VERB CONSTRUCTIONS IN GERMAN AND DUTCH
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Pieter A.M. Seuren and Gerard Kempen (eds.)

Verb Constructions in German and Dutch
VERB CONSTRUCTIONS IN GERMAN AND DUTCH

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Introduction

The present book originated in the Colloquium on Verb Constructions in German and Dutch, held at the Max Planck Institute for Evolutionary Anthropology in Leipzig, 3–4 February 2001, and organized by the editors. The purpose of that Colloquium was to bring together representatives of various schools of linguistic thought and see what they would have to say on questions of German and Dutch verb constructions. Yet the group of contributors to this volume does not entirely coincide with the group of those who presented papers at the Leipzig Colloquium. Of the contributors to this volume, Gosse Bouma, Arnold Evers, Hubert Haider, Gerard Kempen, Karin Harbusch and Pieter Seuren actually took part in the Colloquium and presented papers. Ronald Kaplan, Annie Zaenen, Andreas Kathol and Owen Rambow were not present in Leipzig but were later invited to contribute to the volume.

The result is a collection where a number of different schools is represented. Bouma (Chapter 1) and Kathol (Chapter 5) analyse the German and Dutch verb constructions from the perspective of Head-driven Phrase Structure Grammar (HPSG). Evers and Haider present versions of current Generative Grammar in the Chapters 2 and 3, respectively. A Lexical Functional Grammar (LFG) view on the phenomena in question is developed by Kaplan and Zaenen in Chapter 4. Kempen and Harbusch (Chapter 6) show the results of their analysis in terms of a psycholinguistically motivated formalism called Performance Grammar. Rambow analyses the facts from the point of view of a modified version of Tree Adjoining Grammar (TAG) in Chapter 7. Seuren, finally, applies the Semantic Syntax model, his version of erstwhile Generative Semantics, to the phenomena in question in Chapter 8.

Organizational problems made it impossible to extend the range of theories to be represented. Categorial Grammar, for example, would have figured well in the present collection, but mundane factors of workload made that impossible. Other theories might have been represented as well. The fact that they are not will hopefully stimulate their practitioners to publish their accounts of the syntactic phenomena highlighted in this volume elsewhere.

The topic is interesting enough, for a number of reasons. First, the German and Dutch verb constructions show up a rich array of syntactic phenomena that have so far been distinctly underexposed in the literature, despite the fact that they have proved to be a source of substantial problems in theoretical grammar. Since the
Introduction

Phenomena in question are to a significant extent replicated in a great many other languages, it seems that they can do with some publicity, so that the attention will be diverted a little from English, which is an all too exclusive subject of syntactic discussions but lacks phenomena typical of German, Dutch and many other languages as well. We, the editors, hope that the publication of the present volume will contribute to a more even distribution of the interest shown by theoretical syntacticians in the different language types of this world.

The publication of the papers at hand may, furthermore, help to disabuse both traditional and more theoretically oriented grammarians of German and Dutch of the still widespread but nevertheless false notion that the complementation system in these two languages is basically identical to what is found in English, or, for that matter, in Latin. English and Latin belong to the group of languages where the overtly expressed semantic subject of a non-finite complement clause has the grammatical status of direct object of the superordinate verb (the so-called accusative-cum-infinitive construction). German and Dutch, on the other hand, belong to a different group of languages where the semantically subordinate verb is united with the higher verb (most theories speak of a ‘cluster’), while the argument terms of the subordinate verbs are amalgamated with those of the higher verb. It is time that this fact should finally be given full recognition in the many grammars and grammatical treatises, both traditional and theoretical, that appear on the market.

A further, equally important, reason lies in the fact that there is relatively little interaction among the various schools of linguistic thought. For the past decades, general or theoretical linguistics has been characterized by the parallel existence of a fairly large number of distinct communities, each united by a specific approach or theory, which show a lively pattern of citation and communication within the groups concerned but largely fail to interact across group boundaries. We consider this to be an undesirable state of affairs, though perhaps inevitable as a transitional phase in the discipline’s development to full maturity. It is the express purpose of the present volume to cut through those group barriers.

We realize, however, that this is easier said than done. Habits as well as prejudices are hard to eradicate and feelings of loyalty easily grow into firm doctrinal convictions. Realizing that any possible improvement in this respect will inevitably have to be a long-term process, we decided that it would be premature, and probably futile, to try to get an actual discussion going in the present volume. All we have done, therefore, is simply bring together the various analyses into one volume, hoping and expecting that their mere juxtaposition will provide material for future comparative evaluations.

The relevant facts of German and Dutch verb constructions have not been known very long. Until the middle of the 20th century it was commonly thought, in European linguistic circles, that syntax, in the sense of combining words into larger wholes, be they sentences or texts, was mostly a matter of individual, stylis-
tic creativity, belonging to the study of ‘parole’ rather than of ‘langue’. As a result, there were hardly any serious attempts at investigating the structural properties of sentences beyond the crudest level. During the 1930s isolated pockets of linguistic structuralism were found in Europe, in particular in the Dutch- and German-speaking world, and it is here that the first inklings are found of there being a system behind the apparent chaos of German and Dutch verb constructions. One thinks, for example, of Overdiep’s *Stilistische grammatica van het moderne Nederlandsch* (1936), which, despite its title, was in fact an incipient syntactic description.

Then, after the second World War, European linguists began to develop a greater sensitivity as regards the formal properties of syntactic structures. In Dutch linguistics one finds Paardekooper (1955) as an early harbinger of the new, postwar European structuralism, which even allowed for a modest degree of formalization. In German linguistics it was Gunnar Bech who, in his monumental (1955), presented the first arguments to show that there is a basic distinction, in German, between what he called ‘incoherent’ and ‘coherent’ constructions, the latter corresponding to what we now call verb clusters. Since, however, he did not have at his disposal a clear notion of syntactic rule, and even less of tree structure, as instruments of linguistic analysis and description, he was unable to cast his ideas into the format of a formally precise description.

It was not until the 1970s, when the ideas and techniques of Transformational Generative Grammar began to be widely known this side of the Atlantic, that modern, theoretically oriented grammarians started to observe the data more precisely and more systematically. This quickly led to the first formal analyses and descriptions of the German and Dutch verb constructions, based on then current versions of Transformational Generative Grammar. For a while, Dutch linguists (Evers 1975; Seuren 1972) took the lead, presenting transformational descriptions of verb constructions, especially verb clusters, not only in Dutch and German, but also in French, Japanese and other languages (see Kuroda 1965 for what probably constitutes the very first discussion of verb clustering in the transformational literature). As regards German, a new generation of German linguists quickly followed (see in particular Heidolph et al. 1981). This led to a constant stream of publications in the same tradition, including Haider (1986, 1990, 1993, 1994), Den Besten and Rutten (1989), and many others.

For some strange reason, however, these transformational descriptions, though remarkably successful on current criteria, met with a lukewarm reception in the dominant centers of Generative Grammar in America. In Germany, Austria and the Low Countries (including Flanders), however, the facts were studied ever more systematically in ever wider circles, until they found their way into what may be considered the national standard grammars of German and Dutch (though, for obvious reasons, without any formal theoretical framework). The German Du-
den Grammar has, in its 1995 edition, a marvellously complete and systematic survey (due to Horst Sitta) of the verb cluster data in standard modern German. (Zifonun et al. 1997, though voluminous, is curiously lacking in this respect.) The latest (1997) edition of the ‘national grammar’ of Dutch, the *Algemene Nederlandse Spraakkunst* or ANS, again has prolific data surveys.

At the same time, the striking facts of the Dutch and German verb constructions began to attract the attention of other, newly founded, schools of syntactic theory. Thus one finds Steedman (1983, 1984) and Moortgat (1988), where the Dutch (right-branching) verb clusters with their troublesome nesting dependencies are subjected to an analysis in terms of Categorial Grammar. Joshi (1985:245–249) considers the same Dutch nesting dependencies, in a global way, in terms of Tree Adjoining Grammar. Then, during the 1990s, Hinrichs and Nakazawa, in a number of publications, presented analyses of the German verb constructions in terms of Head-driven Phrase Structure Grammar. Kaplan and Zaenen followed suit, now in the terms of Lexical Functional Grammar. Kempen and Harbusch, with Performance Grammar, and Rambow, presenting his D-Tree Substitution Grammar (DSG) as a variant of Tree Adjoining Grammar, have recently joined the list.

This is, in rough outline, the context in which the present volume came into being. It explains the selection of authors and schools, and our regret at having been unable to cover a wider range. It is hoped that this book will contribute not only to a better knowledge and a better understanding of the facts concerned but also to a better mutual understanding of the various schools of linguistic thought.

Pieter A. M. Seuren
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Chapter 1

Verb clusters and the scope of adjuncts in Dutch

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1. Introduction

The Dutch cross-serial dependency construction is characterized by the fact that complex clauses may be formed in which arguments precede verbal predicates in a non-nesting fashion. In the subordinate clause in (1), for instance, the NP Anne is the subject of the modal mag, and the NP deze film is the direct object of the verb zien.

(1) dat Anne deze film mag zien
that Anne this movie may see
that Anne is allowed to see this movie

The classic transformational analysis of this construction was given in Seuren (1972) and Evers (1975). An underlying structure was proposed in which deze film zien would be a VP left-adjacent to the modal mag and a ‘Verb-raising’ transformation moved the main verb to the right of the modal. A further transformation, called pruning, removed spurious phrase structure nodes, and created a situation where mag governs deze film. Lexicalist analyses of this construction have either employed a syntactic operation called ‘function composition’ which allows the syntactic valency of verbs to be combined, or a closely-related operation known as ‘division’ or the ‘Geach-rule’ in Categorial Grammar and as ‘argument composition’ in Head-driven Phrase Structure Grammar. This mechanism allows the valency of a Verb-raising verb to depend on the valency of its (lexical) verbal argument.
The transformational as well as the lexicalist traditions face certain problems when trying to account for the distribution of adjuncts in the context of verb clusters. Adverbial phrases may either precede or follow complements:

(2) a. dat Kim regelmatig haar moeder bezoekt
    that Kim regularly her mother visits
    that Kim visits her mother regularly
b. dat Kim haar moeder regelmatig bezoekt

The same freedom can be found in clauses containing a verb cluster.

(3) a. dat Kim Anne aandachtig het scherm zag bestuderen
    that Kim Anne attentively the screen saw study
    that Kim saw Anne study the screen attentively
b. dat Kim Anne het scherm aandachtig zag bestuderen

The adverb aandachtig in (3) clearly modifies the main verb bestuderen, and thus it is to be expected that it may either precede or follow the direct object of bestuderen. In other cases, the adverbial phrase is most naturally interpreted as taking scope over the verb cluster as a whole:

(4) a. dat Kim Anne niet het huis hoorde verlaten
    that Kim Anne not the house heard leave
    that Kim did not hear Anne leave the house
b. dat Kim Anne het huis niet hoorde verlaten

What is striking about the word order in (4b) is that the complement of the main verb precedes an adjunct which takes scope over the verb cluster as a whole. Cases where the scope of the adjunct is actually ambiguous, can easily be constructed as well:

(5) a. dat Kim regelmatig haar moeder wil bezoeken
    that Kim regularly her mother wants visit
    that Kim regularly wants to visit her mother
    that Kim wants to regularly visit her mother
b. dat Kim haar moeder regelmatig wil bezoeken

In (5a) and (5b), the same ambiguity is present. The adverb regelmatig can be interpreted as taking scope over the verb wil, but also as taking scope over the main verb bezoeken only.

In transformational frameworks, examples such as (2a) and (4b) have been used as argument for a scrambling transformation, which moves an object, originally generated adjacent to the verb, to the left, and Chomsky-adjoins it
to a vp-node (Webelhuth 1992; de Hoop 1992). The derivation of (6a), given in (6b) illustrates that scrambling must be able to move an object past adjuncts of a higher clause as well.

(6) a. dat Anne deze film waarschijnlijk mag zien
    that Anne this movie probably may see
    that Anne is probably allowed to see this movie

b. 

Note that both elements of the vp deze film zien have been moved. The head has been adjoined to the right of the modal verb by V-raising and the object has been scrambled out of the complement vp to a position left of the adverb which modifies a projection of the modal verb mag. The ambiguity in examples like (5a) and (5b) can now be accounted for by assuming that the adverb was either adjoined to the embedded vp headed by (a trace of) bezoeken, or to the vp headed by wil. In both cases, the object-adverb order is obtained by scrambling.

In Head-driven Phrase Structure Grammar (HPSG; Pollard & Sag 1994), argument composition has been widely used to account for the syntactic valency of verb clusters like mag zien in (6). It is assumed that the complements of the modal mag (defined by the comps-feature) consist of a (lexical) verbal complement plus all the elements on the comps list of that verbal complement. As zien is a simple transitive verb, the comps list of mag in (6) consists of a verbal complement and an accusative NP:

(7) \[
\begin{array}{c}
\text{PHON} \langle \text{mag} \rangle \\
\text{HEAD} \ V \\
\text{COMPS} \langle \text{NP} \rangle \\
\end{array}
\]
Specific grammar rules for combining a head with one or more complements are defined in HPSG as instantiations of a head-complement-structure: a structure consisting of mother, a head daughter and one or more complement daughters. The actual selection of complements follows from the valence principle: the value of the valence feature compS on the mother is equal to compS on the head daughter, minus all selected complements. A complement is selected if it occurs as a non-head daughter in a head-complement-structure, and its feature structure can be unified with an element on compS of the head daughter.

While there is a broad consensus about the lexical aspects of verb clustering, different analyses have been proposed for the syntactic structure of the construction. One approach is to assume that there is a rule, instantiating a head-complement-structure, which allows a lexical verbal head to combine with a lexical verbal complement to form a verb cluster, and another rule which accounts for the selection of non-verbal complements (the head of the rule is underlined):

(8)  head-complement-structure: \( V[+\text{lex}] \rightarrow V[+\text{lex}] V[+\text{lex}] \)

(9)  head-complement-structure: \( V[-\text{lex}] \rightarrow \text{XP} V \)

A standard approach to adjunct word order in the vp simply allows adjuncts to be adjoined to arbitrary verbal projections (by means of a rule instantiating a head-adjunct-structure, which requires that the mod value of the adjunct be unifiable with the feature structure of the head), where the adjunct semantically takes scope over the constituent it is adjoined to:

(10) head-adjunct-structure: \( V \rightarrow \text{AdvP} V \)

Thus, the derivation of the vp in (6) is as follows:

(11) \[
\begin{array}{c}
\text{NP} \quad \text{VP}^{\text{compS} \{} \quad \text{VP}^{\text{compS} \{} \\
\text{deze film} \quad \text{ADV} \quad \text{VC}^{\text{compS} \{} \\
\text{waarschijnlijk} \quad \text{V}^{\text{compS} \{} \quad \text{V}^{\text{compS} \{} \\
\text{mag} \quad \text{zie} \\
\end{array}
\]

The adverb-object word order is derived similarly, by assuming that the adverb modifies a saturated vp (i.e. \( V^{\text{compS} \{} \)).
In van Noord and Bouma (1994) it is observed that cases where an adverb modifies the governed verb, as in (12) and (3a) and (3b) above, are problematic for accounts based on argument inheritance. The manner adverb *hard* in (12) clearly modifies the event denoted by the embedded verb. However, in a non-transformational, surface oriented, framework, the adverb can only be analysed as a sister of a verbal projection headed by *laat*, and thus, as modifying the semantics of *laat* rather than *straffen*.

(12) dat de minister de misdadigers hard laat straffen
that the minister the criminals hard lets punish

A solution for this apparent mismatch between syntax and semantics can be found if adjuncts may be added lexically to the syntactic valency of a verb. By introducing adjuncts lexically on *comps*, they can be selected in syntax by the head-complement rule responsible for selection of non-verbal complements. In (12), the verb *straffen* is therefore now assigned an ‘extended’ *comps*-list including an adjunct. Furthermore, as adjuncts are present on *comps*, they participate in argument composition. The argument composition verb *laat* in (12) gets assigned the following *comps*-list:

(13) \[
\begin{array}{c}
\text{PHON} \langle \text{laat} \rangle \\
\text{HEAD} \langle v \rangle \\
\text{COMPS} \langle \text{NP, ADV}, \langle \text{HEAD} \langle v \rangle \text{COMPS} \langle \text{NP, ADV} \rangle \rangle \rangle
\end{array}
\]

As adjuncts are no longer distinct from complements at the level of syntax, it can be assumed that they are all selected in the Mittelfeld by means of a single head-complement rule:

(14) \[\text{head-complement-structure}: V[\text{comps }()] \rightarrow \text{XP}^+ V\]

The example in (12) can now be analysed as follows:

(15) 
```
        VP[comps ()]
         \[ NP[comps ()] \]
         \[ ADV \]
         v[comps [1, 2, 3]]
             \[ \text{deze misdadigers} \]
             \[ \text{hard} \]
                 v[comps [1, 2, 3]]
                     \[ \text{laat} \]
                         v[comps [1, 2, 3]]
                             straffen
```
In the *adjuncts-as-complements* analysis it is assumed that an adjunct modifies the semantics of the head which lexically introduces it. Thus, even though the adverb *hard* is selected in syntax by *laat*, semantically it modifies the main verb *straffen*. Similar examples where an adverb takes wide scope (such as (6)) are accounted for by assuming that in those cases the lexical argument structure of the modal verb has been extended with an adjunct.

In de Hoop (1992), de Hoop and van der Does (1998), and elsewhere, it has been argued that *object scrambling* interacts with semantics. In particular, they assume that scrambling of an indefinite NP forces a ‘quantificational’ reading of that NP, and that the possibility of scrambling depends on focus and presuppositional structure. Another clear semantic difference between scrambled and non-scrambled word order is described in Ruys (2001): whereas (16a) is ambiguous between a *de re* and *de dicto* reading of the object, the scrambled (16b) only has a *de re* reading.

(16) a. dat Jan vaak een meisje zoekt
   that John often a girl seeks
   that John often seeks a girl
   that there is a girl which John often seeks

b. dat Jan een meisje vaak zoekt
   that there is a girl which John often seeks

The literature on scrambling does not provide a clear answer to the question how to account for this difference exactly, but at the very least examples like these suggest that the relative order of adjuncts and complements must be closely linked to a semantic account of scope. It should also be clear that the adjuncts-as-complements analysis as it stands does not provide such an account, as it allows adjuncts to be interspersed with complements freely on *comps*, and only stipulates that the inserted adjuncts must take scope over the lexical semantics of the verb on whose *comps*-list they originate.

In this paper, I extend the adjuncts-as-complements analysis with an explicit account of semantics which supports a detailed account of the interaction of word order and scope for adjuncts, complements, and *argument raising* verbs. In HPSG, quantifier scope can be accounted for by means of explicit storage and retrieval of *np*-meanings, or by means of underspecification. The latter approach constructs underspecified meaning representations which can be resolved in one or more ways, depending on the constraints imposed on such structures. One of the attractive features of underspecification semantics is that it suggests a framework in which word order may impose constraints on semantic representations. Below, I will develop an underspecified semantics
for a fragment of HPSG with adjuncts-as-complements, and propose a scopal constraint which accounts for the word order phenomena observed above.

In the next section the HPSG analysis of Dutch verb clusters is reviewed in more detail. In Section 3 I outline the essentials of Lexical Resource Semantics (Richter & Sailer 2001b), the underspecified semantics formalism I will be using. In Section 4, the treatment of adjuncts as complements along the lines of Bouma, Malouf, and Sag (2001) is shown to be compatible with the data above. Furthermore, an underspecification semantics for both scopal and non-scopal, intersective, modifiers is presented, and integrated with the adjuncts-as-complements analysis.

In the final three sections, several implications of the proposal are considered. One prediction is that adjuncts in general may take wide or narrow scope with respect to the matrix verb. It is argued that this is correct for a range of adjunct types. Furthermore, the analysis predicts that adjuncts modifying a matrix verb may appear between dependents of the lower verb. Evidence for this prediction is presented. Finally, I address the semantics of clauses containing an argument inheritance verb and more than one adjunct (potentially modifying two different predicates) or a combination of an adjunct and a quantified NP complement. In such cases, the scope of the adjuncts relative to the other dependents is completely determined by word order. To account for this restriction, a constraint on the dependency structure of verbal lexical entries is proposed.

2. Dutch cross-serial dependencies in HPSG

The syntax of the so-called verbal complex in Dutch and German with its notorious crossing dependencies has received ample attention in theoretical linguistics, at least since Seuren (1972) and Evers (1975). Within the framework of Head-driven Phrase Structure Grammar (Pollard & Sag 1994), Hinrichs and Nakazawa (1994) have proposed a lexicalist analysis of this construction in terms of argument inheritance, thereby following earlier work in Categorial Grammar in terms of function composition (Steedman 1984). Various aspects of their analysis have been elaborated in a number of publications (Kathol 1998; Kiss 1994; Nerbonne 1994; Müller 1996; Müller 1999; Meurers 1999; Bouma & van Noord 1998; van Noord & Bouma 1997).

The core observation of Hinrichs and Nakazawa (1994) is that argument inheritance allows complements of one verbal head to be inherited (lexically) by a governing verbal head, thus allowing the governing verbal head to select
the complements of that head. This in turn opens up the possibility of complement word orders where inherited complements occur between true arguments and the verbal head itself.

Below, I present a grammar fragment for Dutch modal and accusativus cum infinitivo verbs. Crossing dependency word orders are accounted for by means of argument inheritance.

Following Bouma, Malouf, and Sag (2001), I assume that the valency of lexical items is determined by a mapping from argument structure to dependency structure and from dependency structure to (grammatical) valency. The list of dependents consists of the list of arguments, possibly extended with adjuncts. The valence features subj and comps correspond to the head and the tail of the list of dependents, respectively.

The lexical entry for the transitive verb bestuderen given in (17) has an argument structure consisting of a nominative and an accusative NP. The semantics of the verb is represented by the head-feature main, whose function is explained in more detail in the next section. Its value is a three-place relation study, including a Davidsonian event variable. The other arguments of the relation are unified with the semantic index of the nominative and accusative NP, respectively.

(17) \[
\begin{array}{c}
\text{PHON} \quad \langle \text{bestuderen} \rangle \\
\text{HEAD} \\
\quad \text{verb} \\
\quad \text{main} \quad \text{study}(e, i, j) \\
\text{ARG-ST} \\
\quad \text{HEAD} \\
\quad \quad \text{noun} \\
\quad \quad \text{case} \quad \text{nom} \\
\quad \quad \text{index} \quad i \\
\quad \text{HEAD} \\
\quad \quad \text{noun} \\
\quad \quad \text{case} \quad \text{acc} \\
\quad \quad \text{index} \quad j
\end{array}
\]

The values of deps and the valence features subj and comps are determined by general mapping constraints. A mapping constraint is expressed as an implication on (typed) feature structures. For now, I assume the constraint in (18), which requires that feature structures of type word must have identical values for deps and arg-st. The constraint in (19) states that, for verbal lexical entries, the single element of subj corresponds to the first element on deps, whereas the tail of deps corresponds to comps:

(18) \[
\text{word} \rightarrow \left[ \begin{array}{c}
\text{deps} \\
\text{arg-st}
\end{array} \right]
\]

(19) \[
\text{word} \rightarrow \left[ \begin{array}{c}
\text{subj} \\
\text{comps}
\end{array} \right]
\]
Verb clusters and the scope of adjuncts in Dutch

The constraints above imply that the lexical entry for *bestuderen* can therefore be as follows:

(20)

Heads may project head-complement and head-subject structures. A head-complement rule for building vp’s was given in (14). Head-subject structures are similar to head-complement structures, except that in this case the non-head daughter is a subject, and therefore has to unify with an element on subj. The fact that subjects are normally selected after all complements, can be implemented by requiring that the comps value of the head must be the empty list:

(21) head-subject-structure: V → NP V[comps ⟨⟩]

As both head-complement and head-subject structures are headed structures, the value of the attribute head is unified on the mother and head daughter. An example is given in (22).
Argument inheritance verbs differ from ordinary verbs in that their argument structure depends on the valence of the verbal complement they combine with. Formally, this can be represented by defining the argument structure of inheritance verbs as the append (∪) of three lists: a list containing a subject argument, possibly a direct object argument (for object control verbs), a list of inherited complements whose value is identical to the comps-list of the verbal complement, and a list containing the verbal complement itself.4,5

Argument inheritance verbs differ from ordinary verbs in that their argument structure depends on the valence of the verbal complement they combine with. Formally, this can be represented by defining the argument structure of inheritance verbs as the append (∪) of three lists: a list containing a subject argument, possibly a direct object argument (for object control verbs), a list of inherited complements whose value is identical to the comps-list of the verbal complement, and a list containing the verbal complement itself.4,5
The argument structure of argument inheritance verbs is flexible, and depends in part on the syntactic valence of the verbal complement they combine with. Consequently, the value of deps and comps is also flexible. The examples below therefore represent only two possibilities for instantiating the flexible lexical entries in (23) and (24). In (25), it is assumed that the verbal complement of moeten is a transitive verb, having a single element on comps. In (26), zien takes an intransitive verb (whose comps list is empty) as verbal complement.

These lexical entries can be used to derive the following examples:
Word order is accounted for by means of linear precedence constraints, which may impose ordering constraints on sister nodes. For the purposes of this paper, it suffices to assume that non-verbal complements are realized in the same order as they appear on COMPS of the head, and that they must precede the
head. Verbal complements inside the verb cluster must normally follow the head. In Bouma and van Noord (1998), an analysis of word order in Dutch and German verbal complexes is presented, which accounts for the order of verb clusters consisting of more than two verbs, and for such phenomena as ‘aux-flip’ and ‘Oberfeldumstellung’ in German, and the distribution of separable verb-particles in Dutch.

3. LRS Semantics

Underspecification semantics accounts for the ambiguity of natural language expressions by assigning such expressions underspecified or quasi logical forms which correspond to one or more fully specified formulas. Ambiguity is expressed by a single (underspecified) formula and thus can be the result of a single grammatical derivation. Ambiguity resolution amounts to instantiating the underspecified representation into a fully resolved formula. Underspecification semantics is particularly popular in computational semantics (Alshawi & Crouch 1992; Frank & Reyle 1995; Bos 1995; Copestake et al. 1999) as it supports architectures in which grammatical analysis only produces different analyses if there are genuine syntactic ambiguities. Reduction of syntactic ambiguity in general has a positive effect on parsing efficiency. Ambiguity resolution amounts to selecting the syntactically correct parse and instantiating its meaning. In many cases, only a partial resolution of the underspecified result is necessary. In an automatic translation system, for instance, it may be necessary to select the correct syntactic structure and to resolve underspecified lexical predicates, but resolving quantifier is not always required.

In this section, I introduce the basic concepts of Lexical Resource Semantics (LRS) (Richter & Sailer 2001a, 2001b), a recent member of the family of underspecified semantics formalisms. LRS allows (standard, fully specified) logical formulas to be described by means of underspecification. The constraints make use of the machinery of constraint-based grammar formalisms as much as possible. In particular, the theory is integrated in the grammar framework of HPSG. I will be mostly concerned with underspecified representations of the scope of quantifiers and scopal adverbs.

The semantics of words and phrases in LRS is encoded by means of the features top, parts, main, and index. The value of top and main is a logical form. The value of parts is a list of terms. The value of index is a logical variable. The top of a clause is its logical form. It has to consist of all and only the terms in its parts list. If parts can be assembled into a logical form in various
ways, an ambiguity arises. **Main** is the element of **parts** which corresponds to the meaning of the lexical head of the phrase. In headed structures, the value of **top**, **main** and **index** is identical on mother and head daughter. For this reason, I assume that these features are present under **head**.

Words typically introduce a single semantic term. The lexical entry for *lezen* (*read*) in (29) has a **parts** attribute containing a term consisting of the relation name *read*, and arguments *e*, *i*, and *j*. The argument *e* stands for a Davidsonian event variable. The other two arguments are co-indexed with the the **index** values of the two **np**-arguments.

I will assume, following the **main** principle of (Richter & Sailer 2001b), that in every lexical entry and every phrase, **main** is required to be a component of **top**.

Scope-taking elements, such as quantifiers, and certain verbs and adverbs, are associated in the lexicon with underspecified terms, containing one or more arguments whose value is required to be a semantic term again. Such arguments are indicated with letters *α*, *β*, …

In quantified noun phrases, the semantic head of the noun is required to be a component of the restriction of the quantifier. The constraint *T* ≪ *U* is used to express that a term *T* must be a component of a larger term *U*. Com-
plex constraints of this type, which cannot be expressed as feature values or
reentrancies, are added to a feature structure with the prefix &.

The parts value of a phrase is simply the concatenation of the parts attributes of the daughters. Therefore, a standard derivation of (31) will give rise
to the parts in (32a).

\begin{enumerate}
\item alle studenten lezen een boek
all students read a book
\item \begin{align*}
\text{HEAD} & \begin{bmatrix}
  \text{TOP} & \text{Student} \\
  \text{INDEX} & \epsilon \\
  \text{MAIN} & \text{Book} \\
\end{bmatrix} \\
\text{PARTS} & \left\{ \forall x (\alpha \rightarrow \beta), \exists y (\gamma \& \delta), \exists \text{book}(y), \exists \text{read}(e, x, y) \right\} \\
& \& \& \alpha \& \& \gamma \\
\end{align*}
\item \begin{align*}
\exists y (\text{book}(y) \& \exists \forall x (\text{student}(x) \rightarrow \text{read}(e, x, y))) \\
\end{align*}
\item \begin{align*}
\exists y (\text{book}(y) \& \exists \forall x (\text{student}(x) \rightarrow \text{read}(e, x, y))) \\
\end{align*}
\end{enumerate}

The semantics of an utterance is the value of its top. This value is constrained to consist of all and only the terms in parts. Furthermore, all scopal constraints must be satisfied. The logical forms in (32b) and (32c) are the result of two ways to instantiate the value of top in (32a), compatible with the principles and constraints.7

As the scope of quantifiers is not subject to restrictions, the analysis also accounts for the fact that quantified NPs may in general take wide or narrow scope with respect to a modal verb. Modal verbs, such as wil in (33), are assumed to be control verbs, i.e. they express a relation between an entity and a VP meaning, where the subject argument of lexical head of the VP is required to be identical to the index of the subject of the modal verb.
In examples like (34) the direct object argument of the embedded verb *vervagen* may take either wide or narrow scope with respect to the modal verb *wil*. Given the lexical entry for *wil* in (33), a derivation of (34) gives rise to the semantic representation in (35a). The value of morph in this representation can be either (35b) or (35c).

(34) dat Kim een computer *vervagen*

that Kim a computer wants replace

*that Kim wants to replace a computer*

*that there is a computer that Kim wants to replace*

(35) a. 

\[
\begin{align*}
\text{HEAD} & \quad \text{TOP} \quad \text{INDEX} \quad \text{MAIN} \\
\text{PARTS} & \quad \text{want}(e, i, \alpha), \text{replace}(e', k, x), \text{computer}(x), \exists(x(\beta \land \gamma))
\end{align*}
\]

b. \[\text{want}(e, k, \exists(x(\text{computer}(x) \land \text{replace}(e', k, x)))\]

c. \[\exists(x(\text{computer}(x) \land \text{want}(e, k, \text{replace}(e', k, x))))\]

Note also that semantic construction does not need to take into account the fact that the embedded *vp* *een computer vervagen* is discontinuous and that the direct object is inherited on the argument structure of *wil*. The meaning of a phrase is determined by the parts list, which is simply the concatenation of the parts of the daughter phrases, and the lexical semantics of the words involved. This schema is general enough to support the syntactic analysis of argument inheritance verbs without extra stipulations.
4. Adjuncts as complements

In this section, Argument Structure Extension as defined in Bouma, Malouf, and Sag (2001) is introduced. I demonstrate that this operation, which allows adjuncts to be selected as complements, enables an account of the fact that adjuncts may appear left of a verb cluster and still take scope over only a part of that cluster. Furthermore, I show that the underspecified semantics introduced in the previous section allows the adjuncts as complements analysis to be combined with an explicit semantics.

4.1 Syntax

The adjuncts-as-complements hypothesis makes the selection of adjuncts a lexical property of the verbs involved, and allows adjuncts to be selected by the same rule mechanism responsible for selection of complements. Arguments for selecting adjuncts as complements in HPSG have been presented for French (Miller 1992; Abeillé & Godard 1994), Japanese (Manning, Sag, & Iida 1999), Polish, Finnish (Przepiórkowski 1999a, b) and English (Bouma, Malouf, & Sag 2001). In van Noord and Bouma (1994) it is argued, on the basis of examples like those presented in the introduction, that the distribution and scope of adjuncts in the context of Dutch verb clusters also provide evidence for lexical selection of adjuncts as complements. By treating adjuncts as complements, selected lexically by the heads which they modify, adjuncts become visible for argument inheritance. This basically allows adjuncts in the Mittelfeld to act as adjuncts of an embedded verb.

In van Noord and Bouma (1994) the valency of verbs is extended by means of a (recursive) lexical rule which adds adjuncts to \textit{comps}. In Bouma, Malouf, and Sag (2001) an alternative is proposed, in which adjuncts are introduced in the mapping from argument structure to dependency structure (\textit{deps}). The \textit{Argument Structure Extension} principle defines this mapping:

\begin{equation}
\text{Argument Structure Extension:}
\end{equation}

\[\text{word} \rightarrow \begin{bmatrix}
\text{HEAD} \\
\text{DEPS} \circ \text{list} \left[ \text{MOD} \left[ \text{HEAD} \right] \right] \\
\text{ARG-ST}
\end{bmatrix}\]

Note that Argument Structure Extension is defined as an implicational constraint: each feature structure of type \textit{word} must satisfy the feature structure in
the implication. The value of \texttt{deps} is defined as the sequence union (or shuffle) of two lists: \texttt{arg-st} and an arbitrary list of adjuncts. This essentially allows any number of adjuncts to be interspersed with arguments on \texttt{deps}, while leaving the relative order of \texttt{arg-st} unchanged. The mapping of dependents to \texttt{subj} and \texttt{comps} remains as before. A transitive verb like \textit{bestuderen} can now be instantiated with a two element \texttt{deps}-list as before, but also with a three element list, as shown in the examples below.

\begin{equation}
\text{(37)}
\end{equation}

Note that argument structure extension requires the \texttt{mod|head} value of the adjunct to unify with the head features of the head which is being modified. The fact that adverbs typically modify verbs, but not nouns or prepositions, is accounted for by restricting \texttt{mod|head} of adverbs to the type \textit{verb}.

The formulation of Argument Structure Extension in (36) does not impose any restrictions on the ordering of adjuncts with respect to arguments, and thus in general allows adjuncts to precede subjects (the initial element of \texttt{arg-st}) as well. In Dutch, adjuncts may precede subjects (in subordinate clauses) only if certain conditions are met. It seems possible to formulate the relevant constraints on adjunct-subject word order in terms of the framework presented here, but this falls outside the scope of the present paper.

As selection of adjuncts is subsumed by the same mechanism responsible for the selection of complements, inheritance of \texttt{comps}-lists consisting of both arguments and adjuncts is predicted. This is illustrated in the example below.
In those cases where the adverb clearly modifies the matrix verb, it is assumed to be introduced on the \texttt{deps} list of the matrix verb, and it is not inherited from the \texttt{comps} list of the governed verb.

(39)