Word Order Constraints on German Verb Clusters

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1 Introduction

There is a broad concensus among researchers working within the paradigm of HPSG that *argument-inheritance* (Hinrichs and Nakazawa (1989; 1994)) is an essential operation in the analysis of so-called *verb clusters* in German. An *argument-inheritance verb* subcategorizes for an unsaturated verbal complement, and for all the complements on the COMPS-list of this verbal complement. In German, auxiliaries and modals are often treated as argument-inheritance verbs.

Questions concerning the constituency of phrases headed by such argument-inheritance verbs, however, have not been answered uniformly. Most analyses of the German VP distinguish between the verb *cluster* and the verb *phrase*, where the *verb cluster* is a subconstituent of the VP containing verbal signs only. The internal structure of the *verb cluster* has been argued to be left-branching (Hinrichs and Nakazawa (1989; 1994)), but arguments for a right-branching structure have been given as well (Kiss, 1994). The VP itself is sometimes analyzed as a contoured structure, in which a verbal projection (a *partial* VP) combines with one complement at a time (Hinrichs and Nakazawa (1989; 1994), Kiss (1994)). Nerbonne (1994) and Baker (1994), on the other hand, argue for a 'flat' VP in which a verb combines with all its complements at once, and in which, in Baker's case, the verb cluster has been eliminated as well.

In this paper, we explore how the account of Dutch verb clusters developed in van Noord and Bouma (1996) might carry over to German. For Dutch, we have argued for an analysis in which a 'flat' structure is assigned to the VP and the verb cluster is not a separate constituent. In this respect, our account is similar to Baker's analysis of German. Our analysis rests on the assumption that a single HEAD-COMPLEMENT schema exists, which licences phrases in which a lexical head (i.e a head of type *word*) combines with an arbitrary number of its complements. Two considerations led us to this proposal. First, the distinction between *verb clusters* and (*partial*) VP's, which is crucial to any account based on verb clusters, requires the introduction of features such as NPCOMPS, and mechanisms (i.e. additional rule schemata) for assigning a value to these features on complex phrases, that are superfluous in an account without verb clusters. Second, phenomena such as *partial* VP *fronting* and the Dutch 'third construction' (*partial* VP *extraposition*), which have been used as arguments for partial VP's in the *Mittelfeld*, are not incompatible with our approach. While the HEAD-COMPLEMENT schema excludes partial VP's as *heads*, it does not exclude such phrases to be built altogether. In van Noord and Bouma (1996), we present an analysis of *partial* VP *fronting* and the 'third construction' that is fully compatible with a 'flat' analysis of the VP.[1]

The most important challenge for a 'flat' analysis of German is to formulate word order constraints that will allow not only the standard, nested dependency, word order (1a), but also the word orders known as *Oberfeldumstellung* or *auxiliary flip* (1b) and *Zwischenstellung* (1c). Hinrichs and Nakazawa (1989; 1994) argue that (1a) and (1b) can best be accounted for if the verb cluster *bestehen können wird* is a separate constituent, with a binary, left-branching, structure. Given this

[1] Space prevents us from giving a full account of *partial* VP *fronting* and the Dutch data. These topics are covered in a longer version of this paper (Bouma and van Noord, 1996).

assumption, examples such as (1b) are a matter of word order variation, with the head *wird* preceding its complement rather than following it. The word order shown in (1c) is problematic for a left-branching analysis, however, as in this case the head *wird* appears in the middle of what is seen as one constituent (i.e. *bestehen können*):

(1) a. daß er das Examen bestehen können wird
that he the exam pass be-able-to will
that he will be able to pass the exam

b. daß er das Examen wird bestehen können

c. daß er das Examen bestehen wird können

For a 'flat' analysis, in which both *bestehen* and *können* are complements of the head *wird*, this problem does not arise, and both *Oberfeldumstellung* and *Zwischenstellung* can be treated as a matter of word order variation. However, if no word order constraints are imposed, the 'flat' analysis will also admit many ungrammatical word orders.

For Dutch, van Noord and Bouma (1996) assumed a word order constraint that had the effect of ordering more oblique complements always closer to the head than less oblique complements. This basically has the effect of allowing nested dependency word orders only. To account for the various word orders allowed in German, a different type of constraint is necessary. Below, we adopt a proposal by Kathol (1996), in which complements are ordered relative to their *governor*.

In section 2, we present lexical entries for German modal and auxiliary verbs, and the HEAD-COMPLEMENT schema introduced in van Noord and Bouma (1996). An overview of previous analyses and the critical data that need to be accounted for is given in section 3. In section 4, we discuss Kathol's analysis of word order in German verb clusters. In section 5, we demonstrate that a combination of a 'flat' analysis of the VP and the word order constraints proposed by Kathol accounts for the various word order patterns in the German verb cluster.

2 Verb Clustering without Verb Clusters

In this section, we present the basics of our analysis of German verb clusters. The analysis of word order is presented in section 5.

Following the analysis of German modal and auxiliary verbs given in Hinrichs and Nakazawa (1989), we assume that modals and auxiliaries are so-called 'argument-inheritance' verbs, which select for a list of complements consisting of a verb and the complements selected by that verb:

(2) a. wollen (*to want*) $\mapsto \begin{bmatrix} \textsc{head} & \textit{verb}[\textit{inf}] \\ \textsc{subj} & \langle \textsc{np} \rangle \\ \textsc{comps} & \boxed{1} \oplus \left\langle {}_{\textit{word}}\begin{bmatrix} \textsc{head} & \textit{verb}[\textit{inf}] \\ \textsc{comps} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix}$

b. haben (*to have*) $\mapsto \begin{bmatrix} \textsc{head} & \textit{verb}[\textit{inf}] \\ \textsc{subj} & \langle \textsc{np} \rangle \\ \textsc{comps} & \boxed{1} \oplus \left\langle {}_{\textit{word}}\begin{bmatrix} \textsc{head} & \textit{verb}[\textit{prt}] \\ \textsc{comps} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix}$

The verbs *helfen* (to help) and *lassen* (to let) are analyzed as argument-inheritance verbs as well. Note that these verbs also select an NP object:

(3) $$\text{lassen } (\textit{to let}) \mapsto \begin{bmatrix} \text{HEAD} & verb[inf] \\ \text{SUBJ} & \left\langle \text{NP} \right\rangle \\ \text{COMPS} & \left\langle \text{NP}[acc] \right\rangle \oplus \boxed{1} \oplus \left\langle {}_{word}\begin{bmatrix} \text{HEAD} & verb[inf] \\ \text{COMPS} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix}$$

We make the additional assumption that argument-inheritance verbs require a verbal complement that is of type *word*. Since the verbal complement cannot be a (complex) phrase, a consequence of this requirement is that an argument-inheritance verb necessarily inherits *all* complements of its verbal complement. This not only prevents spurious ambiguity, but, as we will see below, is also crucial for our account of word order.

The following, general, HEAD-COMPLEMENT schema is used to derive 'flat' verb phrases:

(4) $${}_{phr}\begin{bmatrix} \text{COMPS} & \boxed{1} \end{bmatrix} \rightarrow L^* \; {}_{wrd}\begin{bmatrix} \text{COMPS} & \boxed{1} \oplus \left\langle \ldots \right\rangle \end{bmatrix} \; R^* \qquad \text{HEAD-COMPLEMENT-SCHEMA}$$

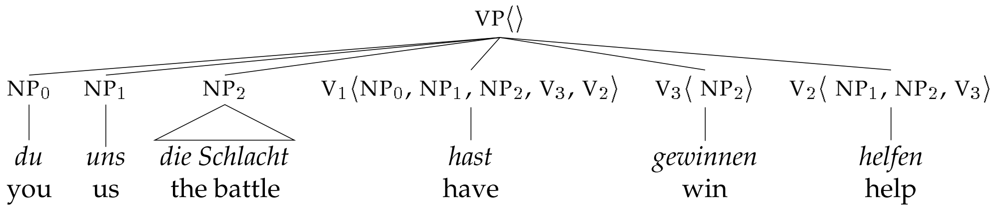
This schema states that a mother node dominates a *lexical* head daughter H, with an arbitrary number of daughters to the left and to the right of H.[2] All non-head daughters are complements. The value of L, R, and COMPS on the mother is determined by the following constraint:

(5) **Valence principle:** The COMPS-list of the mother is a prefix of the COMPS-list of the head and equals the COMPS-list of the head minus the signs left and right of the head.

Thus, (4) can be used to form both partial and saturated verb-phrases. Note, however, that since the head must be a *word*, a phrase derived by means of the schema in (4) cannot be the *head* of a larger HEAD-COMPLEMENT structure. In this paper, we will not make use of partial VP's, but in van Noord and Bouma (1996) we argue that the interaction of (4) and (5) enables an account of *partial* VP *fronting* as well as *partial* VP *extraposition*. Other constraints applying to the HEAD-COMPLEMENT schema are the HEAD-FEATURE and NONLOCAL FEATURE principles of Pollard and Sag (1994) and the word order constraints introduced below.

The schema in (4) and the lexical entries for argument inheritance verbs together give rise to derivations of subordinate clauses in which a lexical head directly combines with all of its complements. Thus, there is no phrase corresponding to the verb cluster, nor any other internal phrase structure in the VP: [3]

(6)



(...that) you helped us win the battle

Since the HEAD-COMPLEMENT schema requires a lexical head, and the argument-inheritance verbs *haben* and *helfen* require a lexical verbal complement, the 'flat' derivation is the only one possible according to the grammar, ignoring word order variation for the moment.

In the remainder of this paper, we will be concerned with the question how to account for word order in VP's containing one or more argument-inheritance verbs. We will provide word order constraints which, in conjunction with the HEAD-COMPLEMENT schema in (4), account for the German nested dependency word order, as well as *Oberfeldumstellung* and *Zwischenstellung* word orders. Before doing so, however, we will first review previous proposals.

[2] We disallow the use of this rule if both L and R are instantiated as the empty list. Thus, there are no non-branching derivations.

[3] Following most HPSG analyses of German, we do not introduce a separate HEAD-SUBJECT schema. Instead, we assume a lexical rule for finite verbs which adds the subject to COMPS.

3 The constituent structure of German VPs

In previous work on German verb clusters, various constituent structures for both the verb cluster and the VP have been proposed. None of the accounts presented so far appears to cover all the relevant data.

Hinrichs and Nakazawa (1989; 1994) argue that the phenomenon known as *Oberfeldumstellung* or *auxiliary flip* (example (1b), repeated as (7) below) provides evidence for the fact that modals and auxiliaries must be 'argument-inheritance' verbs.

(7) daß er das Examen wird bestehen können

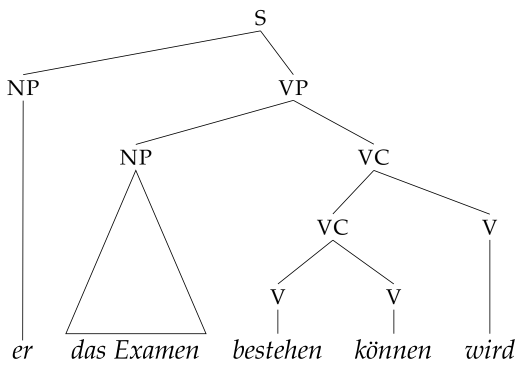
If *können* would select the full VP *das Examen bestehen* as complement, giving rise to a constituent which is itself the complement of *wird*, the word order in (7) would be completely unexpected. If *können* and *wird* are assigned the 'argument-inheritance' lexical entries in (8), however, an analysis suggests itself in which *bestehen können*, but not *das Examen bestehen können* is a constituent.[4]

(8) a. können (*to be able to*) $\mapsto \begin{bmatrix} \text{HEAD} & \textit{verb}[\textit{inf}] \\ \text{SUBCAT} & \left\langle \text{NP} \right\rangle \oplus \boxed{1} \oplus \left\langle \begin{bmatrix} \text{HEAD} & \textit{verb}[\textit{inf}] \\ \text{SUBCAT} & \boxed{1} \\ \text{NPCOMPS} & - \end{bmatrix} \right\rangle \end{bmatrix}$

b. wird (*will*) $\mapsto \begin{bmatrix} \text{HEAD} & \textit{verb}[\textit{fin}] \\ \text{SUBCAT} & \left\langle \text{NP} \right\rangle \oplus \boxed{1} \oplus \left\langle \begin{bmatrix} \text{HEAD} & \textit{verb}[\textit{inf}] \\ \text{SUBCAT} & \boxed{1} \\ \text{NPCOMPS} & - \end{bmatrix} \right\rangle \end{bmatrix}$

In particular, Hinrichs and Nakazawa distinguish between a *verb cluster* (VC) and a *verb phrase*. The *verb cluster* is a subconstituent of the VP, containing verbal elements only. Hinrichs and Nakazawa present a binary-branching analysis, in which the verb cluster, in cases with standard word order, is left-branching:[5]

(9)



Auxiliary flip is handled by means of a binary feature FLIP. If auxiliaries select a verbal complement marked as [FLIP +], the auxiliary must precede that complement.

In Hinrichs and Nakazawa's account, verb clusters are partial VP's marked as [NPCOMPS -], while VP's containing non-verbal complements are marked [NPCOMPS +]. Two separate rule schemata (one in which a lexical head selects a verbal ([NPCOMPS -]) complement, and one in

[4] Note that Hinrichs and Nakazawa use the valence feature SUBCAT instead of COMPS and assume that the subject is in general included in SUBCAT.

[5] In the examples below, VC stands for verb cluster, VP is used for (partial) verb phrases, and S is a verb phrase including a subject.

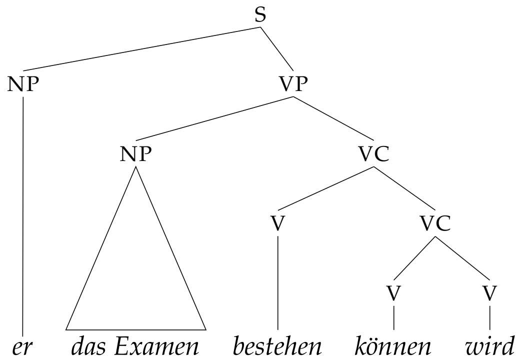
which a head selects an NP (or other non-verbal complement)) are needed to implement the distribution of this feature. The distinction between verb clusters and other partial VP's is essential, as otherwise nothing would prevent an auxiliary to precede a complement consisting of a full VP:

(10) * daß er wird das Examen bestehen können

Such examples are unacceptable to most German speakers.

While the fact that auxiliaries and modal verbs are 'argument-inheritance' verbs has been widely accepted, questions concerning the constituency of phrases headed by such *argument-inheriting* verbs have not been answered uniformly. In Kiss (1994), for instance, it is argued that the verb cluster is right-branching instead of left-branching:

(11)



This analysis has the advantage that auxiliaries and modals can simply select for a *lexical* verb (a property it shares with the preliminary proposal presented in the previous section), instead of a verb cluster. Therefore, a uniform head-complement rule schema can be used and the feature NPCOMPS becomes superfluous. A problem for this kind of analysis is obviously that there is no easy way to account for auxiliary flip.

Of course, one can also give up the assumption that the VP is binary-branching. In Nerbonne (1994), for instance, it is argued that instances of *partial* VP *fronting* (12) are best accounted for by making minimal assumptions about the internal structure of VP's.

(12) a. Das Buch lesen wird er schon können.
the book read will he already can
He'll surely be able to read the book

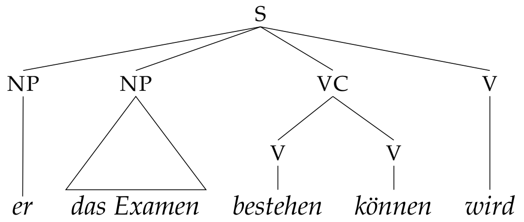
b. Lesen können wird er das Buch schon.

For analyses that assume a correspondence between a fronted element and a *trace* in the remaining clause, such examples are problematic. Only an analysis that assigns multiple bracketings to *das Buch lesen können* can account for the two examples in (12). Such an analysis will lead to spurious ambiguity in examples without fronting. Nerbonne provides an alternative, traceless, account, in which a lexical complement extraction rule shifts an element from COMPS to SLASH. A special feature of this rule is that if an element on COMPS is required to be lexical (or [NPCOMPS -]), this constraint no longer holds for the element on SLASH. This essentially allows an argument-inheritance verb, that normally selects a lexical verb or verb cluster, to have an element on slash matching an arbitrary partial VP.[6]

Nerbonne emphasizes the fact that in his analysis fronting of partial VP's can no longer be used as an argument for assigning such phrases constituent-status in non-fronted positions as well. Consequently, there seems to be no reason why a verbal head could not combine with all its complements in one step. Although Nerbonne does not adress this issue in detail, he suggests that an account of *auxiliary flip* still necessitates the introduction of a *verb cluster*. In Nerbonne's analysis, the verb cluster is one of the arguments of the finite verb:

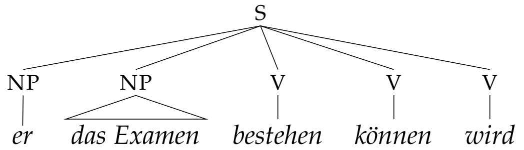
[6]See also van Noord and Bouma (1996), where an analysis along the lines of Nerbonne is proposed, and Bouma and van Noord (1996), where we develop a proposal in which a monotonic version of the complement extraction rule is proposed. A similar monotonic account can be found in Müller (1996).

(13)



Baker (1994) takes the analysis of Nerbonne one step further by assuming that the German VP is best assigned a 'flat' structure, in which a verbal head combines with all its complements at once. Thus, our running example is assigned the following structure:

(14)

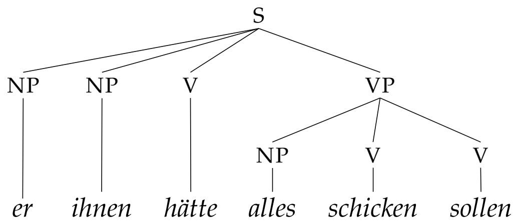


The analysis of Baker resembles the preliminary account presented in the previous section. The HEAD-COMPLEMENT schema presented in Baker (1994), for instance, allows a head of type *word* to combine with an arbitrary number of its complements, as in our rule (4). Furthermore, argument-inheritance verbs select for a lexical verbal complement. Baker accounts for auxiliary flip by assuming that auxiliaries which occur in *flipped* position no longer require a lexical verbal complement, but instead may select any partial VP (note that, as in our account, Baker does not exclude the formation of partial VP's altogether). As is admitted by Baker herself, this account overgenerates, as it not only accepts ordinary cases of auxiliary flip, but also the examples in (15), where example (15a) (which receives the derivation in (16)) is acceptable only to some speakers, and (15b) is completely ungrammatical.[7]

(15) a. daß er ihnen hätte alles schicken sollen
that he them would-have everything sent should
that he should have sent them everything

b. *daß er bestehen wird das Examen können
that he pass will the exam be-able-to
that he will be able to pass the exam

(16)



A peculiarity of Baker's analysis is that she assumes that in examples with standard (i.e. non-flipped) word order such as (14), there is a 'flat' structure, whereas for examples of *auxiliary flip* such as *wird lesen können* she assumes that the double infinitive is a constituent. Since Baker does not use a feature NPCOMPS, her account must therefore also accept the examples in (15). If we want to exclude these (i.e. be able to describe dialects in which these examples are unacceptable) we must either reintroduce some system for distinguishing between verb clusters and other partial VP's, which would severely undermine the motivation for adopting a 'flat' analysis, or else give up the assumption that 'flipped' auxiliaries precede a single constituent. In section 5 we explore the latter option.

[7]Baker cannot exclude the derivation of (15b) since in her HEAD-COMPLEMENT schema she assumes that the complements of the head are the *sequence union* (Reape, 1994) of the selected complements and the (unselected) complements on the mother. This allows the derivation of the phrase *das Examen können*. Our HEAD-COMPLEMENT schema is more restrictive in that it requires the unselected complements to be a prefix of the complements on the head.

4 Kathol's analysis of German Word Order

The analysis put forward in Kathol (1996) combines Hinrichs and Nakazawa's analysis of the German verb cluster with an approach to word order that allows for orderings that do not respect constituent structure. Kathol not only focuses on German, but also extends the analysis to Dutch. Kathol's proposals are interesting for our purposes as he does not appeal to phrase structure to account for word order. Instead, word order constraints are formulated. These constraints can be adopted in our framework as well.

While Kathol accepts the left-branching analysis of the verb cluster argued for by Hinrichs and Nakazawa, he also observes that this analysis does not account for all the German data, and furthermore cannot easily be extended to Dutch. First, Kathol observes that the left-branching analysis of the verb cluster fails to account for examples such as (17), discussed by Meurers (1994), where the auxiliary appears in so-called *Zwischenstellung*:

(17) zu dem Zeitpunkt an dem ich mich entscheiden hätte müssen
at the point at which I me decide had must
at the point at which I should have made a decision

If the phrase *entscheiden müssen* has constituent status, as is the case in a left-branching analysis, this word order is clearly problematic.

Second, Kathol notes that a branching account of the *Dutch* verb cluster cannot account for examples of participle inversion. That is, an account which assumes that Dutch verb clusters are right-branching (i.e. they differ from the German verb cluster only in that argument-inheritance verbs normally precede the verbs they govern), cannot account for verb sequences such as *gelezen moet hebben* (*read[psp] must[fin] have[inf]*), where the governing modal *moet* interrupts the participle-auxiliary sequence *gelezen hebben*. The position of separable verb prefixes in Dutch is equally problematic for a branching analysis of the verb cluser.[8]

The conclusion drawn by Kathol from these examples is not that the branching analysis is wrong, but rather that the analysis must be extended to incorporate some notion of discontinuity. In particular, Kathol, following a proposal of Reape (1994) and an account of German word order based on the notion of *topological field* described in Kathol (1995), assumes that the derivation of verb clusters by means of a binary rule schema leads to an (*word*) *order domain* that is flat, i.e. in which all verbs that are present in the verb cluster are sisters. Order among sisters is constrained by *linear precedence* (LP) statements. An example of a word order domain is given in (18).

(18) $$\left[\textsc{dom}\ \left\langle \begin{bmatrix}\langle \textit{daß} \rangle \\ \textsc{compl} \\ \textit{cf}\end{bmatrix}, \begin{bmatrix}\langle \textit{Peter} \rangle \\ \textsc{np} \\ \textit{mf}\end{bmatrix}, \begin{bmatrix}\langle \textit{das Buch} \rangle \\ \textsc{np} \\ \textit{mf}\end{bmatrix}, \begin{bmatrix}\langle \textit{finden} \rangle \\ \textsc{v} \\ \textit{vc}\end{bmatrix}, \begin{bmatrix}\langle \textit{können} \rangle \\ \textsc{v} \\ \textit{vc}\end{bmatrix}, \begin{bmatrix}\langle \textit{wird} \rangle \\ \textsc{v} \\ \textit{vc}\end{bmatrix} \right\rangle\right]$$

Note that in the derivation of this domain, the elements *finden* and *können* are combined first, with *wird* taking this constituent as verbal complement, after which the NP's are added. The labels *cf*, *mf*, and *vc* refer to the topological fields complementizer field, *Mittelfeld*, and verb cluster. LP-constraints ensure that *cf* elements must precede *mf* elements, and that *mf* elements must precede *vc* elements. Word order within the *vc* field is determined by a feature GVOR (*governor*). The value of this feature and associated LP constraints determine whether a governed verb must precede or follow its governor, and whether a governed verb is necessarily adjacent to its governor. These constraints are dealt with in detail in the next section.

Note that there is a similarity between the word order domain constructed here and the 'flat' VP's produced by the HEAD-COMPLEMENT schema in (4). In both cases, the elements which can be ordered relative to each order by means of word order constraints are roughly the same (ignoring the treatment of complementizers and possibly the subject). This suggests that the word order constraints proposed by Kathol may carry over to an approach which derives 'flat' word order domains directly.

[8]See Bouma and van Noord (1996) for an account of these phenomena compatible with the analysis developed below.

5 German verb clustering without verb clusters

In this section, we develop an approach to German word order in which we adopt two of Kathol's ideas. First, following the topological fields approach, we identify a part of the word order domain as the 'verb cluster'. Second, we adopt Kathol's idea that word order within the verb cluster is not only determined by the position of a complement with respect to its head, but also with respect to its *governor* (where a *governor* of a complement is a sign which has this complement as a non-inherited element on its COMPS-list). We show that the constraints Kathol imposes on the relative order of a governor and its complement carry over to our analysis, and can be used to account for the various German word orders. In our proposal there is no need to give up the idea that word-order is determined by constituent structure (i.e. our underlying formalism is concatenative).

5.1 The Directionality Constraint

We have reduced the amount of phrase structure to a minimum. Therefore we must rely on word order constraints to ensure that all and only grammatical word orders are derivable. The treatment of word-order starts out with the directionality constraint. Heads may specify for a given complement whether it has to precede or follow the head. For this purpose, a feature DIR is introduced, with '←' and '→' as possible values. The interpretation of this feature is given by the following word order constraint:

(19) **Directionality Constraint:** All elements left of the head have the feature specification [DIR →], whereas all elements right of the head have the specification [DIR ←]:

$$1.\ \begin{bmatrix}\text{DIR} & \rightarrow\end{bmatrix} < {}_{head}\begin{bmatrix}\,\end{bmatrix} \qquad\qquad 2.\ {}_{head}\begin{bmatrix}\,\end{bmatrix} < \begin{bmatrix}\text{DIR} & \leftarrow\end{bmatrix}$$

The position of a complement with respect to its head can now be specified lexically, by simply adding the appropriate specifications on the COMPS-list of the head. Thus, the lexical entry for e.g. 'wollen' is extended as follows:

(20) wollen (*to want*) $\mapsto \begin{bmatrix}\text{HEAD} & verb[inf] \\ \text{SUBJ} & \langle \text{NP} \rangle \\ \text{COMPS} & \boxed{1} \oplus \left\langle {}_{word}\begin{bmatrix}\text{HEAD} & verb[inf] \\ \text{COMPS} & \boxed{1} \\ \text{DIR} & \rightarrow\end{bmatrix} \right\rangle\end{bmatrix}$

5.2 Izone and Ozone

The effect of the directionality constraint is that in many cases the only constraint imposed on word order is that the head must be final. That is, in a clause containing one or more argument-inheritance verbs, and where the finite verb occurs in final position, all complements are [DIR →]. These complements can therefore occur in any order. While the order of NP's, PP's and adverbials in the German *Mittelfeld* allows for a certain amount of variation, it is definitely not the case that verbal complements of argument-inheritance verbs and non-verbal complements can be scrambled. Therefore, additional constraints need to be imposed.

In Kathol's topological field approach, verbal complements of argument-inheritance verbs occupy the *vc* field, whereas non-verbal complements normally occupy the *mf* field. As *mf* elements must precede *vc* elements, this has the effect of ordering verbal complements closer to the head than non-verbal complements.

We adopt a solution that is similar to the idea of having topological fields. As we need to distinguish only between elements that are in the 'verb cluster' and elements outside it, and as we do not want to make reference in our general HEAD-COMPLEMENT schema to concepts that are relevant in clausal syntax only (such as *verb cluster*), we introduce a slightly different terminology. The feature ZONE with values *i(zone)* and *o(zone)* distinguishes complements that appear close to the head from those that are further away:

(21) **Zone Constraints**

$$1.\ \begin{bmatrix}\text{DIR} & \rightarrow \\ \text{ZONE} & o\end{bmatrix} \prec \begin{bmatrix}\text{DIR} & \rightarrow \\ \text{ZONE} & i\end{bmatrix} \quad 2.\ \begin{bmatrix}\text{DIR} & \leftarrow \\ \text{ZONE} & i\end{bmatrix} \prec \begin{bmatrix}\text{DIR} & \leftarrow \\ \text{ZONE} & o\end{bmatrix}$$

The *izone* corresponds to Kathol's *vc* topological field.
Since we assume that the head of a phrase is always part of the *izone*, we also modify our HEAD-COMPLEMENT schema slightly:

(22) $$_{phr}\begin{bmatrix}\text{COMPS} & \boxed{1}\end{bmatrix} \rightarrow L^* \; _{wrd}\begin{bmatrix}\text{COMPS} & \boxed{1} \oplus \langle \ldots \rangle \\ \text{ZONE} & i\end{bmatrix} \; R^* \qquad \text{HEAD-COMPLEMENT-SCHEMA}$$

The interaction of the Zone and Directionality constraints is represented schematically in (23).

(23) $$\underbrace{\overbrace{L_1 \ldots\ldots L_i}^{\begin{bmatrix}\text{ZONE} & o\end{bmatrix}} \; \overbrace{L_{i+1} \ldots L_m \; H \; R_1 \ldots R_j}^{\begin{bmatrix}\text{ZONE} & i\end{bmatrix}}}_{\begin{bmatrix}\text{DIR} & \rightarrow\end{bmatrix}} \; \underbrace{\overbrace{R_{j+1} \ldots\ldots R_n}^{\begin{bmatrix}\text{ZONE} & o\end{bmatrix}}}_{\begin{bmatrix}\text{DIR} & \leftarrow\end{bmatrix}}$$

One of the most important reasons for giving up the idea that there is internal structure in the verb cluster, is the fact that it allows an easy formulation of the constraint that verb clusters may not be interrupted by non-verbal constituents. In particular, in our account of Dutch, we assumed that all (obligatory) argument-inheritance verbs require their verbal complements to be of type *word*. Now that we have introduced a feature ZONE which distinguishes verbal complements that must be part of the 'verb cluster' from other complements, we no longer need to state this constraint in the lexicon. Instead, we assume that the following constraint applies to the HEAD-COMPLEMENT schema:

(24) **Izone Principle:** All [ZONE *i*] daughters are of type *word*.

Note that since the head of a HEAD-COMPLEMENT schema is *izone*, we can in fact remove the constraint that the head must be of type *word* from our revised HEAD-COMPLEMENT schema (22). More importantly, we have argued that the introduction of the Izone principle in fact leads to an improved account of partial VP fronting (Bouma and van Noord, 1996).

5.3 Word Order within the Verb Cluster

In Hinrichs and Nakazawa's account of *auxiliary flip*, a (head) feature FLIP controls the position of a complement relative to its head. [FLIP -] complements must precede the head, whereas [FLIP +] complements must follow it.[9] Given a binary branching analysis of the verb cluster and the assumption that modals are unspecified for FLIP, Hinrichs and Nakazawa predict that both [*lesen können*] *wird* and *wird* [*lesen können*] are possible word orders. For an analysis in which the verb cluster word order domain has no internal structure, such as Kathol's and ours, ordering with respect to the head only will not be sufficient. Note for instance that if we require *lesen* to precede the head and do not impose any restriction on the position of *können*, we predict the following word orders:

[9]Note that this constraint (apart from the feature specification used to implement it) is exactly the same as the Directionality constraint.

(25) a. lesen können wird

b. *können lesen wird

c. lesen wird können

Of these, (25b) is clearly ungrammatical, while (25c) is only acceptable to some speakers. What is more, the grammaticality of *wird lesen können* is unpredicted.

To solve this problem, Kathol proposes a word order constraint that determines the position of a complement relative to its *governor*, instead of relative to the *head*. Below, we assume that A governs B iff B is an element of the *argument-structure* of A.[10] The notion *argument-structure* (and the corresponding list-valued feature ARG-S) is introduced in Iida et al. (1994) and Manning and Sag (1995). In the canonical case, ARG-S is the `append` of the values of valence-feature COMPS, SUBJ and SPR (and thus is equivalent to what used to be SUBCAT). Exceptions to the canonical case are possible, however. For instance, in *pro-drop* languages, ARG-S may contain arguments that do not occur on any of the valence lists. Manning and Sag (1995) describe ARG-S as "an attribute of only lexical signs, used to explain properties such as binding and 'deep' subcategorization". In van Noord and Bouma (1996) we used ARG-S in this sense. The ARG-S of argument-inheritance verbs contains only elements for which the verb 'really' subcategorizes and not those inherited from its verbal complement. This allowed us to propose a version of the HPSG-binding theory formulated on ARG-S, instead of the valence-features COMPS, SUBJ and SPR. Similarly, we now define the *governor* of a complement as the sign on whose ARG-S-list it appears.

There is a distinction between the notion *governor* and *head* in constructions headed by an argument-inheritance verb, as in these cases not all complements are governed by the same head. Following Kathol, we use the feature GVOR to specify the position of a complement relative to its governor. The specification [GVOR $\rightarrow$] means that the element has to precede its governor and [GVOR $\leftarrow$] means that it has to follow its governor. The specifications [GVOR $\hookrightarrow$] and [GVOR $\hookleftarrow$] mean that an element has to immediately precede or follow its governor. We can now state the following word order constraints:[11]

(26) **Governor Constraints**

1. $\boxed{1}\left[\text{GVOR} \;\; \rightarrow\right] \quad \prec \quad \left[\text{ARG-S} \;\; \left\langle \ldots \boxed{1} \ldots \right\rangle\right]$

2. $\boxed{1}\left[\text{GVOR} \;\; \hookrightarrow\right] \quad \prec\!\!\prec \quad \left[\text{ARG-S} \;\; \left\langle \ldots \boxed{1} \ldots \right\rangle\right]$

3. $\left[\text{ARG-S} \;\; \left\langle \ldots \boxed{1} \ldots \right\rangle\right] \quad \prec \quad \boxed{1}\left[\text{GVOR} \;\; \leftarrow\right]$

4. $\left[\text{ARG-S} \;\; \left\langle \ldots \boxed{1} \ldots \right\rangle\right] \quad \prec\!\!\prec \quad \boxed{1}\left[\text{GVOR} \;\; \hookleftarrow\right]$

[10] Kathol adopts a somewhat different definition. Since he assumes a separate valence feature VCOMPS, on which verbal complements are represented and on which there is no inheritance, and since only the governors of verbal complements need to be identified, it is possible to define the governor of a verbal complement as the sign on whose VCOMPS-list this complement appears.

[11] Kathol restricts the scope of these constraints to elements that are in the *verb cluster* field. The reason for this restriction is that, in main clauses, finite verbs may also appear in first or second position. Kathol (1995) provides an account of main clauses in which these are derived by means of the same rules used to derive subordinate clauses. The only difference is that in main clauses the finite verb occupies a different topological field. If we would adopt a similar account of verb-first and verb-second, we would have to restrict the scope of the Governor constraints to *izone* elements as well.

5.4 Examples

Our account of the various word order possibilities within the German verb cluster rests on two assumptions. First, all argument-inheriting verbs select a verbal complement that must be in the *izone*. Second, the relative order of elements in the *izone* is determined by specifying the position of a complement relative to its governor. The second part of our account follows the proposals made in Kathol (1996).

We start by presenting lexical entries for main verbs, nonfinite modals, and auxiliaries which occur in 'flipped' position.

As in German it is the governed verb, rather than the governor, which determines whether 'flipped' word orders are possible, we must assume that (main) verbs come with a specification for GVOR. Thus it is the complement, rather than the head or governor, that determines word order. German main verbs, for instance, do not 'trigger' flipped word order, and thus are specified as [GVOR $\rightarrow$]:

(27) bestehen (*to pass*) $\mapsto \begin{bmatrix} \text{GVOR} & \rightarrow \\ \text{COMPS} & \left\langle \text{NP}_{acc,ozone} \right\rangle \end{bmatrix}$

Note also that transitive verbs select an NP-complement that is part of the *ozone*.

As a modal verb may trigger *auxiliary flip*, it is unspecified for GVOR. At the same time, modals require that their verbal *izone* complement must precede it. Note that this requirement is not redundant: if a modal governs another modal (where the governed modal will be unspecified for GVOR), we need this constraint to block 'flipped' word orders such as * *kann singen müssen*:

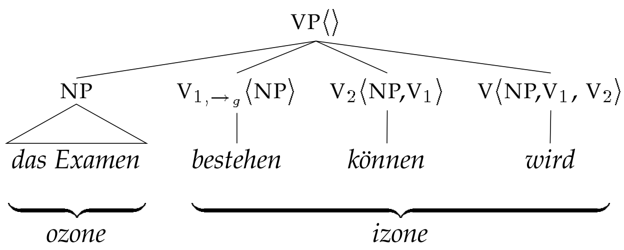
(28) können (*be able to*) $\mapsto \begin{bmatrix} \text{COMPS} & \boxed{1} \oplus \left\langle \begin{bmatrix} \text{HEAD} & \textit{verb[inf]} \\ \text{ZONE} & i \\ \text{GVOR} & \rightarrow \\ \text{COMPS} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix}$

A finite auxiliary such as *wird* places no constraint on the GVOR value of its verbal *izone* complement, and thus allows for both normal and flipped word order:

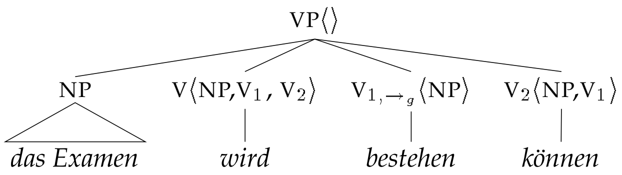
(29) wird (*will*) $\mapsto \begin{bmatrix} \text{COMPS} & \boxed{1} \oplus \left\langle \begin{bmatrix} \text{HEAD} & \textit{verb[inf]} \\ \text{ZONE} & i \\ \text{COMPS} & \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix}$

Given these lexical entries, and the HEAD-COMPLEMENT schema given in (22), we can derive exactly the three word orders given below:

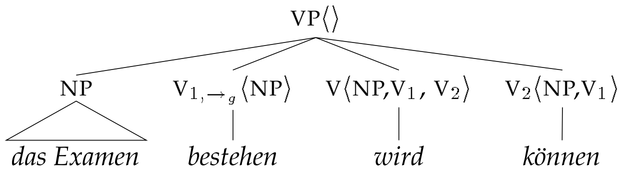
(30)



(31)



(32)



The examples above illustrate that our account predicts the possibility of *auxiliary flip* and *Zwischenstellung*, if the auxiliary governs a modal verb. If the auxiliary governs a main verb, *flipped* word order is ruled out.

Two more issues need to be mentioned. First, for those speakers that do not allow the *Zwischenstellung* word order in (32), we assume, following Kathol, that the GVOR specification on main verbs is [GVOR $\hookrightarrow$] instead of [GVOR $\rightarrow$]. The restriction that the governor of a main verb must be right-adjacent rules out the derivation in (32), but not the derivations in (30) and (31).

Second, if a verb cluster contains two auxiliaries, the ordering possibilities are as follows:

(33) a. daß er die Lieder gesungen haben wird
that he the songs sung have will
that he will have sung the songs

b. * daß er die Lieder wird gesungen haben

(34) a. daß er die Lieder singen können haben wird
that he the songs sang be-able-to have will
that he will have been able to sing te songs

b. daß er die Lieder wird haben singen können

c. * daß er die Lieder haben singen können wird

d. * daß er die Lieder wird singen können haben

The conclusions to be drawn from these data are that (i) the status of *haben* as a trigger for *flipped* word order is determined by the verbal complement that is governed by *haben* (i.e. if the governee is a main verb (33), *haben* is not a trigger, whereas if it is a modal (34), *haben* may trigger *flipped* word order) and (ii) that *haben* may itself occur in *flipped* position if and only if its governing auxiliary is too (34b,c,d). These observations lead to a lexical entry for nonfinite auxiliaries in which there is a reentrancy between the value of GVOR of the auxiliary and the value of GVOR on the verbal complement:[12] [13]

(35) $$\text{haben } (\textit{to have}) \mapsto \begin{bmatrix} \text{GVOR} & \boxed{1} \\ \text{COMPS} & \boxed{2} \oplus \left\langle \begin{bmatrix} \text{HEAD} & \textit{verb[psp]} \\ \text{GVOR} & \boxed{1} \\ \text{ZONE} & i \\ \text{COMPS} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix}$$

[12] We may in fact assume that this reentrancy is present on auxiliaries in general (and thus there is no need to distinguish between finite and nonfinite verbs in this respect) as finite verbs are never governed.

[13] Note that we assume that *haben* uniformly governs a past participle. This implies that there must be a lexical entry for *können* specified as [VFORM *psp*]. Other solutions are possible as well, but this is immaterial to the present issue.

6 Conclusion

In this paper, we have developed an account of word order in German verb clusters based on minimal assumptions about phrase structure. We have demonstrated that the kind of word order variation that has been used to argue for a branching analysis of the verb cluster in German can in fact be accounted for without introducing the 'verb cluster' as a subphrase of the VP. Furthermore, since a 'flat' VP leaves room for a considerable amount of word order variation, phenomena which are problematic for a branching analysis can be accounted for as instances of word order variation as well.

References

Baker, Kathryn. 1994. An integrated account of "Modal Flip" and partial verb phrase fronting in German. In *proceedings of the 30th Regional Meeting of the Chicago Linguistic Society*, University of Chicago.

Bouma, Gosse and Gertjan van Noord. 1996. Word order constraints on Germanic verb clusters. In Erhard Hinrichs, Tsuneko Nakazawa, and Andreas Kathol, editors, *Complex Predicates in Nonderivational Syntax*. Academic Press, New York. To appear; manuscript available as http://www.let.rug.nl/˜gosse/papers/.

Hinrichs, Erhard and Tsuneko Nakazawa. 1989. Flipped out: AUX in German. In *Papers from the 25th Annual Regional Meeting of the Chicago Linguistic Society*. Chicago Linguistics Society, Chicago, pages 187–202.

Hinrichs, Erhard and Tsuneko Nakazawa. 1994. Linearizing AUXs in German verbal complexes. In John Nerbonne, Klaus Netter, and Carl Pollard, editors, *German in Head-driven Phrase Structure Grammar*, Lecture Note Series. CSLI, Stanford, pages 11–38.

Iida, Masayo, Christopher Manning, Patrick O'Neill, and Ivan Sag. 1994. The lexical integrity of japanese causatives. Paper presented at the LSA 1994 Annual Meeting.

Kathol, Andreas. 1995. *Linearization-based German Syntax*. Ph.D. thesis, Ohio State University.

Kathol, Andreas. 1996. Constituency and linearization of verbal complexes. In Erhard Hinrichs, Tsuneko Nakazawa, and Andreas Kathol, editors, *Complex Predicates in Nonderivational Syntax*. Academic Press, New York. To appear.

Kiss, Tibor. 1994. Obligatory coherence—an investigation into the syntax of modal and semimodal verbs in german. In John Nerbonne, Klaus Netter, and Carl Pollard, editors, *German in Head-driven Phrase structure Grammar*. CSLI, Stanford, pages 71–107.

Manning, Christopher and Ivan Sag. 1995. Dissociations between argument structure and grammatical relations. draft.

Meurers, Walt Detmar. 1994. A modified view of the German verbal complex. Handout of a talk presented at the 1994 HPSG Workshop, Heidelberg.

Müller, Stefan. 1996. Yet another paper about partial verb phrase fronting in German. In *Proceedings of the 15th International Conference on Computational Linguistics (COLING)*, Copenhagen.

Nerbonne, John. 1994. Partial verb phrases and spurious ambiguities. In John Nerbonne, Klaus Netter, and Carl Pollard, editors, *German in Head-driven Phrase Structure Grammar*, Lecture Note Series. CSLI, Stanford, pages 109–149.

van Noord, Gertjan and Gosse Bouma. 1996. Dutch verb clustering without verb clusters. In Patrick Blackburn and Maarten de Rijke, editors, *Specifying Syntactic Structures*. CSLI Publications, Stanford, pages 123–153. In press; manuscript available via http://www.let.rug.nl/˜vannoord/papers/.

Pollard, Carl and Ivan Sag. 1994. *Head-driven Phrase Structure Grammar*. University of Chicago / CSLI.

Reape, Mike. 1994. Domain union and word order variation in German. In John Nerbonne, Klaus Netter, and Carl Pollard, editors, *German in Head-driven Phrase Structure Grammar*. CSLI Publications, pages 151–197.