} as well.

The unacceptable coordination is exemplified in (14) (example (20) from Bresnan et al.):

\[
\begin{align*}
\text{(14)} & \quad \ldots \text{dat Jan de meisjes een treintje aan Piet en de jongens een pop} \\
& \quad \ldots \text{that John the girls a toy train to Pete and the boys a doll} \\
& \quad \text{aan Henk zag geven voor Marie.} \\
& \quad \text{to Hank saw give for Marie}
\end{align*}
\]
...‘that John saw the boys give a toy train to Pete and the girls give a doll to Hank for Marie.’

This is not considered ungrammatical by all speakers, but even if it were completely out, it would justify the proposed hierarchical c-structure only on the assumption that nothing but a single constituent can be right-node raised in Dutch. This assumption is clearly incorrect since sentences like the following are completely acceptable:

(15) ...dat Annie witte en Marie bruine suiker op haar boterham wil ...that Annie white and Marie brown sugar on her bread wants.
...‘that Annie wants brown sugar on her bread and Marie white sugar.’

(16) ...dat drugmisbruik veel bij tennis- en bij voetbalspelers onder ...that drug abuse often in tennis- and in soccer-players under de dertig voorkomt.
thirty occurs.
...that drug abuse occurs often in tennis players and in soccer players under thirty.

Here the material shared across the conjuncts is not a constituent. While this observation does not explain the contrast noted in Bresnan et al. (1982), it does undermine their second argument in favor of the hierarchical structure of the NP sequence.

We conclude, then, that the use of functional uncertainty and f-precedence allows a treatment of the Dutch infinitival constructions that avoids the technical and linguistic problems of the Bresnan et al. account. In particular, the NP functional uncertainty in the VP rule (13) interacts with LFG’s formal account of constituent coordination (Kaplan and Maxwell 1988b) to provide the appropriate analysis of the Dutch coordination in example (9): the uncertainty on een liedje is realized as OBJ in one conjunct and as XCOMP OBJ in the other. It would be surprising, however, if the Dutch facts alone would require f-precedence and functional uncertainty as desirable ingredients in an account of the syntactic

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1 Some speakers (W. de Geest, p.c.) consider this sentence to be grammatical as well as the one in (i) which we assume to be a case of right node raising:

(i) ...dat Jan de meisjes een treintje aan Piet en de jongens een pop aan Henk zag geven.
saw give.

...‘that John saw the boys give a toy train to Pete and the girls give a doll to Hank.

Other speakers seem to consider both versions to be ungrammatical (Schuurman 1987).
properties of infinitival constructions. In what follows we examine some facts of Zurich German that are also naturally handled in these functional terms.

4 Extending the solution to Swiss German

The infinitival constructions of Zurich German are similar to the Dutch ones discussed above in that the verbs generally come in the same order (the least embedded ones precede the more embedded ones). Sentences that are grammatical in Dutch will also be acceptable in Zurich German as the sentence in (17) illustrates:

(17) ...das er sini chind mediziin wil la schtudiere.
(transcription as given in Cooper 1988)
...‘that he wants to let his children study medicine.’

The language allows a broader range of possibilities, however. The verbs have to cluster together in Standard Dutch, whereas NPs and PPs can be interleaved with the verbs in Zurich German, as illustrated in (18):

(18) a. ...das er wil sini chind la mediziin schtudiere.
 b. ...das er sini chind wil la mediziin schtudiere.
 c. ...das er mediziin sini chind wil la schtudiere.
 d. ...das er sini chind wil mediziin la schtudiere.

But not all orders are allowed:

(19) *...das er wil la sini chind mediziin schtudiere.

The main constraint on the word order in infinitival constructions in Zurich German seems to be:

(20) All the nominal arguments of a particular verb precede it.

There is some disagreement about whether this is the only syntactic constraint on order. Haegeman and van Riemsdijk (1986) add the requirement that the arguments of a higher verb have to precede those of a lower one. Lotscher (1978) does not imply such a constraint, and Cooper (1988) explicitly rejects it. We will follow Cooper here, although Kaplan and Zwelling (1988) modeled the account given by Haegeman and van Riemsdijk. It seems to us that the disagreement might be less about the data per se than about what counts as marked and unmarked word order, but a further study of the conditions influencing the different orders would be necessary to establish this.

The constraint in (20) also holds in Standard Dutch, as we saw in Section 2, but for Zurich German it cannot be formulated in the same way as was done in Bresnan et al. (1982) for Dutch. This is because
in Zurich German the NPs and the Vs whose relative order has to be maintained do not have to be adjacent.

The use of functional uncertainty in conjunction with f-precedence allows us to account for these data again without violating the nonbranching dominance constraint. The appropriate rules are given in (21). The VP rule uses an immediate dominance notation to express the free categorial ordering; this adds nothing to the formal power of LFG (Kaplan 1989). The symbol NGF ranges over the grammatical functions SUBJ, OBJ, ... that are usually associated with nominals.

\[(21)\quad \text{VP} \rightarrow \left[ \begin{array}{c}
\text{NP}^* \\
(\uparrow \text{xcomp})\text{NGF}=\downarrow \\
\text{V}^* \\
(\uparrow \text{xcomp})=\downarrow
\end{array} \right]
\]

\[\text{V} \rightarrow \text{V} \quad \uparrow \text{f}, (\uparrow \text{NGF})\]

In this section we have deployed LFG’s descriptive devices to account for dependencies and order without relying on nested tree structure configurations to provide the necessary f-structure embeddings. We have illustrated this by developing a flat structure for the NP dependents in infinitival constructions. A moment’s reflection will show, however, that

\[\downarrow \text{f}, (\uparrow \text{NGF})\]

Relevant lexical entries would be the following:

(ii) \textit{wii} \quad \text{V} \quad (\uparrow \text{pred})=\downarrow
\quad \downarrow = ‘\text{want}<(\uparrow \text{subj})(\uparrow \text{xcomp})’
\quad (\uparrow \text{subj}) = (\uparrow \text{xcomp subj})
\quad \uparrow \text{f}, (\uparrow \text{NGF})
\quad (\uparrow \text{xcomp}) \uparrow \text{f}

(iii) \textit{achtudiere} \quad \text{V} \quad (\uparrow \text{pred})=\downarrow
\quad \downarrow = ‘\text{study}<(\uparrow \text{subj})(\uparrow \text{obj})’
\quad (\uparrow \text{subj}) = (\uparrow \text{xcomp subj})
\quad \downarrow \text{f}, (\uparrow \text{NGF})

(iv) \textit{laa} \quad \text{V} \quad (\uparrow \text{pred})=\downarrow
\quad \downarrow = ‘\text{let}<(\uparrow \text{subj})(\uparrow \text{xcomp})>(\uparrow \text{obj})’
\quad (\uparrow \text{subj}) = (\uparrow \text{xcomp subj})
\quad (\uparrow \text{xcomp}) \uparrow \text{f}, (\uparrow \text{NGF})

The annotations in these entries associate the semantic form predicate of each verb explicitly with its lexical node, so that it can take a position in the f-precedence relation distinct from that of the larger f-structure that it heads. The schema \(\uparrow \text{f}, (\uparrow \text{NGF})\) specifies that the nominal arguments of every verb must not follow it. For the predicates \textit{laa} and \textit{wii}, the additional schema \(\uparrow \text{xcomp} \uparrow \text{f}\) indicates that the open complement must come after the verb. The tree representations that these entries and rules allow us to generate are completely flat, as exemplified in (v):
we could also use these formal devices to obtain the same f-structures from c-structures that exhibit more hierarchy, e.g. binary right branching trees. We see then that the availability of richer formal devices to capture linguistic dependencies leaves the c-structure underdetermined. In the conclusion we discuss briefly the general problem of motivating c-structure in LFG.

5 Other infinitival patterns in Dutch

5.1 Extraposition.

It is well known that the verb-raising patterns discussed above are not the only patterns for verbs taking infinitival complements in West Germanic. Another pattern is so-called extraposition, in which the whole infinitival clause follows the matrix verb. This is illustrated for Dutch in (22):

(22) omdat [Jan Marie verbood [Piet toe te laten [het boek te lezen]]] because John Marie prohibited Pete to allow the book to read.
'because John prohibited Marie to allow Pete to read the book.'
(relevant internal clause boundaries are indicated by [ ])

Following Schuurman (1991) we hypothesize that extrapoosed and non-extraposed infinitival complements differ in that extrapoosed complements are COMPS and non-extraposed ones are XCOMPS. Evidence for the distinction comes from the fact that impersonal passives are possible only with extrapolated complements. This is illustrated in the contrasts in (23) and (24). The (a) sentences illustrate that *frachten* 'try' can take both verb-raising and extrapolation; the (b) sentences show that the imper-

\[
\begin{array}{c}
\text{(v)} \\
S \\
\text{NP} \quad \text{VP} \\
\text{er} \\
\text{NP} \quad \text{NP} \quad V \quad V \quad V \\
\text{sini chind medaiin wil la schutdiere}
\end{array}
\]

Having proposed a completely flat structure for Zurich German, we could propose a comparable account for Dutch. There are two differences between Dutch and Zurich German: (1) the nominal arguments of higher predicates must precede those of lower ones, and (2) all the NP constituents must precede all the verbs. A lexical entry like *laten* (corresponding to the Zurich German *las*) will have the additional ordering constraint given in (vi) and the phrase structure grammar will include the c-structure linear-precedence constraint in (vii):

(vi) \( \uparrow \text{XCOMP}^+ \text{NGP} \prec \downarrow \text{NGP} \)
(vii) \( \text{NP} \prec_c V \)

In section 5, we discuss some facts that argue against this flattening of the verbal complex.
sonal passive is possible with the extrapoed variant but not with the verb-raising variant.

(23) a. omdat Jan heeft getraacht Marie te helpen.
    because John has tried Marie to help.

b. omdat er (door iedereen) werd getraacht Marie te helpen.
    because there (by everybody) was tried Marie to help.

(24) a. omdat Jan Marie heeft trachten te helpen.
    because John has tried to help.

   ‘because John has tried to help Marie.’

b. *omdat er (door iedereen) Marie werd trachten te helpen.
    because there (by everybody) Marie has tried to help.

In LFG the subject of an XCOMP is identified with a function of the higher clause by an equation of functional control. According to Bresnan (1982), such an equation can only specify the subject or object of the higher predicate. The rule of impersonal passive formation, however, would produce a control equation that does not satisfy this condition because it identifies the XCOMP SUBJ with an oblique agent function. This accounts for the ungrammaticality of (24b). In the extrapoed version the COMP function does not require a functional control equation. Thus, the impersonal passive is permitted, and the appropriate referential dependency is then established by an identity of semantic structure. In functional control all the syntactic features of the controller and the controller are identical. In a relation of semantic identity, only the referential properties of the two are identified; the syntactic features are allowed to diverge.8

There is another distinction between the extrapoed and verb-raising constructions, as pointed out in den Besten et al. (1988): in verb-raising constructions the complement of the auxiliary is in the infinitive (24a) while for extrapoed it is a participle (23a). This can be regulated with a simple feature that we will not spell out here.

We allow for the possibility of extrapoed complements by replacing the Dutch VP rule in (13) with the one in (25):

(25) $\text{VP} \rightarrow \text{NP}^* \text{V'} \left(\begin{array}{c} \text{VP} \\
\left(\text{[XCOMP*NGF]}=\downarrow \right)
\end{array}\right)

The position of the COMP is unambiguously fixed by the phrase structure rules, so it will always show up in sentence-final position.

8In Icelandic and German (Netter, p.c.) adjuncts that agree with the understood subject show up in the nominative, providing further evidence against a functional control solution (see Andrews, 1982, for discussion).
5.2 The 'derde constructie'

In some dialects of Dutch, there are sentences that look like a mix of the two constructions discussed above. This is studied in detail in den Besten et al. (1988) under the name de derde constructie, the third construction. An example is given in (26):

(26) omdat Jan Marie getracht heeft te helpen.
    because John Marie tried has to help.
    'because John has tried to help Marie.'

As we noted above, verb-raising and extraposition are distinguished by the fact that the complement of the auxiliary is in the infinitive with verb-raising and in the participle form with extraposition. Here, however, we see a sentence that looks like a verb-raising structure but has the complement of the auxiliary in the participle form. Under our account, it is simple to model this dialect: the only difference with the standard language is that now the COMP can also be introduced by functional uncertainty. The annotated phrase structure rule is given in (27):

(27) \[ VP \rightarrow \begin{array}{c} \text{NP}^* \end{array} \begin{array}{c} V' \end{array} \begin{array}{c} \text{VP} \end{array} \begin{array}{c} \left(1 \{ x\text{COMP} \}^{*} \right) \end{array} \begin{array}{c} \text{COMP} \end{array} \begin{array}{c} \text{NGF} = 1 \end{array} \begin{array}{c} \left(1 \{ \text{COMP} \} = 1 \right) \end{array} \]

We presume that the NP ordering constraints will be similar to those for xCOMP elements. In the absence of any data on this, we leave it as an open question here.

6 Ordering constraints with topicalizations:
   Relativized f-precedence

In the preceding section we have shown that our account gracefully models some of the differences in the West Germanic infinitival constructions, but there are some interactions that we have ignored. A rather crucial one is the interaction between topicalization and word order in what is traditionally called the middle field (the part of the sentence between the subject and the verb in final position, thus excluding topicalized or extraposed elements).

6.1 Basic facts

In (28) we illustrate the basic topicalization patterns found in Dutch.

(28) a. Het boek heeft Jan zeker gelezen.
    The book has John certainly read.
    'The book John has certainly read.'
b. Gelezen heeft Jan het boek zeker.
   Read has John the book certainly.
   ‘John has certainly read the book,’

c. Het boek gelezen heeft Jan zeker.
   The book read has John certainly.
   ‘Read the book, John certainly has.’

d. Jan het boek gegeven heeft Piet zeker.
   John the book given has Pete certainly.
   ‘Pete has certainly given the book to John.’

e. Het boek heeft Piet Jan zeker gegeven.
   The book has Pete John certainly given.
   ‘Pete has certainly given the book to John.’

f. Het boek gegeven heeft Piet Jan zeker.
   The book given has Pete John certainly.
   ‘Pete has certainly given the book to John.’

g. Het boek heeft Jan de kinderen laten lezen.
   The book has John the children let read.
   ‘John let the children read this book’.

NP dependents can be topicalized regardless of their level of embedding in an xCOMP. This is illustrated in (a), (c), (e) and (g). Complete xCOMPS can also be topicalized when embedded under auxiliaries or modals, as illustrated in (d). Particibles (or infinitives) can also be topicalized as shown in (b). The topicalization of partial xCOMPS is not acceptable in the dialect of the native speaker co-author of this paper, but its equivalent is acceptable in German. We have the impression that speakers vary in their acceptance of several of these patterns and are here describing a rather lax dialect.

6.2 Interactions

The word order constraints that we have discussed above apply properly to arguments and complements when they appear in the middle field, but when we take ordering in topicalized position into account, those constraints are no longer adequate. This is illustrated in (28g), where het boek ‘the book’ precedes de kinderen ‘the children’ although it is a dependent of a lower xCOMP. This topicalized word-order would be
generated by the phrase-structure rule \((29a)^4\) but it would violate the \(f\)-precedence condition stated in the rules in \((13)\), generalized here as \((29b)\):

\(\begin{align*}
(29) & \quad \text{a. } S' \rightarrow \text{XP } S', \text{ where } \\
\text{XP} = & \{ \text{NP} | \text{VP} | \ldots \} \\
& \left( \left\{ \text{xcomp} \right\} \text{NGF} = \downarrow \left( \left\{ \text{xcomp}^+ \right\} = \downarrow \right) \right) \\
& \left( \left\{ \text{xcomp}^* \text{NGF} \right\} = \downarrow \right) \\
& \left( \left\{ \text{xcomp}^+ \text{NGF} \right\} \neq \text{NGF} \right)
\end{align*}\)

b. \(\text{VP} \rightarrow \text{NP}^* \text{V}'\)

\(\begin{align*}
\text{V}' & \rightarrow \text{V} \\
& \left( \left\{ \text{xcomp} \right\} = \downarrow \right) \\
& \left( \left\{ \text{xcomp}^+ \text{NGF} \right\} \neq \text{NGF} \right)
\end{align*}\)

Intuitively, it seems that the restrictions on word-order that apply to dependents in their middle-field positions do not operate when those elements appear in topic position. However, the word order constraints imposed by the \(f\)-precedence condition in \((29b)\) apply globally across the whole sentence; they are not limited to operate just within the middle field. Given our phrase structure rules, we must be able to restrict our ordering conditions to operate just within the VP domain. In essence, the \(f\)-precedence predicate used in \((29b)\), which is not sensitive to domains of constituent structure, must be replaced by a more specific one that takes certain dominance relations into account. This new predicate, \(f\)-precedence relative to a category \(X\), defines a relation on \(f\)-structure el-

\(\text{4According to this phrase structure rule COMPs cannot be topialized in Dutch. In Dutch there are apparent exceptions:}\)

(i) ?? Dit boek te lezen zal ik niet vergeten.

This book read will I not forget.

Naar school gaan verzuimt ze nooit.

To school go failed she never.

Naar school gaan tracht ze nooit.

To school go tries she never.

As in English they only seem to occur with verbs that also take NP objects (cf. examples in (ii)), so an account along the lines of the one given in Kaplan and Zaenen (1989) should be possible.

(ii) Haar plicht verzuimt ze nooit.

Her duty failed she never.

* De taak tracht ze nooit.

The task tries she never.

Whether this would generalize to German is not clear. Reis (p.c.) gives German sich versuchen as a verb that does not take an NP but allows topization. We have not investigated the situation in enough detail to propose an account of the COMP topization facts.
ements according to the c-structure order of only some of the nodes they correspond to. In particular, the c-structure order of two nodes is taken into account only when the lowest node of type X that dominates one is also the lowest node of type X that dominates the other. Formally, we say that two nodes that appear in such a configuration are X codominated; the nodes $n_1$ and $n_2$ in trees in (30a) and (30b) are VP codominated whereas those nodes in (30c) are not:

\[(30) \quad a. \quad VP \quad \quad b. \quad VP \quad \quad c. \quad VP\]

\[n_1 \quad n_2 \quad NP \quad NP \quad n_1 \quad n_2 \quad \quad n_1 \quad VP \quad \quad n_1 \quad n_2 \]

The condition of X codomination enters into a relativized version of f-precedence according to the following definition:

\[(31) \quad \text{For two f-structure elements } f_1 \text{ and } f_2 \text{ and a category } X,\]

\[f_1 \text{ f-precedes } f_2 \text{ relative to } X \text{ iff for all } n_1 \in \phi^{-1}(f_1) \text{ and for all } n_2 \in \phi^{-1}(f_2), \text{ } n_1 \text{ and } n_2 \text{ are } X \text{ co-dominated and } n_1 \subset n_2.\]

We write $f_1 \prec_X f_2$ to indicate that $f_1$ f-precedes $f_2$ relative to $X$, and use this predicate in the modified version of the V' rule:

\[(32) \quad V' \rightarrow V \quad \left(\begin{array}{c}
V' \\
(\uparrow \text{XCOMP}) = \downarrow \\
(\uparrow \text{XCOMP}^+ \NGF)^{\uparrow V'}(\uparrow \NGF)
\end{array}\right)\]

This rule imposes ordering constraints only on the nodes that are codominated by VP (in this case the VP under S), and thus ignores topicalized constituents that are outside of this ordering domain. Note that when a VP itself is topicalized as allowed by (29a), the relativized f-precedence condition must also hold of constituents within that VP.

In section 3 and 4 we proposed a flat structure for the NP dependents of XCOMPS regardless of the level of embedding, but we did not flatten the V' verbal complex. The formal techniques that we have developed could be further exploited to eliminate the intermediate V' constituents. But there are other conditions on what can be topicalized that argue against such a phrase structure simplification. Consider example (33):

\[(33) \quad \ldots \text{dat ze het boek heeft willen kopen.} \]

\[\ldots \text{that she the book has wanted to buy.}\]

It is possible to topicalize either of the infinitival complements, as shown in (34), but it is not possible to topicalize the object of a more embedded
verb along with a higher verb, leaving the more embedded verb in its middle-field position. This is shown in (35).\(^5\)

(34) Het boek willen kopen heeft ze.
The book wanted to buy has she.

? Het boek kopen heeft ze gewild.
The book buy has she wanted.

(35) *Het boek willen heeft ze kopen.
The book wanted has she buy.

If we allow for a completely flat VP in which all the verbs are sisters of each other and daughters of the VP, it would be difficult to state this constraint. If we keep the right branching V' chain as in rule (32), the proper ordering directly emerges. The equation attached to the VP in the topocalization rule (29a) insures that the topocalized material as a whole is part of an xCOMP. The organization of the V' both in topocalized position and in the middle field guarantees that there are no 'holes' in either verbal complex.

7 Conclusion

In this paper we have treated some of the word order variation in infinitival complements in West Germanic. We have shown that our approach allows us to account for the differences and similarities between Dutch and Zurich German in a straightforward way. Within the confines of this paper it is not possible to discuss the corresponding data for all variants of West Germanic, but we think that our approach extends easily to these other dialects. We have also not dealt with certain other issues in full detail: for instance, the constraints on partial VP topocalization are not exactly known and we have probably modeled them incompletely.

At a more fundamental level, our account raises questions about the status of c-structure and of ordering constraints. LFG is different from other frameworks in that it makes a clear division between a level of representation that directly encodes order, the c-structure, and other levels that do not, e.g. the f-structure. This allows us to isolate ordering constraints as either conditions on the c-structure itself or on the interaction between the c-structure and other levels. The study of the constraints in West Germanic show a rather intricate pattern of interactions: on the one hand, ordering constraints have to be sensitive to f-structure information without relying on a c-structure encoding of the f-structure hierarchy; on the other hand, they are sensitive to some basic hierarchical organization of the c-structure that divides the sentence into domains that have

\(^5\)For a discussion of the participle/infinitive alternation see den Besten et al. (1988).
traditionally been recognized (e.g. the middle field and the Vorfeld, corresponding here to the topicalization domain) but that are not recognized as major subdivisions of the sentence in the generative tradition. Further study should give us more insight into what motivates these domains.

References


REFERENCES / 239


